

Popular Mechanics

ELECTRIC CARS
What owners really think about them



GARDENING

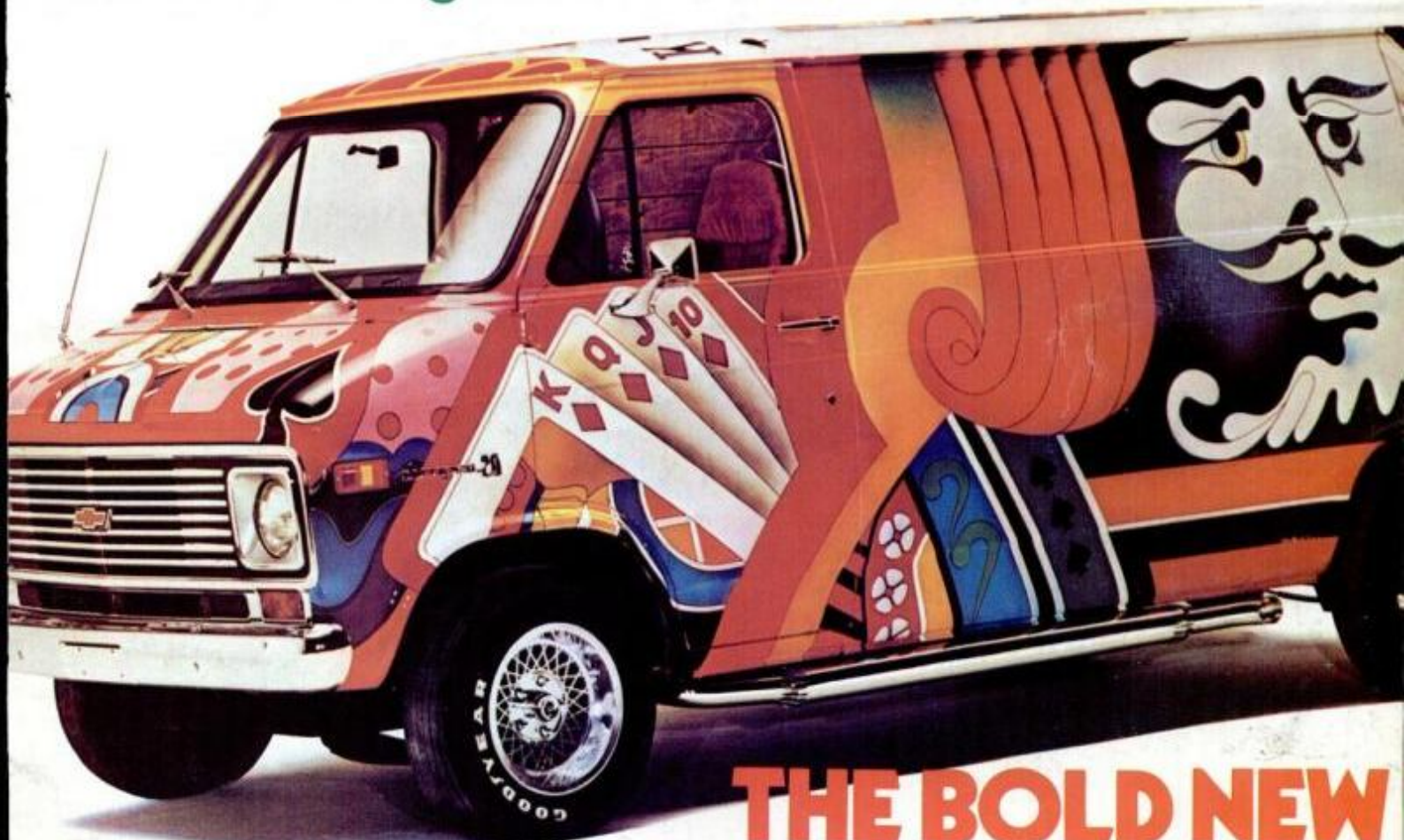
4 great projects

- Bicycle-wheel cart
- Compost box Bench
- Wheelbarrow

UNDERGROUND HOUSES:
Surprising comfort at lower cost

14 pocket cameras

PLUS: Surefire vegetable bonanza!



THE BOLD NEW LOOK OF RVs

Announcing: PM's paint-job photo contest

- 24 rigs for off-roading and camping

NIGHT DRIVING:
Your most dangerous everyday driving test

ISAAC ASIMOV:
20 ways our world may end



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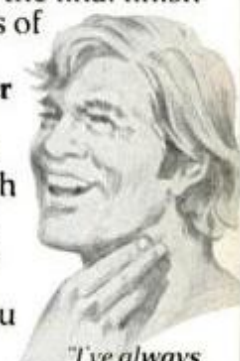
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Building a razor to these standards means we have to hone each blade six times, at three different angles. And use microscopes and computers for quality control.

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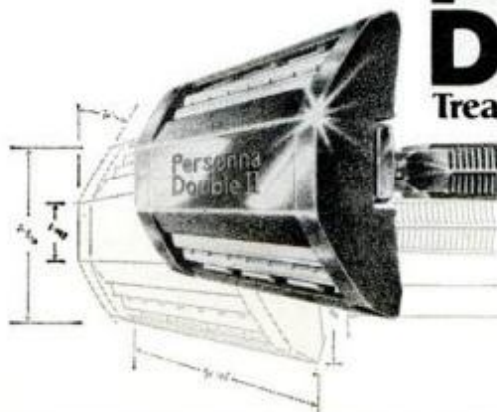
Personna Double II. Two sets of precision twin blades. We treat your face as if a millionth of an inch mattered. To *your* face, it does.



"I've always been fond of my neck."

Personna Double II

Treat your face with precision.



This One



Q9BN-JLN-YR3W

On the cover
A full-house hand decorates a home-on-wheels Chevy van fully fitted out for on-the-go cavorting or camping. See page 105 for contest where you show off your own.



Popular Mechanics®

MARCH 1977

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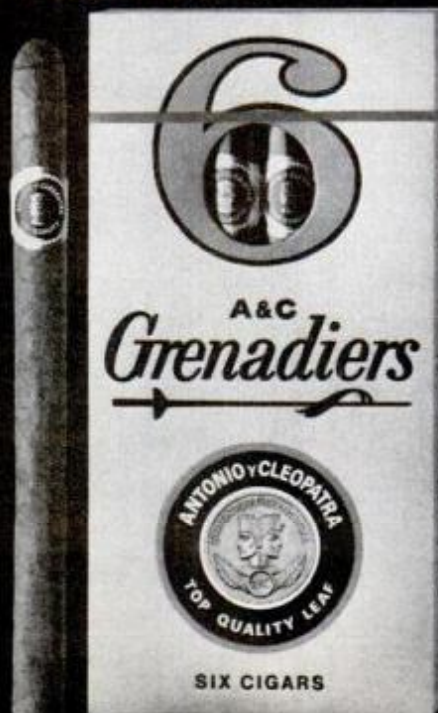
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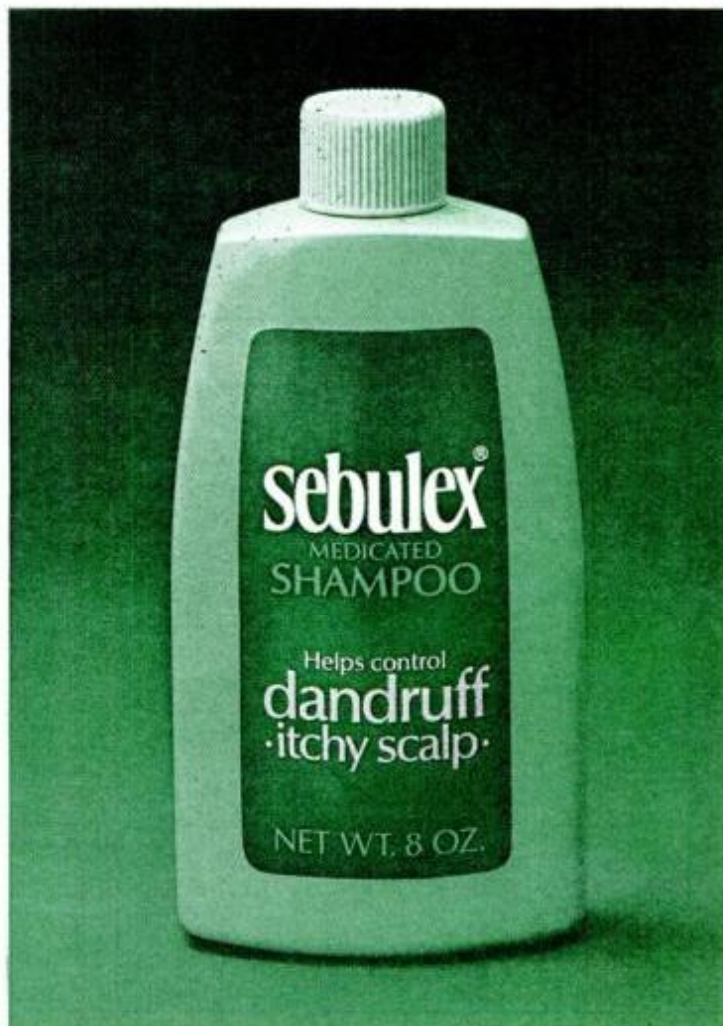
If you're out to control your dandruff, to help stop the oiliness and itching, use what more doctors recommend—Sebulex.

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LETTERS TO THE EDITOR

Static from the CB set

I want to congratulate Anthony Curtis and Ivan Berger on their well-written and meaningful article (*Tomorrow's CB: Will You Wear it on Your Wrist?*, page 98, Dec. '76). I agree with Berger when he says: "By the time we actually get wrist radios—if ever—Dick Tracy may have long since retired from the force."

RICK LARSON
BLOOMINGTON, MINN.

Alphonse was first

As reported in *Science Worldwide* (page 58, Dec. '76), A.V. Iannarelli has a great idea—criminal identification by photos of the ear. Alphonse Bertillon also thought so when he introduced the system of "Bertillonage" in 1882. He wrote extensively on the technique, one of his articles being *La Photographie Judiciaire*, published in about 1890.

The system was used in this country for a while. It fell into disfavor when it was the basis for the conviction of a Willy something-or-other who had the same name and ear profile as another Willy, the actual criminal.

PHILIP L. BANCROFT
WAYLAND, MASS.

That 721-foot Peachtree

I enjoyed the feature about the Peachtree Center Plaza (*Tallest Hotel Is Far Out, Too*, page 68, Nov. '76). Having seen this Atlanta hotel about a year ago, I can't help but agree with author Stanley Abercrombie that it is fascinating in every way. The author is correct in describing it as the world's tallest hotel. It is the highest building in the South, but not the highest "structure."

The two smokestacks of the Etowah generating station (also in Georgia) easily top the hotel. Nevertheless, Atlanta can be proud of having a structure like the Peachtree, a worthy addition to a beautiful city.

K.F. SCHULZE
TORONTO, CANADA

According to the Georgia Bureau of Industry and Trade, the stacks referred to are the 1000-footers of the Bowen Generating Plant of the Georgia Power Co. on the Etowah River near Cartersville.

Fifty years in the making

In October 1926, *Popular Mechanics* began a series of five monthly articles on building a model of Henry Hudson's *Half Moon*. In October 1976, 50 years later to the month, I completed my model—begun at age 11 and finished at age 61. I enclose a photo.

Over the years I became absorbed in both the lore and the technicalities involved in the construction and rigging of 17th century ships, studying books and visiting libraries and museums throughout the country, developing an expertise on the subject and an appreciation for



the beauty of the museum specimens.

Your articles led to a virtually lifelong fascination with a study (more than a hobby) affording education, delight and stimulation to the imagination.

FRANK J. RUMMEL, M.D.
GREEN VALLEY, ARIZ.

Wrong laser expert

In your laser article (page 97, Nov. '76) there's a picture of a "Dr. Kumar Patel" and his CO₂ laser. The same photo was featured by a science journal some time ago, but the man was identified as Ali Javan. Has he changed his name, or did someone err?

RAY BETHLY
MILWAUKEE, WIS.

Someone erred. The scientist is Dr. Ali Javan formerly of Bell Laboratories. Our apologies to both gentlemen, as well as to our readers, for the unwitting mis-identification.

Gremlins in the dollhouse

I plan to build the Victorian dollhouse (*Two Enchanting Dollhouses You Can Build*, page 116, Dec. '76) but, in looking over the diagrams, have a question: Is the outer shell of the house really supposed to be made of thinner plywood than the inner walls and the floors?

FRANK HOLZ
CINCINNATI, OHIO

No, to answer your questions, but our dollhouse was indeed enchanted. Labels on the plywood cutting diagrams on page 122 were transposed. (The 1/2-in. plywood should be 1/4-in. and vice versa.)

Also, the sides and back of the house should be cut 23 1/2 in. high instead of 25 1/2 in. high as indicated on the plans.

A big-engine advocate

Congratulations to PM and Robert Lund (*Detroit Listening Post*, page 12, Nov. '76) for a common sense bit of editorial comment (which, I might add, is on the Endangered Species list). Mr. Lund explores the pros and cons of "big engine or small," and comes up with: "Manufacturers of replacement parts are rubbing their hands in glee over the switch to smaller engines." He points out that "parts wear out faster on small engines." That goes for the entire automobile—engine, brakes, etc.

Why is it that the so-called conservationists and energy-conscious people have not thought of this? Their minds stop at the mpg statistics—never once thinking of the energy wasted in (1) manufacturing extra parts and (2) shipping these replacements parts to their many destinations.

In the long run, the "economy car" will use more energy than the so-called "gas-guzzler." As Mr. Lund says, "What you save in the price of gas with the small engine could be wiped out by higher repair bills."

V.H. WILCOX
TORRINGTON, CONN.



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*Based on regular separate prices from 1977 Power and Hand Tool Catalog.

Penske comes home

It was a glorious day for the Grand Ol' Flag last summer when the Penske PC4 Formula 1 car with John Watson at the wheel won the Austrian Grand Prix. It was the first Grand Prix win for an American team since Dan Gurney won at Spa in 1967. But competition on the international Grand Prix circuit is a tough business, and for the '77 season Roger Penske will be concentrating on his North American racing program.



competition on the international Grand Prix circuit is a tough business, and for the '77 season Roger Penske will be concentrating on his North American racing program.

Happily for race fans, much of Roger's motorsports activities have been caught on film and three features have been produced so far. The latest, *Vroom at the Top*, follows Penske teams to Indy, Monaco and the World 600.

The second film, *Search*, I found especially fascinating because it contrasts Penske's clean-machine team to a part-time, amateur operation, typical of the way most drivers and mechanics start out. The third film is *The Continuing Challenge*, a documentation of an almost 4000-mile-long race—the East African Safari Rally. All three are Sears 16-mm sound films and are on free loan to schools, car clubs and other groups from Association Films, 866 Third Ave., New York, N.Y. 10022.

Safe color cars



When the fog rolls in, a lot of cars drop out of sight. As the photo above shows, lighter-color cars remain visible—they're "safer" than darker colors when it comes to being seen in hazy, twilight and nighttime conditions.

The subject of car color has received a lot of attention from Mercedes-Benz. The company found

that most people choose a particular color to satisfy their personal taste. The second reason was for its ability not to show dirt; the third, ease in matching if the car was damaged; fourth, safety.

As a result of its research, Mercedes has come up with an index of visibility. Colors were tested under sunny, overcast, twilight and foggy conditions and with various backgrounds; including asphalt streets, concrete highways, meadowlands and snow. Mercedes found that tops in visibility are luminous orange, white and light yellow. Next were light orange, dark yellow, light gray, light blue and light red. After that, all with a visibility index of about 50 percent, were light brown, light green, dark gray, dark red, dark blue and dark brown. At the bottom of the list were black and dark green.



Remember when you didn't have a choice of color? It was Henry Ford who said of his cars

that you can order "any color as long as it's black . . ." That famous quote is now the title of a marvelous new book which is subtitled, *The First Fifty Years of Automobile Advertising*. There are 150 illustrations, many of them color, or early ads and posters for Duesies, Detroit Electrics, Fords, Duryeas, Jordans, Pierce Arrows, Reos, Rickenbackers and many more. It's an absolutely fascinating volume with text and historical notes by Peter Roberts. Published at \$14.95 by William Morrow & Company, Inc., 105 Madison Ave., New York, N.Y. 10016,

Almost 500 time again

In another month, Indy 500 hopefuls will flock to the Speedway to begin practice for the world's most famous race.

A sure way to put this 61st running of the 500 into historical perspective is with a new volume published by Rand McNally, *The Indianapolis 500, A Complete Pictorial History*. This is a 286-



pager that covers all of the races since the first running in 1911. It lists only the top 10 finishers for each year's race. The \$16.95 volume by John and Barbara Devaney, is full of great photos.

Not long for this world



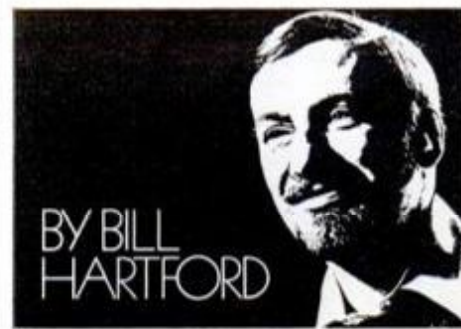
Most of the cars at last year's Geneva Auto Show reflected a concern for the contemporary driving environment—the need for improved safety, better economy and, overall, a more rational approach to automotive design.

Not so this "Eagle," done up by one Luigi Colani, as his personal motorcar. It's reminiscent of the dream cars we saw in the '30s, but on today's roads it's a nightmare. The monster is 23 feet long and 7 feet wide.



Lowest U.S. prices

Its bargain time on small cars, with quite a number of them stickered under \$3000. This '77 Toyota Corolla two-door sedan is \$2788. The '77 has a new grille design, four-speed manual, power front discs and other nice features. EPA is 49 highway and 36 city. The rock-bottom price tag, however, is still claimed by Honda: The '77 four-speed Civic sedan is \$2779. ★★





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DETROIT LISTENING POST



GM big cars shaved again

There's a report out of GM that the company has taken a second look at plans to shrink its largest cars in 1979-80 and has decided to make them even smaller. The cars are Cadillac, all models, Buick Riviera and Oldsmobile Toronado. They will be pulled down to a wheelbase of 108 to 110 inches. That would make them 6 to 8 inches shorter than the original downsizing called for.

Assuming the report is true—it comes from a source wired in to what GM is doing—the move will set off a chain reaction. Not only at GM, but at the other companies, too. If GM has had second thoughts about the size of its biggest cars, somewhere down the road the company will have to take a second whack at reducing the size of its other cars. Another if: If there was any way of keeping the big cars big, GM would be the last automaker to go small. GM practically invented the big car in this country and has always been partial to king-size machines.

The situation is something like the old cartoon of the guy who sets out to trim one leg off a table to level it, only to end up sawing down all four legs. GM is one leg of the table. Ford, Chrysler and American Motors are the others. If GM saws a section off its leg, the other companies are almost certain to follow suit.

Ford shopping for a diesel

Although Ford has a program in the works to develop a diesel for use in a passenger car, the company is also checking around to see what's available from outside sources. Ford's diesel is far behind GM's and Ford would like to know what's available if it wanted to crash-program a diesel car to counter the vehicle coming from Oldsmobile. Diesels made in this country are too big to install in an automobile—they are made for trucks—so if Ford goes this route, it would have to buy the engine in Europe.

How soon a 'sealed' engine?

How soon a car with a sealed engine? That depends on what you mean by a sealed engine. If you mean an en-

gine encased in a permanent cover and locked up so you can't get at it, forget it. That's wild blue yonder and anybody who tells you an engine can be locked up for the life of the car has overdosed on science fiction.

But if you define a sealed engine as one that will run a specified number of miles without service or adjustment, without so much as a change of oil, Detroit is pretty close to the goalpost. The companies inch a little nearer the goal every model year. Parts and lubricants last longer and the intervals between oil changes, tune-ups and routine maintenance are stretched out.

I put the question about "sealing" the engine to the head honchos at the four Detroit companies. Second definition of what constitutes a sealed engine—a car requiring service say only once a year. Here are the answers from the guys who know what's possible and what's coming:

■ **Roy Chapin Jr., chairman of the board of American Motors:** "A permanently sealed engine isn't probable or desired, because it would decrease the ease of serviceability. But we are already at the point where service at annual intervals is a near-term reality. We consider our present engines reliable for 100,000 miles, except for the need to replenish lost oil and to inspect spark-plugs and filters at increments of 30,000 miles. We look for oil life to increase as we gain more knowledge of the newer petroleum and non-petroleum lubricants. The only real challenge remaining is to improve gasketing and sealing materials and methods to prevent loss of oil through interior and exterior engine paths. Advances in these areas are coming rapidly."

■ **Gene Cafiero, president of Chrysler:** "Our goal is for low maintenance of both the engine and the transmission. But the limitation is better expressed in mileage intervals, rather than a time period, to allow for different driving patterns. We're getting closer to the goal, as evidenced by such things as the longer life of oil filters."

■ **Lee Iacocca, president of Ford:** "Yes, we're rapidly reaching the point where the average driver won't

have to worry about his engine in the first year of driving. We're practically there now. Of the normal 38 to 40 scheduled maintenance checks in our 1977 owner's manual, there are only five or six items that require attention in the first year of normal driving. Things like oil and filter changes, checking the drive belt and adjusting the timing and carburetor."

■ **Pete Estes, president of General Motors:** "We've talked about the possibility of bolting the hoods down on our cars some of these days. We're closer to that possibility now than we were when we first mentioned it a few years ago. I think it will come, but I wouldn't want to estimate exactly when."

Ford foresees plastic wheels

Ford is building a huge plant at Milan, Mich., to manufacture plastic parts. I asked a Ford guy why they need a 765,000-square-foot plant to make plastic parts. Are they going to make the whole car out of plastic? "Not the whole car," he replied, "but a lot more of it." Like what? "Well, give us five years and I think you'll see plastic wheels on most if not all of our cars."

If you can't lick 'em . . .

I had a story in PM last September on the problems do-it-yourselfers encounter when they change their own oil. How do you dispose of the old oil in a way that doesn't pollute? Car dealers and service stations aren't keen on letting d-i-y's dump used oil in their holding tanks because they want to sell the oil change. Well, one of the oil companies has apparently had a change of heart. Shell has decided if it can't sell you the full shot, maybe they can sell you the oil. And if they sell you the new oil, they will let you dump the drained oil in the holding tank. This does not apply to all Shell stations. It's up to the individual station operator whether he wants to go along with the idea. Shell has supplied stations participating in the program with a stock of those little reminder stickers you put on the edge of the car door to keep track of time for the next change. They're free. ★★



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I enjoy smoking
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Salem.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

19 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report APR. '76.



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Deane Bradfield is four of the best insurance agents you'll ever find.

Ken and Wanda Meyer of Waterloo, Iowa, thought they had found a good insurance agent when they took out an auto policy with State Farm agent Deane Bradfield more than twenty years ago.

But over the years, they've changed their minds.

Today they know Deane is actually four good insurance agents.

"Since we first went to him, he's handled the insurance on all our cars—I couldn't even guess how many," Ken says.

"He helped us insure our homes while the kids were growing up. And after we moved to an apartment, Deane handled the renters insurance.

"He's also helped keep our life insurance program up-to-date."



And if they should ever require individual health coverage, Ken adds, "I'd certainly talk to Deane first."

"Whenever he thought we were underinsured or there were discounts we could take advantage of, he's pointed them out to us,"

Wanda says. "We've recommended Deane to many people because we know he'll treat them as well as he's treated us."

If you want to be as well treated as Ken and Wanda Meyer, just check the Yellow Pages for the State Farm agent in your neighborhood. And make it a point to get acquainted soon.

You'll find your State Farm agent is four good people to know.



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STATE FARM INSURANCE COMPANIES Home Offices: Bloomington, Illinois

THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS BY THE EDITORS

Kerosene garage heater



I've spent some real cold days and evenings working in my attached but unheated garage. It was work that had to get done so I bundled up and dug in. But all the time I thought how nice it would be to pump some heat into that frigid garage—gosh, I'd even be able to do some leisurely puttering, and in the dead of winter!

I gave some thought to extending pipes from the house heating plant into the garage, insulating it and so on, but then realized that the quick, easy and economical way to get heat when you need it (which isn't all that often) is with a simple, \$100 kerosene heater.

The Reddy Heater, rated at 30,000-B.T.U., is made by Koehring, Automaster Div., Bowling Green, Ky. 42101. Called the Model M-30, it's the smallest heater made by this long-time manufacturer of space heaters. Designed specifically for the homeowner, the M-30 uses about a quart of kerosene (or No. 1 fuel oil) per hour and draws only 2½ amps. After filling the 2¼-gal-

lon fuel tank, all you do is plug in the heater and feel the warmth. Operation and construction are shown in the cutaway below.

Koehring provides a very complete manual with the heater covering its operation, maintenance and service, and a list of parts. As with any such heater, you must observe basic safety rules, such as providing adequate ventilation, elevating it above floor level slightly, and so on. Maintenance is as easy as changing air filters and cleaning sparkplug electrodes.—*B.H.*

Flexible booster cables

It used to be that unless you had the very best of booster cables, covered with real rubber, they'd snarl and stiffen up in winter. PVC and other plastic covered cables are just plain nasty to work with. These new booster cables are covered with TPR, a Uniroyal product. TPR is used on a wide range of cables—those shown are 12-foot, 6-gauge. Write to Woods Wire Products, Box 675, Carmel, Ind. 46032.—*B.H.*



Ready for any fire

It's hard to believe, but there are few households where you will find a fire extinguisher. Even fewer cars

are equipped with this basic fire-fighter. I've had one at home, but just got around to getting one for the car. I plan to mount it on the front floor, just in front of the driver's seat, where it will be easy to grab. It's a Kidde Fire Away 110 (U.L.-rated 1-A: 10 B:C). The compact all-purpose, dry chemical unit weighs just about 4 pounds, takes a 2½-pound Kidde Tri-Class recharge, pressurized to 195 p.s.i. This extinguisher and other Kidde units are widely available. Mine was \$10 at Sears. Walter Kidde and Co., Inc., is in Belleville, N.J. 07109. Check pressure gauges periodically and for recharging information, see your classified directory or local fire department.—*B.H.*

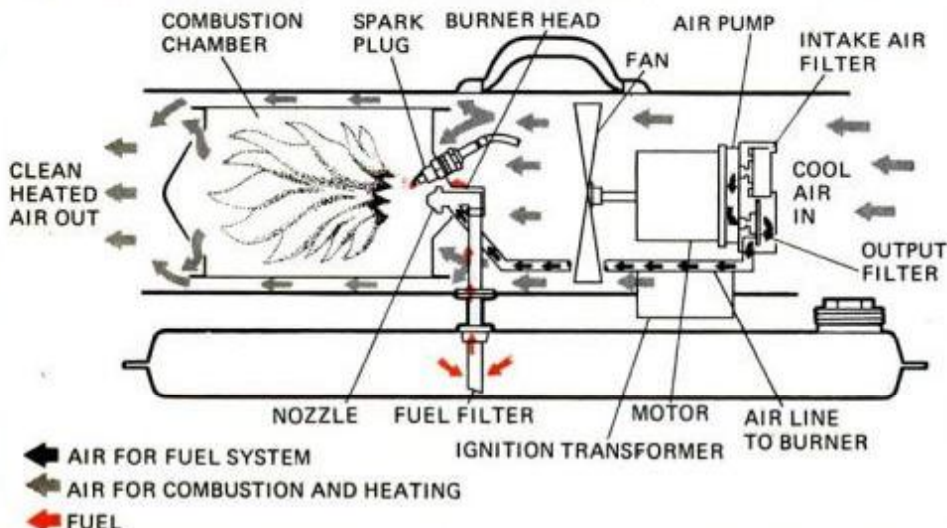


Highway emergency kit



Most drivers start accumulating all the glovebox and trunk items shown here one by one when they get their first car. It may take years before they have everything that's in this Illuminator 3000 kit.

I've gathered all this gear together over the years so that's why I envision this package as the perfect present for the new car owner. It's got everything he would ever need, right down to Band-Aids and a siphon pump. The kit costs \$30. Carter Hall, Inc., 6 West 32nd St., New York, N.Y. 10001.—*B.H.*



A little care now may save some big worries later.



It always seems to happen at the most inopportune time. All of a sudden your car decides to up and just quit working — leaving you stranded.

What a helpless feeling. Nobody stops . . . nobody seems to care.

All this trouble could probably have been avoided with just a little ol' fashioned preventive maintenance.

Don't let a poor start stop you.

Batteries are quite often overlooked. You don't notice that they gradually lose that sudden burst of starting power that you need. And if you don't have an old, tired battery replaced — some day it can stop you cold.

Your AC-Delco serviceman can restore that starting kick with Delco batteries in four levels of price and performance. One is

sure to fit your kind of driving and your checkbook.

The place to think about mileage is in the service bay.

That's why it makes sense to install quality AC Spark Plugs and reliable Delco Remy Points with your next tune-up. They work as a team. And together with new Delco wires and distributor parts — they can help put miles back in mileage.

Reliable performance might demand more than new plugs.

You've made a great start. All you have to do now is complete the job. Because good performance can depend on other factors, too — like a clean PCV valve and gasoline and air filters.

Now that you're thinking about it, why not plan on a thorough AC-Delco tune-up. One visit to your AC-Delco serviceman is all it takes. Who knows . . . it may save you some big worries.



Go
with the names
you know.



AC-DELCO DIVISION OF GENERAL MOTORS CORPORATION

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APPLIANCE CLINIC

BY PAUL MANN



Gasping for air

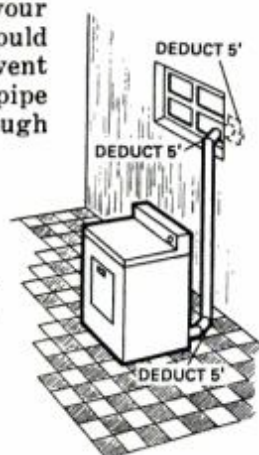
My new Maytag gas dryer doesn't provide enough heat in an hour's time to completely dry a load of clothes. It stays on about 30 seconds and then goes off five minutes. What's wrong?—C.W. Waltz, Cedar Rapids, Iowa

You describe a typical airflow restriction, which is probably the result of one of three conditions. When there is an airflow restriction, a safety switch shuts down the drying source when excessive heat builds up. The source of heat remains off until the temperature reaches the safe area.

The three reasons for an airflow restriction are as follows:

1. Not cleaning out the lint filter often enough. This should be done after every drying cycle.
2. A buildup of lint in the vent pipe. The pipe should be removed and cleaned.
3. A vent that for some reason is too narrow, too long or has too many bends. Since your machine is new, the vent configuration could be your problem. You should have a 4-inch vent pipe. A 3-inch pipe won't permit enough

Starting with the constant, a 30-ft. pipe, deduct 15 ft. for the two turns and damper hood (dotted lines). Maximum vent length for this dryer is 15 ft.



circulation to let out all of the heat.

Maximum length of the pipe should be 30 feet. From this deduct 5 feet for every elbow and turn and 5 feet for the vent hood outside. If you have a flexible accordion-type vent pipe, deduct another 5 feet because of the pipe's ribbed configuration.

No response

We have a General Electric Americana electric range (Model J-795) that has a bug in the heat-control

circuit for the bottom oven. The temperature rises to the point set on the temperature control, and the heating element goes off as it should. The problem arises when the heating element tries to come back on.

It will cycle on and off at about two times per second, causing house lights to flicker. This would apparently continue indefinitely if we didn't move the temperature control higher or lower. When the new temperature is met, rapid cycling starts again. The top oven works fine. What's the solution?—Herbert D. Mann, Hendersonville, Tenn.

The solution is undoubtedly to replace the responder in the control circuit, which works with a sensor to cycle the heating element off and on according to the designated temperature. When the responder fails and refuses to "make" the circuit, the condition you describe occurs.

To replace the responder, remove the panel. Behind the control for the bottom oven you will see a little rectangular black box having six connections. This is the responder. Disconnect the wires, remove the box and replace it. Your problem should clear up.

Tarnished crown

Thirteen months after we bought a Speed Queen Model DA 3660 automatic clothes washer, it refused to go into the spin mode. The fluid drive unit had gone bad, and a new one had to be installed. Now, little more than two years later, the fluid drive again failed. I went to a Speed Queen parts store where there were about 25 such units, each taken from a machine like mine. In case you don't know, a new fluid drive costs \$45. As it was, this lemon cost me \$177. It's hard to believe a company with a reputation like this one has could design such a poorly made machine.—Robert Lendy, Chicago

It so happens that you own one of the most durable and reliable washing machines on the market. The fact that many commercial establishments use Speed Queen attests to this. However, fluid drive assemblies are no more immune to breakdowns than clutch-type transmissions, especially if you abuse them. Overload-

ing the machine can cause undue stress on the roller clutch, seal and bearings, which can wear prematurely. Once this takes place, the fluid drive assembly has to be replaced.

Since 1970, the household Speed Queens have used a drive system that works around a reversing motor. The motor operates in one direction for agitation and in the opposite direction for spin. The fluid drive is pinned directly to the motor shaft, and is designed with a roller clutch arrangement which allows it to "free-wheel" in agitation and to lock the fluid drive to the motor shaft in spin to turn the washtub.

The motor turns an impeller inside the fluid drive shell which creates a hydraulic lock between the rotating impeller and the outer shell. This brings the washtub up to full spin speed gradually, requiring a smaller amount of starting torque from the motor.

As you can see, this is an intricate system which is "owner-proof." There are no adjustments to make. All you can do to safeguard the unit is to make sure, as I said once before, that you do not overload the machine.

Danger in the pan

There is an important addition that should be made to "Will-o'-the-wisp" in the October Appliance Clinic. The drip pans beneath frost-free refrigerators are not only a source of offensive odors, but there lurks a possible source of a crippling disease. Bacteria spores called thermactinomyces build up which can cause farmer's lung. This is a disabling respiratory disorder. As you stated, that pan should be cleaned often.—James H. Clarke, Oakland, Calif.

Several readers told me the same thing. Thanks to all for your help and for keeping me on my toes. ★★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N. Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.

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All you shift is your weight!

Riding the automatic-transmission Honda CB-750A is a whole new experience.

by Ross R. Olney

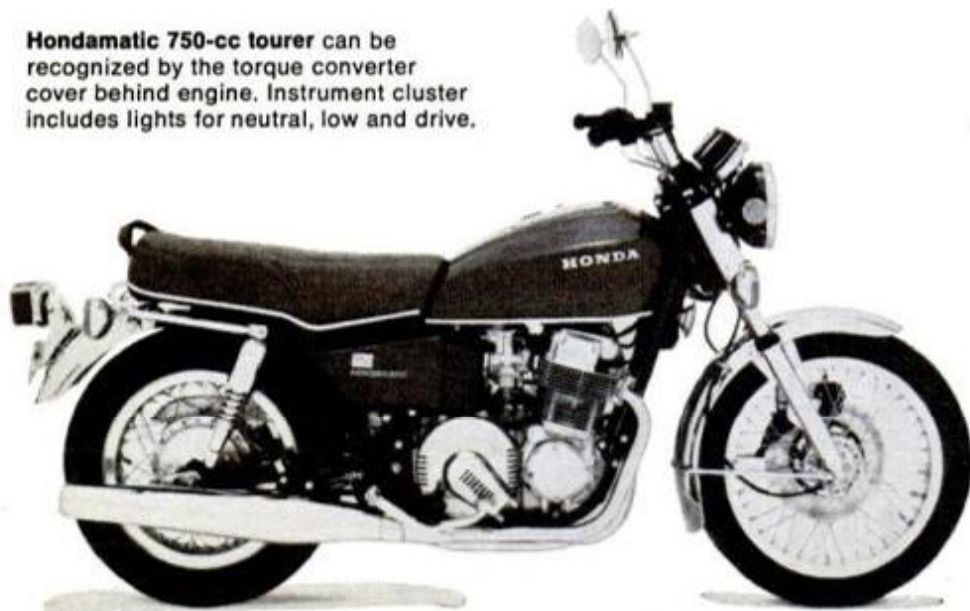


SPECIFICATIONS—HONDA CB-750A

Engine type: Four-stroke sohc Four
Bore and stroke: 61x63 mm (2.402 x 2.480 in.)
Piston displacement: 736 cc (44.9 cu. in.)
Compression ratio: 8.6:1
Carburetors: 4, 24-mm Keihin
Air filtration: dry paper
Ignition: Battery and coil
Rake/trail: 28°/4.5 in. (115 mm)
Fuel capacity: 5.1 gal. (19.3 liters)
Oil capacity: 5.8 qts. (5.5 liters)
Electrical power: 290-w. alternator
Battery: 12-v., 20 AH
Primary trans.: Hy-Vo chain (1.35:1 ratio)

Secondary trans.: 5/16 x 5/8-in. No. 530 roller chain
Gear ratios overall: Low, 8.63:1
High, 5.80:1
Tires: Front, 3.50 x 19 Dunlop F6
Rear, 4.50 x 17 Dunlop K87
Brakes: Front, disc 11.7 x 1.625 in. (29.7 x 4.12 cm)
Rear, drum 7.1 x 1.6 in. (18 x 4 cm)
Wheelbase: 58.3 in. (148 cm)
Seat height: 32.5 in. (82.5 cm)
Ground clearance: 7.5 in. (19.05 cm)
Curb weight: 565 lbs. (256.3 kg)

Hondamatic 750-cc tourer can be recognized by the torque converter cover behind engine. Instrument cluster includes lights for neutral, low and drive.



Honda has taken all the work out of street riding, but left all the fun in this shift-less bike. The "A" in the CB-750A designation stands for automatic, but it's really semi-automatic.

You can ride the 750A all day long without touching the left-foot gearshift pedal. You can stop, start (and this bike digs away from a stop sign with *gusto*) and ride in heavy traffic for hours without shifting. The reason they still won't call it a full automatic is that the torque converter trans does have two speed ranges, *low* and *drive*. Along with neutral, the three light up on the fancy instrument cluster depending on the gear you are in. Otherwise, in city driving, the bike is so easy-riding you might forget where you left the gear selector. And to get around the automatic/semi-automatic semantics, Honda calls the mechanism, the Hondamatic.

A toe-twitching ride

Bike riders accustomed to a clutch will find their toe twitching and their left hand spasmodically trying to squeeze a lever that isn't there. But only for the first few stops. Then all that nervousness fades away and you *ride*!

If you are a rider who *demand*s to shift, you can start in neutral (if the kick stand is down, the trans is locked in neutral no matter where you have the foot lever), then shift into low to move out. Then, watching the line on the speedometer, you lift the pedal one more notch to drive (at about 60 mph). Better yet, though, just shift into drive in the morning and leave it there all day.

There is some creep forward just as with any automatic, less in drive than in low. You'll need a light touch on the right-hand brake lever for the front wheel or the right foot pedal for the rear to hold the bike while you wait for a red light. Unless you want to shift it into neutral. When you get off this bike Honda calls a "luxury tourer," just engage the parking brake to keep it from rolling away.

The 750A has hydraulic brakes, disc in front and drum at the rear, with a brake-fluid reservoir on the right handlebar. A kick of the rear brake pedal releases the parking brake.

How to be shift-less

To go from shifter to shift-less in one quick step might seem worrisome before you do it, especially if you are planning to jump from a bike that would bend in the middle under the weight of the Honda 750

(Please turn to page 201)

The Straight Talk Guide to Sears Lowest-Priced Guardsman Tires.

Finding quality tires at reasonable prices can be a confusing ordeal. Not anymore. Sears makes it as simple as sliding your finger.

GUARDSMAN TIRE BUYING GUIDE

- Find the size car you drive.
- Pick the tire size you need.
- Match it to the tire type you want.
- Put your finger on a Guardsman low price.



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SUB-COMPACT SIZES

	BLACKWALL PRICE	FEDERAL EXCISE TAX	BLACKWALL PRICE	FEDERAL EXCISE TAX	BLACKWALL PRICE	FEDERAL EXCISE TAX
A-78-13	\$16.50	\$1.72	\$22.88	\$1.73	\$34.00	\$1.84
B-78-13	\$18.50	\$1.82	—	—	\$36.00	\$2.00
560-15	\$20.50	\$1.77	—	—	\$29.88*	\$1.91


COMPACT SIZES

C-78-13	—	—	\$25.88	\$2.01	—	—
C-78-14	\$20.50	\$2.01	—	—	—	—
D-78-14	—	—	\$26.88	\$2.09	\$36.00	\$2.27
E-78-14	\$21.00	\$2.23	\$27.88	\$2.26	\$37.00	\$2.41
F-78-14	\$22.00	\$2.37	\$29.88	\$2.42	\$41.00	\$2.54


MID SIZES

G-78-14	\$24.00	\$2.53	\$31.88	\$2.58	\$43.00	\$2.69
G-78-15	\$24.00	\$2.59	\$31.88	\$2.65	\$44.00	\$2.79


FULL SIZES

H-78-15	\$26.00	\$2.79	\$33.88	\$2.88	\$47.00	\$2.96
L-78-15	—	—	—	—	\$49.00	\$3.28

*Metric size 155R-15.

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PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

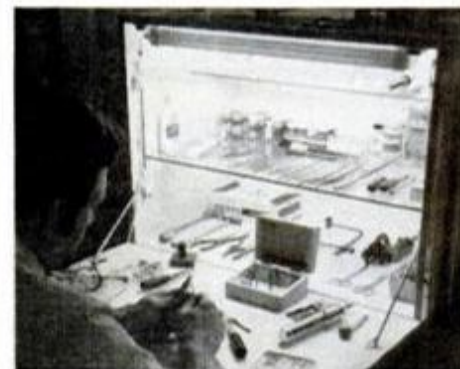
Soak up food odors

If your refrigerator accumulates enough leftovers to stock a delicatessen, you might find this little gadget useful. It's a thin plastic container (only 3 x 6 in.) that's packed with activated carbon to absorb food odors. The unit, available at local Frigidaire dealers for \$2.95, should last for 12 months.



Portable sticklight

GE has come up with a new fluorescent fixture called Bright Stik. The 33-watt unit throws a warm light, is sealed with no moving parts, has a full-length strip that acts as ballast and light shield and weighs only 9 oz. Adhesive pads on the mounting brackets make it easy to mount. The \$13.50 fixture is made to burn for 5000 hours.

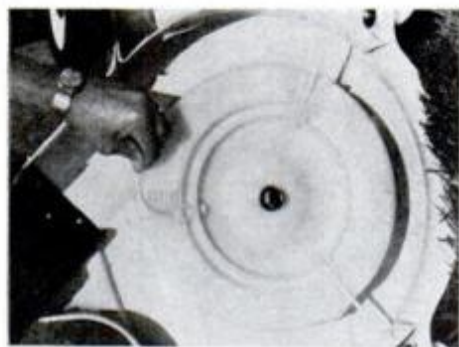


Bladeless mower

Safety-conscious consumers will appreciate this mower which cuts the grass without metal blades. They've been replaced on Roper's

machine by a plastic disc that holds three removable and flexible tapered pins (also plastic). The mower does a decent job on the grass, but really earns its price tag (\$154.95) by not destroying the stray objects that often get left in the yard.

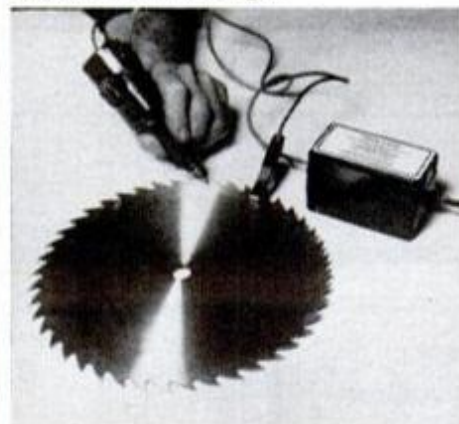
We drove it over a baseball mitt,



a towel, a tennis ball and a soda bottle, all of which survived. The plastic pins bend when they hit a solid object which should reduce the risk and severity of personal injury.

The machine comes with nine pins and each set of three should stay sharp enough for about 10 average mowings. The Roper Corp., 1905 West Court St., Kankakee, Ill. 60901, will be selling blister packs of three pins for about \$1.50 through distributors.

Extra metal strength

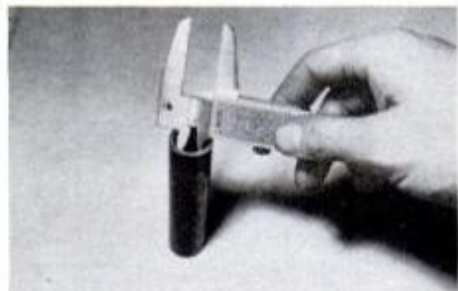
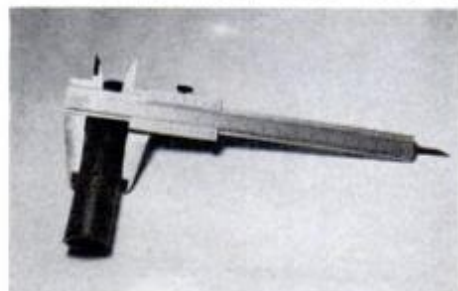


Here's an interesting tool with a lot of applications around the shop and house. The Tung-Carb applicator, made by Bebe Mfg. Co., Weirsdale, Fla. 32695, is designed to apply a layer of tungsten or titanium carbide on the wear surfaces of high-speed cutting tools, dies, punches, household items like scissors and garden equipment like lawnmowers. We used the tool, which combines an electric pulse

with vibrations (120 per second), to put a tungsten layer on the tips of a circular saw blade. A dial controls the amount of metal buildup to a maximum of about .0005 in. The \$75 tool is also said to add to the life of sparkplugs.

Low-priced caliper

Here's a real beauty at an even more beautiful price—definitely a rare combination. The tool: a



vernier-scale caliper with $\frac{1}{20}$ -mm and $\frac{1}{1000}$ -in. scales, a range of 140-mm to 5 $\frac{1}{4}$ -in., stainless steel hardened jaws (two on each side for inside and outside measuring) and it's packed in a fitted, protective case. The price: \$16.95.


The tool, made in West Germany, is a really nice piece of machine work. The jaws are precisely edged and the sliding scale operates smoothly and locks solidly. The scale faces are anodized and glare-free.

It's a tool you'll find valuable if you work on projects that require a high degree of accuracy. The Alinox No 210 is sold by Schleisinger's Tools Ltd., 1257 Utica Ave., Brooklyn, N.Y.—M.M.

Let us know

If you come across a new product with a unique feature we'd like to hear from you. The special quality could be the price, design or a special capability.

Put the details in a letter to PM Workbench, Popular Mechanics Magazine, 224 West 57th St., New York, N.Y. 10019.



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No man knows the rewards of owning the best like the man who rides the Deere.

A John Deere Lawn and Garden Tractor is an investment that'll pay dividends for years to come. It's available with 10-, 12-, or 14-hp engine. And its 4-speed transmission has a variable-speed drive that lets you change travel speed without clutching or shifting. Or without reducing the working speed of the mower or tiller attached. And because it's a John Deere Lawn and Garden Tractor, it's "human engineered."

Controls are clustered, within easy reach; color-coded for quick identification. The seat is cushioned, and high-backed for support.

The operator's platform is wide and roomy. A triple-safe starting system prevents accidental starts when the mower is engaged, or the transmission is in gear. And besides mowers, we can provide a dozen other John Deere attachments matched to the tractor size. So you have a versatile workhorse that pays you back in time and work saved year after year.

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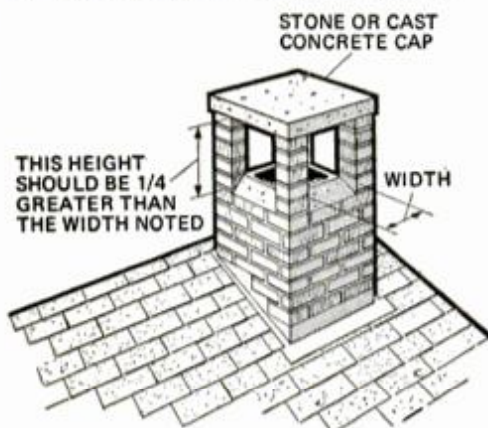
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HOMEOWNERS' CLINIC



Natural stone chimney cap

My chimney is at the end of the house. I sometimes get rainwater in my fireplace from a tall tree that overhangs the chimney. What kind of cap can I put on the chimney to



remedy this problem?—E. Johnson, St. Paul, Minn.

One type of chimney cap that is both ornamental and effective is a natural stone cap built in the manner illustrated. You or your masonry contractor can plan the details depending on the size of your chimney. It is likely that the top several courses of brick in the original chimney will have to be relaid and replacement tiles installed.

Paint specks on aluminum siding

My home has aluminum siding. In painting the trim I got a few small specks on the siding that I didn't see in time to wipe off when they were wet. Is there some way these can be removed without damaging the finish on the siding, by using a solvent, perhaps?—W.L. Sandquist, Galion, Ohio

Rather than risk the use of any solvent, I would try gently lifting the specks off with a scraper of the type used for removing paint drips from window panes. If you work carefully, you should find the specks can be removed without damaging the siding finish.

Discouraging moss on bricks

Moss tends to accumulate on the bricks of our side porch. What do you suggest we do to prevent this?—E.A. Cassel, Stroudsburg, Pa.

Moss tends to propagate in any

location where there is a lack of air circulation, especially along walls shrouded by low shrubbery or tall plantings. It would help to clear them away to allow air to circulate and sunlight to dry the moisture. Remove existing moss with a wire brush, wash the bricks with a strong solution of trisodium phosphate or a household cleaner containing this chemical. When the bricks are thoroughly dry, apply a coat of clear masonry sealer. This treatment will usually discourage the growth of new moss and leave the brick surface looking its best.

Spray cans won't work

I have some aerosol cans of paint that haven't been used for several years. These won't spray any longer. No matter how I twist or turn the nozzles, they still won't work. Is there a solution, or must I toss them out?—Leonard Block, Los Angeles, Calif.

No doubt the nozzles are clogged with hardened paint. They can usually be cleared by dunking them in lacquer thinner. Use a baby-food jar or other small jar. Pour a small quantity of the thinner into the jar, just enough to cover the nozzles. Allow them to remain for 36 hours or more. That should solve your problem. Lacquer thinner is a highly volatile, flammable solvent, so use it with care.

Remove screw anchors from wall?

I have purchased an older home with plastered walls. In two of the rooms there are several Molly-type screw anchors in the walls. How do you get 'em out?—Richard Olsen, Helena, Mont.

You don't, ordinarily, unless you can cut an opening in the plaster, which is hardly advisable, particularly if the plaster is over wire lath or a masonry base. However, by working carefully, you can drive the anchor into the plaster so that it is $\frac{1}{4}$ in. or so below the surface. Undercut the resulting hole a little and fill it with spackle. Mound the fill slightly and then sand it smooth after the spackle dries. Finish with a matching paint, and you'll have a smooth looking wall.

Relining a cedar chest

Mothballs were used in an old cedar chest I recently purchased. Is there any practical way to remove the mothball odor and revive the cedar aroma?—Marvin Davis, Tuscaloosa, Ala.

Try exposing the interior of the chest to full sunlight. In time, the sun should dissipate the odor. Better still, reline the chest with $\frac{3}{8}$ -in. cedar closet lining, available from most building materials dealers. This will reduce the interior size of the chest only slightly, but should eliminate the mothball odor and give your chest a cedar fragrance.

Gluing a mirror to the wall

I bought a large old mirror at an auction and want to hang it without its frame. Can I glue it to the wall?—J.B. Chase, Erie, Pa.

This is possible, but not necessarily the best way. Spread several beads of construction adhesive over the back. Then you must hold the mirror carefully in place until the caulking sets, and it will be hard to remove later if you move or want to change decor. I'd add small metal or clear-plastic mirror clips that screw to the wall. They hold a hefty weight, scarcely show and leave tiny holes that are easy to patch.

Sagging front door

Our front door sticks so badly at the threshold that at times it is almost impossible to open. What can be done to correct this?—Mrs. R. Richards, Detroit

Usually you can fix sagging doors by shimming the lower hinge. Remove screws, cut thin cardboard to size of hinge leaf, insert cardboard between leaf and jamb, punch in holes for screws and reattach hinge. This raises lower edge of the door so it will clear the threshold. ★★

Do you have a home maintenance or repair problem? Send it to Homeowners Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.49 postpaid. Send orders to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.

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Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

If a sedan is too small, a big station wagon too

INTROD THE 1977



expensive, and a van too uncomfortable, take the Bus!

USING VW BUS.

What? *You* drive a bus? Sure — why not? You have a family, don't you? Well, the new VW Bus was made for families, and vice versa. It gives you more of everything all at once: more room, more economy, more versatility, more comfort. And on top of all that, it's a lot more fun to drive. Just check it out against your other choices.

ROOM AND COMFORT

The '77 VW Bus not only beats a sedan hands down—it even outspaces a station wagon. In fact, it gives you 70% more room inside than a full-size, domestic station wagon. Put in everybody in the family, and we mean *everybody!* Up to seven people. You've still got plenty of room for your luggage, your dog, and your parakeet.



Or fold down the third seat and you just about triple the cargo area while you carry four people in style. Or if you really want to do some hauling, take out the middle seat, and now your Bus has as much deck area as a small truck.

How does it compare to a van? Your Bus is almost as roomy, but because the rear seats are not optional, it's a whole lot more comfortable. And a lot nicer, for that matter. In fact, the interior is beautifully finished.



VERSATILITY

See that rear hatch? And the big sliding door? They mean you can use your Bus like no other vehicle. One minute you're carrying the Little League team, or the whole dance class. The next you're taking home that antique dry sink you practically stole at the auction. Yet, because the Bus is shorter than most cars, it's easy to park. For all-around usefulness, there's nothing like your VW Bus.

ECONOMY

The '77 VW Bus costs only a little more to buy than the average domestic sedan and less than most big station wagons. And to run, it's out front by miles. The 2-liter engine is powerful and responsive, but it's also super-efficient, because it has electronic fuel injection which helps to give you an estimated 28 mpg on

the highway, 20 in the city with standard transmission in the 1977 EPA tests. Of course your actual mileage may vary depending on where and how you drive, your Bus' condition and optional equipment.

DRIVEABILITY

Your Bus has fully independent suspension on all four wheels, and radial tires, which give you a smooth ride and excellent roadholding. It has ten-inch power-assisted front disc brakes, for sure stopping power. And just look at the visibility from the driver's seat. Together, they all add up to great handling, and more pleasurable driving. And you can choose a standard transmission or fully automatic.



From any angle, the '77 VW Bus is clearly a winner. So visit your Volkswagen dealer and see how much farther your money will go when you take the Bus. Just be sure to bring the whole gang with you. As we say, the '77 VW Bus is a family affair.

TAKE THE BUS

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Introducing the Hy-Gain 40-channel CB System.

We make the whole works to make it work better.

Model 426. 40-channel
FM/AM/CB disguise
antenna. 40."



Model 2683A. 40-channel mobile transceiver. Phase Lock Loop.
Automatic modulation control. Switchable Automatic Noise Level.
Combined illuminated S/RF/SWR meter. True noise blanker.

There are two important parts to 40-channel CB radios. The transceiver and the antenna. It's important for you to know that. Because unlike ordinary radio, CB radio band waves are much more subtle and sensitive.

In order that you get the maximum in clear transmission and reception, you should buy your CB transceiver and antenna the same way you buy the coat and pants for a suit. Together.

Of all the people who make 40-channel CB radios, only one is a major manufacturer of both radios and antennas. That's Hy-Gain.

So when you buy a Hy-Gain CB radio and antenna, you're buying a CB system whose components are made for each other. When things are made together, they work better. That's our CB system.

Model 2680A

Model 2683A



Model 2682A

Model 674C

hy-gain.
WE KEEP PEOPLE TALKING.

CAR CLINIC

BY MORT SCHULTZ



Airborne ailments

I am a sales representative with a Ford agency and I've been receiving some pretty consistent complaints from some of my customers. Certain blue and red paints are greatly affected by what is called "industrial fallout." FoMoCo states that it is an uncontrollable act of nature. Can you suggest a way to remove this spotting?—Don Valley, Turners Falls, Mass.

Don't ask me, Don. Ask your service manager, because FoMoCo gives a really super explanation in service bulletin 101 (11/21/75). Notice that a clear distinction is made between industrial fallout and chemical fallout. Industrial fallout is defined as minute particles that are carried in the air which eventually settle on exposed surfaces. They include iron dust, smoke, soot, blast-furnace dust and fly ash, with iron dust being most detrimental to auto finishes. Particles embed themselves in paint film and after an amount of weathering they appear as tiny dots of rust.

Chemical contamination is either acid or alkaline which causes off-color spots in paint film. A common source of such contamination is sulfur dioxide, which is a by-product of the burning of high sulfur fuels, such as oil, gas and coal. When moistened, chemical fallout will cause a change in color pigment. For example, blue spots will develop on red paint.

The best way to treat industrial fallout is to wash the car and then apply liberally a solution of oxalic acid, detergent and warm water to all affected surfaces with a large sponge. The formula is 6 to 8 ounces of oxalic acid in 1 gallon of warm water to which 1 or 2 tablespoons of a nonalkaline detergent have been added.

Keep wetting the surface and rubbing it with a fine nylon bristle scrub brush until the surface no longer feels rough or gritty because of particles. Wash thoroughly with clear water.

If chemical fallout has not extended below the surface, it can be removed by hand or machine-polishing the finish with a medium-grit

auto-body polishing compound. If the spotting has penetrated deeply, the damage may be repaired only by refinishing.

Goo goo

The plastic dash in my 1969 Chrysler Newport has melted because of the sun's heat and formed a sticky mess that won't wash off with detergent. What can be done?—Clyde A. Watts, Hopeland, Pa.

Nothing that I know of will restore your dash. You must either live with it just the way it is, or tear it out and replace it with another dash.

Catch as catch can

Sometimes my new 1976 Chevrolet Nova with six-cylinder engine and manual transmission stays in first gear when I stop at a traffic light and then start off. It does this only on occasion and therein lies my trouble, because my dealer won't do anything unless it happens for him. It never does. What should I do about this?—Joseph Rossini, Brooklyn, N.Y.

Leave the car at the dealer's and let him road-test it under cold conditions. The problem may have something to do with temperature. Maybe the gear oil is too thick when cold.

Other than this, the cause of the problem lies either with you (perhaps you are not fully disengaging the clutch), the pressure plate (defective diaphragm) or inside the

transmission with a worn or defective synchromesh.

Whatever, your dealer's excuse that he can't duplicate the problem and thus can't do anything about it is no excuse. Keep after him to work out your problem or find a more reliable dealer.

Spouting off

About two years ago I had the misfortune of dropping the rubber spout of a five-gallon gas can in the fuel tank of my 1966 Oldsmobile Toronado. I would prefer getting this out, but the foreman at the Olds dealership told me not to worry about it—that the spout wasn't likely to disintegrate. I would appreciate your comments.—Jean Louis Drapreau, Holyoke, Mass.

I agree with the dealer. If you feel uneasy about the spout, though, and want to get it out, you will have to drop the tank, pull out the fuel gauge, dump gas and work the spout out through the opening. In my area, the minimum charge for doing this is \$14.

Delayed action

Can you tell me why the gas pedal sticks in my 1973 Capri? It happens often just as I try to accelerate from idle. I've lubricated the linkage with graphite. The problem is particularly aggravating in close traffic where a sudden lunge forward is upsetting to say the least. The car is equipped with the 2600-cc

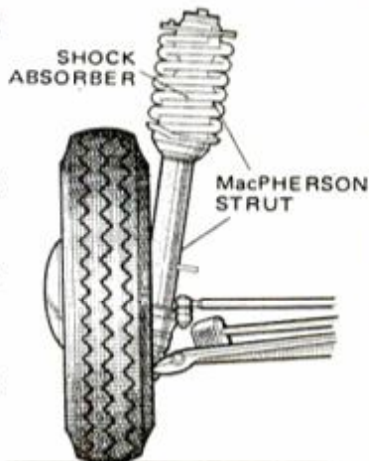
(Please turn to page 30)



PM CAR CARE

Doing the MacPherson strut

Foreign cars such as Capri, Datsun, Toyota and Volkswagen have a front suspension system known as the MacPherson strut. This independent system has the wheel literally bolted onto the shock absorber. These units have somewhat less service life than a conventional shock absorber. Renewing Macs used to require a foreign-car specialist, but no more. Now shock-absorber aftermarket manufacturers are issuing shock-absorber cartridges you slip into the housing after removing the original inner pressure tube and piston-rod assembly. Giving Mac new life, therefore, is now within the scope of the Saturday mechanic.



If you've ever said...

"There must be a better

one of our free Career Booklets may provide the opportunity you've been looking for.

It happens to all of us, sooner or later. No matter what kind of job we have.

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1977 Ford Granada. Photographed in Garmisch, Germany.

How did an American Ford Granada compare in tests of smoothness and quietness of ride with a \$20,000 German Mercedes?

Read how German engineers rated both cars after 7 days of testing.

Aerial view of test site in Bavaria, Germany. A Bavarian highway at dawn: drivers await "start" signal from test engineers.



FORD GRANADA

MERCEDES-BENZ 450 SE

Test results.

For 1977, a new Granada was brought to Germany for a scientific ride comparison with a Mercedes-Benz 450 SE (U.S. sticker price: \$20,689*). The Granada was a standard production car equipped with optional 250 CID engine (\$96.) and automatic transmission (\$186.). The testing was conducted by an independent German engineering firm. *Excluding taxes, title, destination charges.

Test 1: Smoothness test.

To test for "riding smoothness" the German engineers drove the Granada and the Mercedes at various speeds over a variety of roads in northern Germany, ranging from cobblestone to smooth highway. Using a sensitive electronic recorder, they measured both cars' interior vibration levels.

Test results: A thorough analysis of the engineers' data showed that in three out of the four test conditions there were "no major differences" in smoothness between the Granada and the Mercedes.



Test 2: Quietness test.

In the next series of tests the cars were evaluated for "quietness" of



Sleek profile of the 1977 Granada Sports Coupe.

ride. Again, they were compared over a variety of road surfaces in the north and south of Germany, at speeds ranging from 30-55 miles per hour. A sound meter recorded their interior decibel levels on the International dBA scale. The test data was then sorted by computer.

Test results: Analysis of the data from this series showed that in *all* the tests the Ford Granada consistently rode as quietly as the Mercedes-Benz.

1977 Fuel economy.

The Granada design—spacious inside for full riding comfort, trim outside. Of course, gas mileage will vary with the kind of driving you do, how you drive, optional equipment and your car's condition. But allow yourself to compare Granada's EPA mileage ratings with any or all of its new competitors.

EPA Mileage Estimates—'77 Granada		
Engine	City	Highway
200 CID-Manual*	21	28
250 CID-Manual*	21	28
250 CID-Automatic†	18	23
302 CID-Manual*	16	24
302 CID-Automatic†	16	22

*Not available in California. †Ratings lower in Calif.

Granada choice.

It starts with the classic European styling and remarkable riding comforts that are the hallmark of Granada—at the very modest base sticker price of \$4,010* for the 2-Door, \$4,088* the 4-Door.

If you prefer an extra accent on luxury, the new Granada Ghia should suit perfectly. The base Granada Ghia 2-Door: \$4,440; Ghia 4-Door: \$4,518.

And if you're looking for a sporting proposition, there's a Granada waiting to take you away: the Sports Coupe: \$4,521., with optional WSW tires \$39. (*Excluding taxes, title, destination charges.)

The idea...

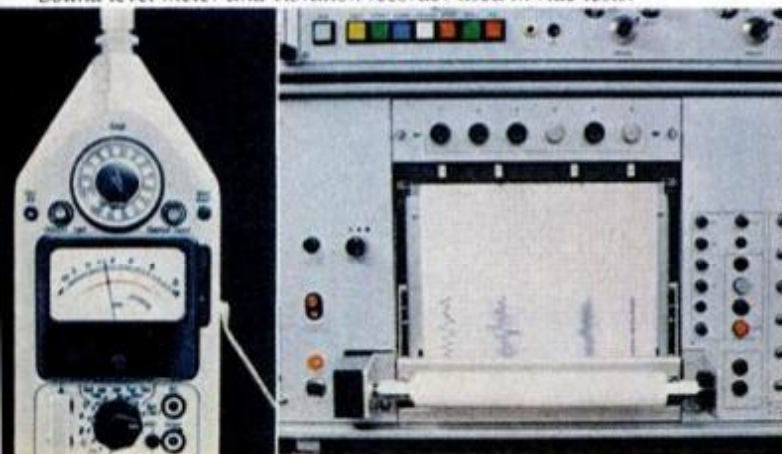
... was to offer American drivers classic styling and great riding comforts at a *sensible* price.

You've read what this Granada did against a \$20,000 Mercedes-Benz in Germany. Take a Granada test drive of your own and see for yourself.

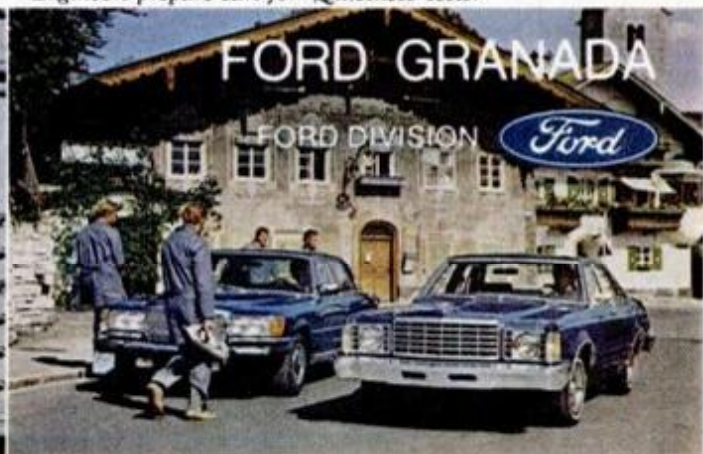


When America needs
a better idea,
Ford puts it on wheels.

Sound level meter and vibration recorder used in ride tests.



Engineers prepare cars for "Quietness Tests".



CAR CLINIC

(Continued from page 23)

engine.—Christopher T. Groessel, Lithonia, Ga.

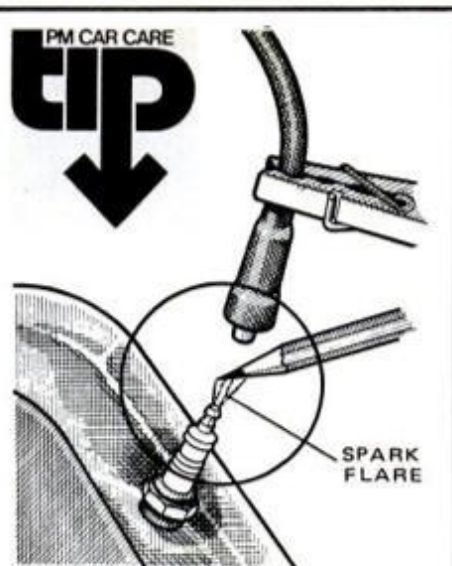
The gas pedal linkage and/or the throttle lever may be hanging up. Examine the linkage for bends. The linkage has to run straight and true from the gas pedal to the throttle lever. Examine the throttle lever. Make sure it isn't being impeded by an accumulation of foreign matter.

In all probability you will find that the linkage and throttle lever are okay. That's when you have to get inside the carburetor to rectify what is probably the reason for your problem—a throttle shaft that is sticking because it is damaged or because of a burr blocking smooth movement of the throttle plate.

By the way, have you checked the gas pedal area? Maybe smooth operation is being impeded by a piece of carpeting, say, interfering with pedal action.

Catching cold

I own a 1974 AMC Sportabout wagon, and I have a toughie for you. What would cause the horn not to work and the radio to die out at the first sign of cold weather? Neither



Pondering polarity

When you replace a coil, it is very important to make sure that the two primary leads are reconnected properly. A reverse connection reverses polarity, considerably decreasing the voltage available for ignition. For an easy way to check polarity, insert the point of a soft lead pencil between an ignition cable and sparkplug terminal while the engine is running. The spark flare will be toward the plug terminal if polarity is right. If not, reverse the leads at the coil.

horn nor radio will work all winter. In the spring, they come to life again.—David E. McElreath, Uxbridge, Mass.

Sooner or later I get them all. Oh, well—let's give it a shot.

Dave, look for a loose ground outside the car that gets moisture between the ground and ground strap, and then freezes and stays frozen, interrupting service until thawing. One such ground is the one that comes from the engine to the frame crossmember. Remove it, clean it off and reconnect it real tight.

Harry Miller's hot tip

Thanks go to Harry J. Miller of Sarasota, Fla., for this tip:

Without removing any parts except sparkplugs, you can make a quick and accurate assessment of timing-chain or gear wear.

Remove plugs and turn on ignition. Connect one clip of a 12-volt test lamp to the distributor terminal of the ignition coil. Connect the other clip to a ground and tighten the alternator belt more than normal.

Use a 12-inch ratchet handle with socket to fit the alternator pulley nut. Turn nut clockwise until ignition timing mark nears the fixed timing pointer. Test light should

Aftate® for Athlete's Foot is better than Desenex. Much better.

Because Aftate contains a special medication proven more effective in killing Athlete's Foot fungus than the medication in Desenex. Aftate is The Killer.

To relieve the burning, cracking and itching of Athlete's Foot, there's something better than Desenex. Much better. It's Aftate. Aftate kills all major types of Athlete's Foot fungus and helps prevent reinfection.

4 effective treatment forms.

Spray liquid and gel (red label); use for the treatment of even most stubborn cases.

Spray and sprinkle powders (blue label); use for daily foot care and to help prevent reinfection.



Aftate is The Killer.

© Plough, Inc. 1977

be out. Continue to turn the engine until the test bulb lights, then chalk-mark the damper opposite the timing-indicator pointer. Turn the engine counterclockwise until test lamp goes out. Then mark the damper again.

The distance between the marks represents the amount of lost motion or wear.

They goofed

I took my 1976 Chevrolet Vega station wagon to the garage a couple of months ago to find out why the automatic transmission is always a pint or so low on fluid. They said they found the speedometer cable was loose at the pan. They said that's the only place you can lose transmission oil. They said that they fixed it and there were no other leaks. So how come I'm still running a pint or so low every couple of weeks?—Joseph C. Rachas, Roebling, N.J.

Because "they" should know better. You can also lose transmission oil through the vacuum modulator, back through the vacuum line to the carburetor if the modulator's diaphragm is leaking. The fluid is sucked into the engine and burned. What's the solution?

Tell "they" to replace the modu-

lator, or do it yourself by disconnecting the vacuum line, unscrewing the bad modulator from the transmission and screwing in a new one.

A dippy stick

I want to complain about the engineering misfit who designed the oil dipstick in my 1975 Ford van with 351-cu.-in. engine. The dipstick is behind the airconditioner compressor. Because of the convoluted way in which it's in the tube, you can't get an accurate reading. When you draw the stick out, oil is wiped off. Phooey.—James Flynn, Chicago, Ill.

Time for a little consumer ingenuity, Jim. Fashion a makeshift handle from a wire clotheshanger that will allow you to draw the dipstick in a straighter line from the tube. Wrap your wire attachment around the dipstick handle. I can't take credit for this fix. I stole it from a VW mechanic who had to do the same thing so his Rabbit customers with airconditioning could get to the dipstick without burning their hands on a hot engine or scraping it against the compressor.

SERVICE TIPS

■ Wider use of a gasoline additive called MMT in unleaded fuel is fouling up many

car owners, not sparkplugs. MMT, which is a manganese compound, leaves a red-rust-colored deposit on the firing end of sparkplugs. Some have misdiagnosed the condition as rust deposits caused by water in cylinders when, in fact, it is normal. Reddish MMT deposits do not affect sparkplug performance to any greater extent than lead deposits left by leaded fuel.

■ If your 1976 Opel Isuzu drops dead and refuses to run, check the fan belt first. If a belt breaks or comes off, the generator ceases to operate and the engine will quit because the electric power needed to run the electric fuel pump is cut off.

■ An exhaust whistle during acceleration from a 1976 Ford or Mercury equipped with a 351 or 400-cu.-in. engine can be corrected by drilling a 1/8-in. hole through all diffuser screens as close to the center as possible. The diffuser assembly is located at the rear of the tailpipe and contains either two or four screens. Your Ford or Mercury dealer is authorized to do the job under the provisions of service bulletin 120. ★★★

GOT A PROBLEM WITH YOUR CAR?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

"What I like best about Carpenter's Wood Filler is how it disappears on a finished job."

Dom De Filippo
Carpenter.

*as defined in the Federal Hazardous Substances Act

"Beautiful! You practically need a magnifying glass to spot where I used Carpenter's Wood Filler," Dom De Filippo reports.

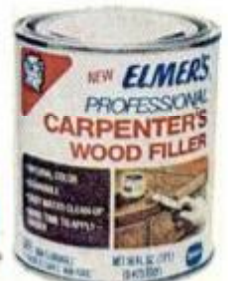
Professional carpenters agree this new product is a major improvement. It goes on so smoothly you can't believe it. It has excellent shrink resistance, so there are no tell-tale depressions to spoil a finished job. And it's formulated to hold the natural stain,

without over-darkening.

It's a pleasure to use, too. Just clean up with water before it dries—then you can nail, drill, paint, shellac or varnish it. It's non-toxic, non-flammable,* practically odorless.

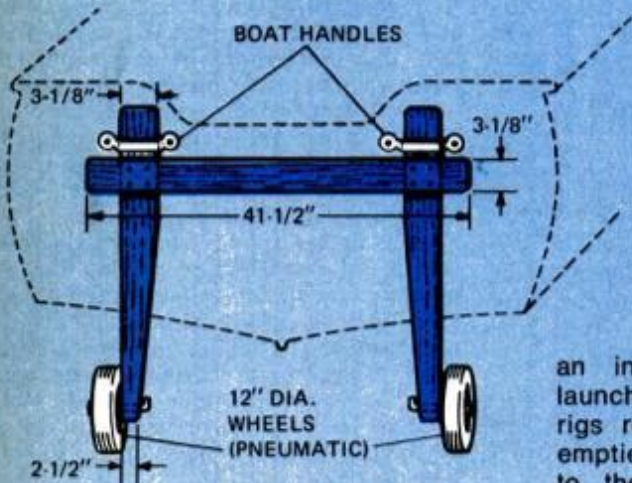
Take a tip from the pros. Try new Elmer's® Professional Carpenter's Wood Filler.

Elmer's. When results count.



Tips for better boating

Three quick projects for the do-it-yourself skipper



TOTE-LAUNCHER

Large boats remain in water or are launched and hauled out on a trailer, but the small boat that is usually handled by one person can be a handful without the help of an invention like the tote launcher shown. Many roller rigs require the boat to be emptied of all gear and taken to the water upside down.

With mine, the boat can be rolled into the water and the launcher removed there. The crossbrace can even be positioned so that an outboard motor, tilted up, can be left on the transom.

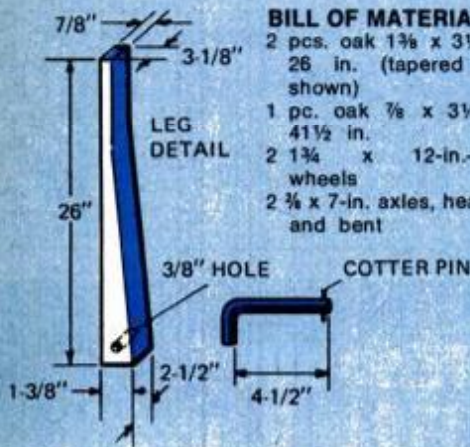
For removal, the rig is slipped out from under the handles and brought aboard, axle cotter pins removed, and the wheels stowed. If wing-nuts are used on the brace bolts, the legs can be folded.

—R. Thomson

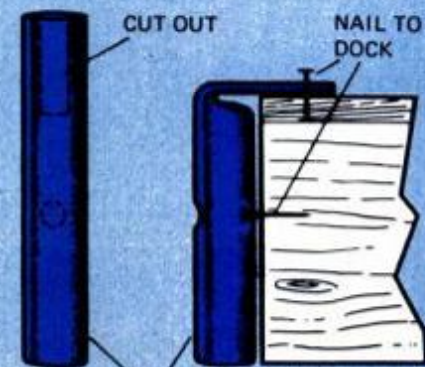
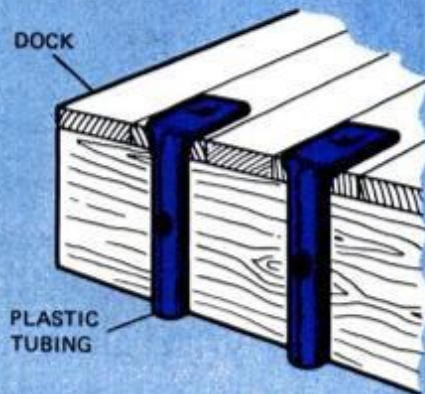
BILL OF MATERIALS

- 2 pcs. oak 1 3/8 x 3 1/2 x 26 in. (tapered as shown)
- 1 pc. oak 7/8 x 3 1/2 x 41 1/2 in.
- 2 1 3/4 x 12-in.-dia. wheels
- 2 3/4 x 7-in. axles, heated and bent

LEG DETAIL



BOAT DOCK BUMPERS



PLASTIC TUBING

When we replaced the plastic water line from the pump house to our summer cottage, we used the old pipe to protect our boat and dock from chafing.

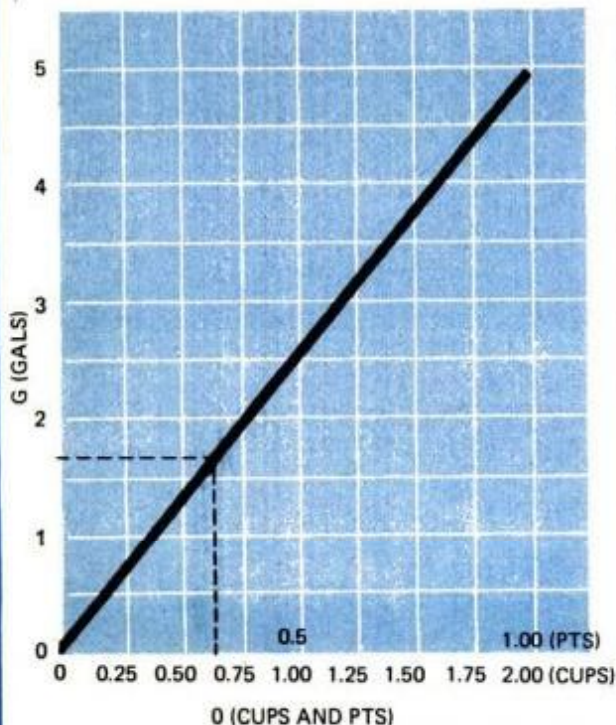
Lengths of pipe were cut to the depth of the dock facing plus an extra four inches. The pipe was then cut in half lengthwise for the top four inches so that only half the pipe remained to form a tongue at the top that was easy to fold over.

One or more holes were drilled in the outer side of the pipe and galvanized nails were used to secure the tongue to the top decking of the dock, while nails positioned through the holes and driven with a nailset fasten the pipe to the upright face of the dock. Our boat is no longer scarred.—Q. Kirk Davis

OIL/GAS MIX RATIO

To figure easily the amount of oil to mix with your outboard gas, mark gallons up the left side of graph paper and cups and pints along the bottom. Up on the horizontal line for five gallons, mark the point for the amount of oil to add and then draw a diagonal from that point back down to the zero mark.

Then, when you almost top your tank, read the gas added from the pump gauge and find that amount on your diagonal. Look directly below and you'll read the oil to add.—W.A. Carroll



Son of a legend.



The new Model 275 Coleman™ Lantern.

That familiar green Coleman lantern is a tough act to follow.

But this new Dusk Brown offspring is everything its "daddy" was. And then some.

Even simpler to use.

The Easy-Lite control has "OFF-LIGHT-ON" positions that you can see and *feel*. You can dial to full brightness in one turn.

And that same control also cleans the generator tip *automatically*. Every time you light the lantern.

There's even a frosted band on the globe to make the Model 275 throw a softer no-glare glow that's easier on the eyes.

And a wide 8¼" ventilator that spreads an even circle of light. Down... where you need it. And want it.

Sure, the "old" Coleman lantern will be around for a long time. In stores. And wherever the frogs are croaking. And the crickets chirping.

But the new 275 will be there, too.

Efficient. Dependable. Rugged. Getting the job done.

After all, it is a Coleman.

The great outdoors is too good to miss.



The Coleman Company, Inc. • Wichita, Kansas

Материал, защищенный авторским правом

One of a kind.

Where others seek mere wealth, he searches for experience.

He captures it in his own distinct way.

He smokes for pleasure.

He gets it from the blend of Turkish and Domestic tobaccos in Camel Filters.

Do you?



**Turkish and
Domestic Blend**

19 mg. "tar", 1.2 mg. nicotine av. per cigarette. FTC Report APR. '76.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

ALL OUTDOORS

RV insight

Your recreational-vehicle dealer is your expert who can answer nearly all RV questions if he has been in business for a while and wants to keep you as a customer. Your car dealer is often less knowledgeable when you ask about how much trailer tongue weight one model can handle or what suspension packages are available. Instead, at your Dodge dealer, ask for 1977 *Dodge Trailer-Towing and Recreational Vehicles*. Ford dealers can get you 1977 *Ford Recreation Vehicles*. Chevrolet dealers feature the 1977 *Chevy Trailering Guide*. Study these and you can be the expert.

Off-road fans should look for the \$1.95 *Scout Four-Wheel Drive Book* at International Scout dealerships and newsstands. It's a complete how-to manual for the sport.

Boat broadcasting

Until citizens band broadcasting began its recent boom, the most abused and overworked channels were the double-sideband AM marine frequencies used by recreational boatmen and professional mariners. Hundreds of miles of airways could be so cluttered with chatter transmission that sometimes emergency calls couldn't get through.

But now, broadcasting from your pleasure boat is a whole new ball game. The old marine radio system has finally been phased out and is illegal. Three systems replacing it this year have a lot of advantages, though most cost much more. Here's the story.

To be sure someone is listening when you call for help—probably the biggest benefit of a marine radio—you need a VHF/FM radiotelephone. While you may dream of sailing around the world, the chances are that you are usually near land and other boats most of the time. Unlike the older AM sets that could punch out and clutter up a radius of hundreds of miles, VHF signals tend to travel in a straight line, don't curve over the horizon, and may be dependable only up to five miles.

These line-of-sight signals go out up to 50 miles, however, if you're transmitting efficiently at full legal power to a Coast Guard or telephone company antenna mounted atop a tall building. Thus, you can

use your convenient static-free VHF/FM to report directly to the Coast Guard, or call the telephone company and have it direct your call to the Coast Guard, your mechanic, marina, home, or anyone else who has a telephone, just as was done with the old marine sets. Since VHF, like CB, has this limited range, your signals don't bounce and soar out beyond line of sight to interfere with other boatmen waiting for a free channel.

Today's VHF sets usually cost between \$200 and \$500, are little larger than a CB base station, do not use excessive current, and could conceivably be mounted in your rowboat, since the large ground plate of the AM sets is not required. Little hand-held walkie-talkie VHF transceivers are available. Licensing with the FCC, similar to that required for CB, is necessary. Commercial ships use VHF extensively, and in a busy harbor a pleasure skipper can listen to Channel 13 and learn just how a big ship plans to maneuver.

But if you intend to cruise far out from land, while budgeting for a boat that can handle open seas, you'll want to add a long-range single-sideband radiotelephone, plus a VHF set. This is not an either/or proposition. You must have a licensed VHF set aboard before you can install a licensed SSB. Your cost, therefore, will be, say, \$400 for VHF plus perhaps \$1000 or more for single sideband. Total cost for installations, sets and antennas may come to about \$2000, but you'll be well fixed for high-seas cruising (until you decide you'd also like Loran C and radar).

Citizens band, your third choice for pleasure-boat communication, works well along with very-high-frequency and single-sideband sets but not well by itself. Unfortunately, the Coast Guard has enough VHF and SSB emergency channels to monitor and cannot guard CB too. The telephone company has no marine operator wavelengths a CB broadcaster can use. You must rely on other CB users to hear you and relay "mayday" messages.

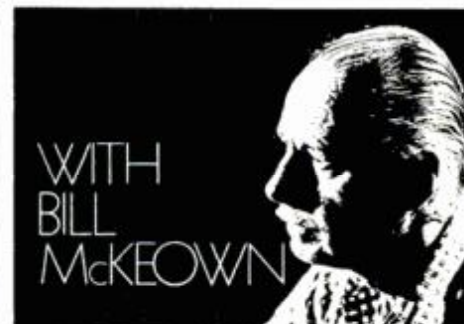
There are now so many CB sets in use, however, that your chances of being heard are good on busy boating days in many areas. Marine R/T owners used to scoff at CB, but now it can be very useful; you

should certainly take yours afloat if you have one. Many marinas now stand by on CB channels, and even low-power walkie-talkies are useful for Channel 14 communication between fishing boats, or for keeping contact with the kids off in a dinghy or out beachcombing. As long as you do not rate CB as a dependable marine emergency aid, it's a fine boating accessory and a useful supplement to the other sets. Raytheon expert Capt. Big-John Millard points out that the recent CB boom has probably aided VHF and SSB since it has showed the benefits of reliable marine radio communications.

The Radio Technical Commission for Marine Services, a nonprofit industry group, has recently prepared an excellent 72-page guide for boatmen interested in taking a radio afloat. Called *How to Use Your Marine Radiotelephone*, it is \$2.50 at marine dealers or from the RTCM, c/o FCC, Box 19087, Washington, D.C. 20036. And when you are considering the move up to SSB, an easy-to-understand but explicit *Guide to Single Sideband Marine Radio* is available for \$2.50 from Raytheon Marine dealers or \$3 with handling from Raytheon Marine, 676 Island Pond Rd., Manchester, N.H. 03103.

Gold fever

Any outdoorsman who ever wondered if there's gold in them thar hills he's hiking now has a good directory for finding out in a new volume by Verne Ballantyne from Arco Publishing, 219 Park Ave. South, New York, N.Y. 10003. *How and Where to Find Gold*, \$8.95, is a practical down-to-pay dirt study of the necessary first steps for finding millions. Once you strike it rich, you learn how to get assay reports and file claims, plus the federal and state requirements. The handbook fits a backpack easily and makes a useful guide. ★★



The 40-channel Cobra 29XLR. From the sleek brushed chrome face to the matte black housing, it's a beauty. But its beauty is more than skin deep. Because inside, this CB has the guts to pack a powerful punch.

The illuminated 3-in-1 meter tells you exactly how much power you're pushing out. And pulling in. It also measures the system's efficiency with an SWR check. In short, this Cobra's meter lets you keep an eye on your ears.

The Digital Channel Selector shows you the channel you're on in large LED numerals that can be read clearly in any light. There's also switchable noise blanking to reject short-pulse noise other systems can't block. The built-in power of DynaMike Plus. Automatic noise limiting

and Delta Tuning for clearer reception.

And the added protection of Cobra's nationwide network of Authorized Service Centers with factory-trained technicians to help you with installation, service and advice.

The Cobra 29XLR. It has 40 channels. And it has what it takes to improve communications by punching through loud and clear on every one of them. That's the beauty of it.



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Punches through loud and clear.

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PUNCH AND BEAUTY



Yes, you can test your own transistors

by Andy Morgan

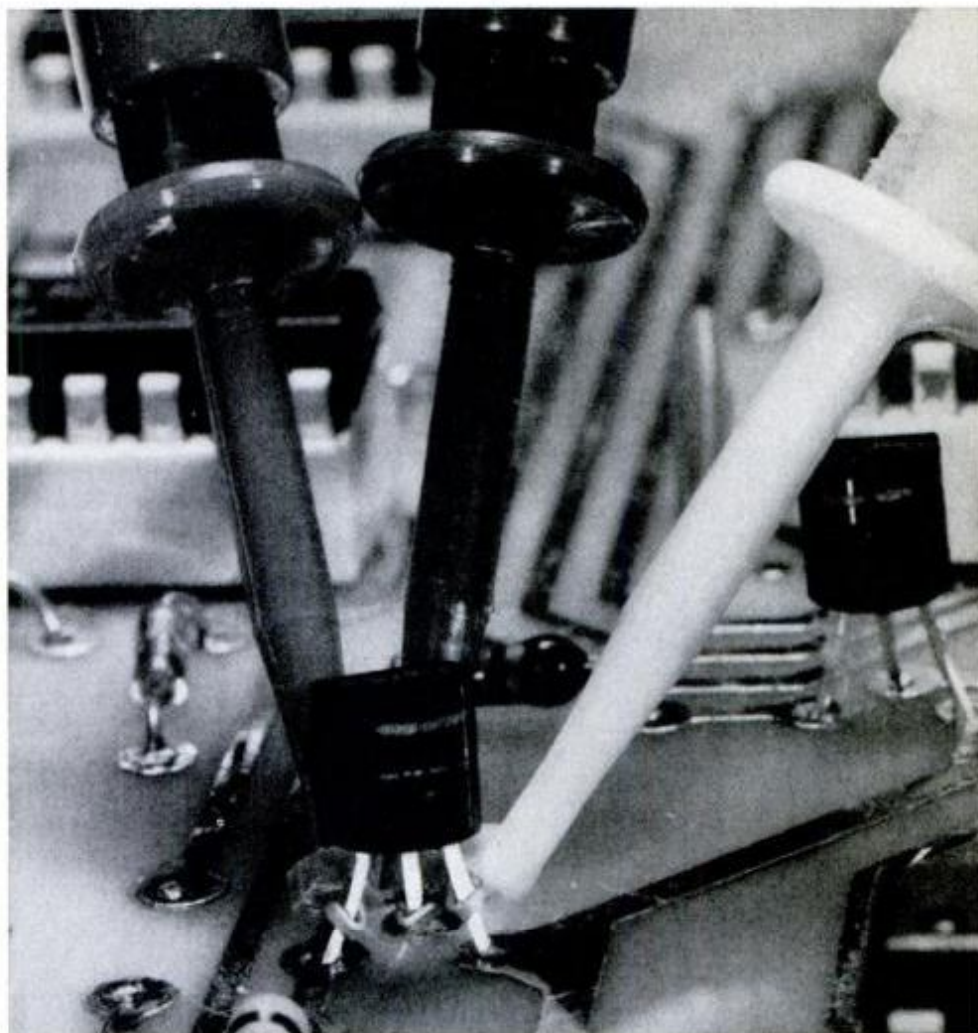
Remember when TV sets had tubes and you had a fighting chance of fixing them if they went on the blink? You took the back off, pulled the tubes out, then tested them on a checker at the corner drugstore. If they didn't test right, you could buy replacements right there. Usually that cleared up the trouble.

Now TV sets are solid-state (except for their picture tubes). And when something goes dead and you look at the back of the set, you find a label reading:

No user-serviceable parts inside. Refer servicing to a qualified technician.

Is that really true? Do you have to pay a repairman for a house call if the problem is a single bad transistor? Isn't there anything you can do yourself?

Yes, there is. You can sometimes fix the set yourself, and often track the problem down far enough to keep a check on the repairman. All you need is some knowledge of transistor-testing methods, plus some relatively inexpensive test equipment. Then you'll be on your way to saving mon-



Is that transistor good or bad? What's wrong with it? Is it shorted? Open? Leaky? Transistor testers can answer these questions and more, and you can perform many checks without specialized equipment, using an ordinary voltage and resistance meter.

ey on repairs of your TV and all your other transistorized equipment.

Method No. 1: Check voltages

Transistors rarely get sick, but they often die. A bad transistor nearly always has a short or an open circuit between its leads, not some subtle change in its performance. That

makes the first step very simple: Check voltages at each lead of the suspect device. (Of course, this assumes that the TV doesn't pop its fuse or circuit breaker every time it's turned on.)

Almost any voltmeter can be used for this purpose, including inexpensive volt-ohm-milliammeters (VOMs). Or you may prefer a digital multimeter (DMM) or digital voltmeter (DVM).

Luckily (since transistors are usually soldered into place, not plugged in, as tubes were), you make this check without removing the transistor from the circuit. But you must observe safety precautions when working on any equipment which, like television, may contain hazardous high voltages.

Clip one test lead (usually the black, ground lead) to the set's metal chassis. Then, for safety's sake, use *only one hand* to probe into the unit with the other lead. (If you keep your other hand in your pocket, you're less likely to touch another point completing a circuit through your body.)

If the transistor is good, the volt-

(Please turn to page 41)



Photos: Benn Mitchell



Different testers, different tests: Heath digital voltmeter (DVM), Hickok 215 transistor tester and Triplett VOM (top left) check resistance. Heathkit, Mura and VIZ (\$33) units (left) check d.c. gain (d.c. beta). Lafayette, Sencore and B&K meters (above) check a.c. gain—the Lafayette (top) checks tubes, too! Most tests can be made without removing the transistor from the circuit, and often without your knowing which lead is which.

Turner Lake, British Columbia, Canada

Canada at its best.

Share some tonight.



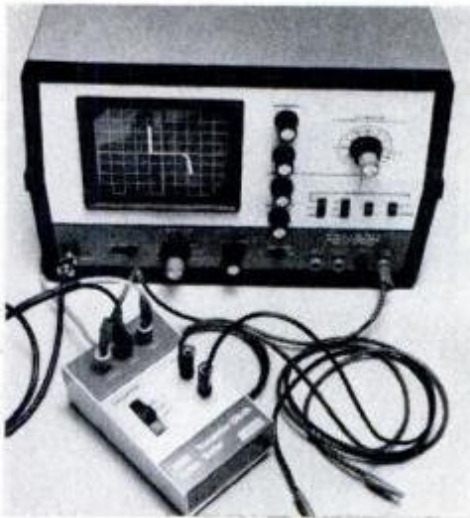
Try the light, smooth whisky that's becoming America's favorite Canadian.
Imported Canadian Mist.

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YES, YOU CAN TEST YOUR OWN TRANSISTORS

(Continued from page 39)



Breakdown voltage test requires just an oscilloscope and a.c. signal source—but this Eico checker simplifies test. More elaborate scope tests are rarely needed.

age on each of its leads will usually be at least slightly different from those on the others. If any two leads test the same, suspect a shorted transistor. If you can, check the voltages against a schematic diagram (or against the other channel if it's a piece of stereo gear with only one channel working improperly).

Method No. 2: Check resistance

If the equipment you're testing won't turn on or stay on, the first step is to check resistances. And if you've narrowed down the suspects by checking voltages, this is a good second step.

Remember that transistors can generally be thought of as two diodes—circuit elements that conduct current in only one direction—in series, with leads of like polarity wired together and this junction brought out as the third lead. The resistance between the base and either of the other two leads should be very high in one direction and very low in the opposite one; and resistance between the collector and emitter should be very high in both directions.

You can use this fact—and your VOM or DVM—to determine if a transistor is shorted or open. If the resistance between any two leads is less than a few ohms in both directions, suspect a short; if resistance between the base and either other lead is very high in both directions, suspect an open transistor.

With a VOM, this test is telling—but tedious, because you have to keep switching the test leads around. So if you spend much time troubleshooting, you might consider a specialized transistor tester like the Hickok 215

(\$138); you simply connect its three test leads to the transistor, and light-emitting diodes tell you whether the device is good or bad, whether it's an NPN or PNP type, and which of its three leads is the base.

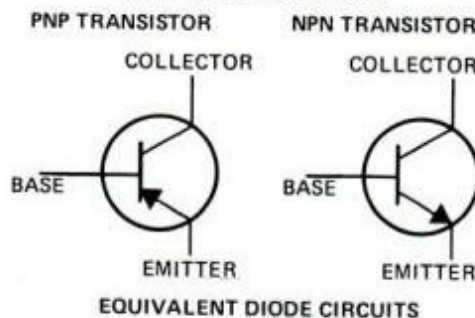
Method No. 3: Check d.c. gain

If you've determined that none of the transistors is shorted or open, but the circuit still doesn't work, you may have to test for more subtle problems. A transistor may check out okay on simple resistance tests, but still not amplify. So the next step is to see whether or not it does.

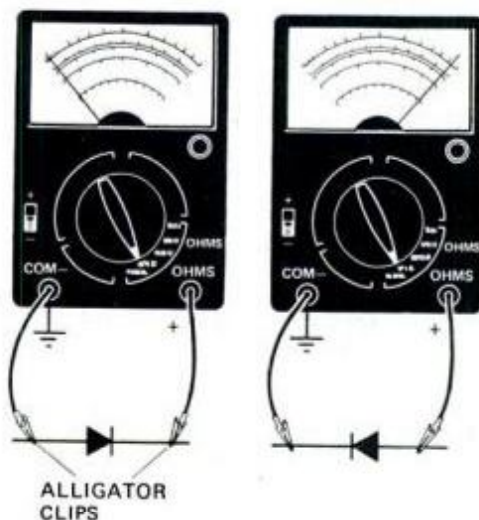
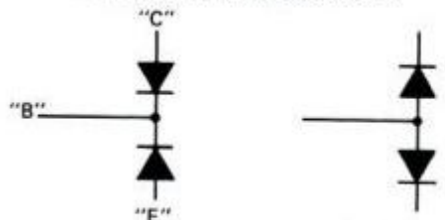
A transistor's amplifying ability, called its "beta," is the ratio between its input current and its output cur-

(Please turn to page 43)

How a simple meter can test transistors



EQUIVALENT DIODE CIRCUITS



Treat a transistor as a pair of diodes, and you can check it with an ohmmeter: Resistance should always be high between the transistor's emitter and collector, but only high in one direction between the base and the other two leads.

...And the Best of Canada.

Here's a new way to get authentic goods from the North Country... items that are not readily available in local stores.



Chamois Cloth Shirt. Long sleeves and long tuck-in tails. (Ladies' has squared tails.) Warm, durable and machine washable. Colors: Forest green, Tan, Navy, Bright red. Men's sizes: 14½ to 19. Ladies' sizes: 10 to 20. \$12.50



Early American Trapper Blanket. 85% wool, 15% nylon for durability. 72" x 90". Machine washable. Patterns: White with candy stripes, Red with black stripes, Green with black stripes. \$26.75



Old-fashioned Scarlet Union Suit. For active outdoor men and women. Duofold soft cotton inside with wool, cotton and nylon outer layer. Sizes: 34-36-40-44-48. \$17.50

Include cap liner from Canadian Mist® (except ½-gallons) and deduct \$1.00 from each order. (Offer valid only in states where legal—not in California.)

Please send the full Canadian Mist Trading Post Catalogue only. I have enclosed 25¢. (Catalogues sent free with every order.)

Please send me the following:
 Chamois Cloth Shirts @ \$12.50 = \$ _____
 Men's size _____ Ladies' size _____
 Men's Color _____ Ladies' Color _____
 Trapper Blankets @ \$26.75 = \$ _____
 Pattern _____
 Scarlet Union Suits @ \$17.50 = \$ _____
 Size _____
 Add for postage and handling \$ 1.50
 Total Order \$ _____
 Deduct \$1.00 if Canadian Mist cap liner is attached. \$ _____
 AMOUNT ENCLOSED \$ _____

Check or Money Order BankAmericard
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Card Number _____ Exp. Date _____

Customer's signature _____

NAME _____

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CITY _____

STATE _____ ZIP CODE _____

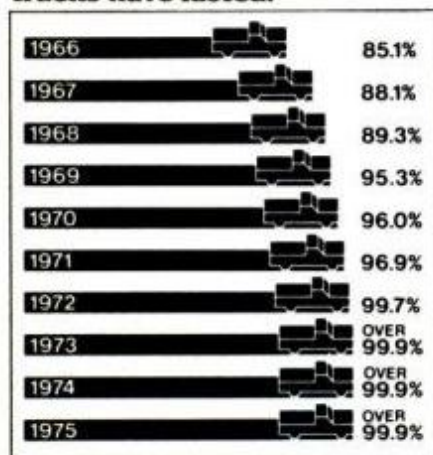
Mail to: CANADIAN MIST TRADING POST Dept. 7-37,
 P. O. Box 637 Brunswick, Maine 04011

CHEVY TRUCKS. TOUGH IN THE RIGHT PLACES.

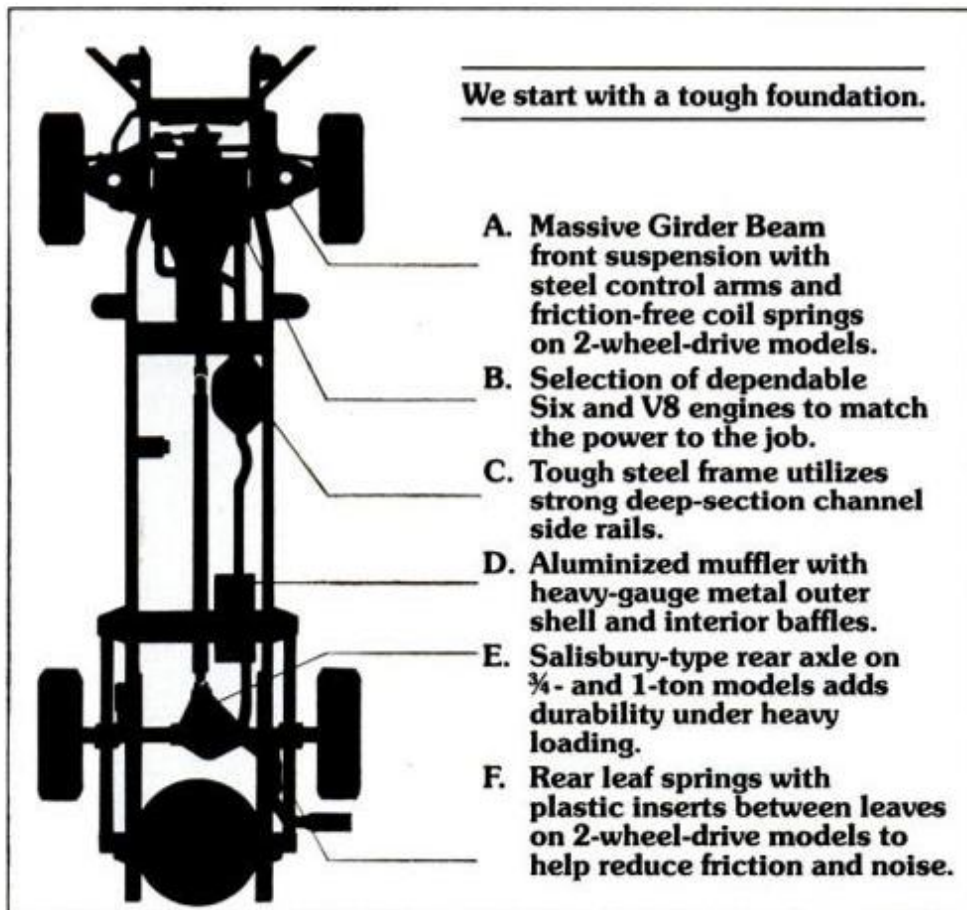
At Chevrolet, we expect our trucks to *stay tough*. So we devote special attention to the points that are prone to stress and wear.

Here's what Chevy means by tough. Chevy brake systems are computer-matched to the gross vehicle weight rating of the truck. Heavier duty trucks get heavier duty braking systems automatically. *Double-wall construction* in vital areas—front fenders, hood, doors, Fleetside box and tailgate. *Extensive rust and corrosion protection* includes a 7-step process for cabs, total immersion in primer for pickup boxes.

And here's how long Chevy trucks have lasted.



The chart above shows the percentage of Chevy trucks still in use in each of the 10 most recent model years recorded. 96% of all Chevy trucks registered during those model years, as reported by R. L. Polk & Co., were still in use on July 1, 1975.



YES, YOU CAN TEST YOUR OWN TRANSISTORS

(Continued from page 41)

rent. You can measure this, too, with a simple meter, but it's not a simple job. It's much better if you can use a meter designed specifically for this test.

There are a lot of these around, including the Mura 375-M (\$50), the Heath IT-121 (\$63 in kit form), and the VIZ Instrument's WUC-506B (\$33) Hook them up as directed, and you can read beta directly from a meter scale. But you'll need to know the beta the transistor should have before you know if it's working correctly. Here again, a schematic diagram is very helpful.

The Mura also has convenient voltage and resistance scales that can be used for the simpler transistor tests (though they're not enough to replace a good VOM in other jobs). And both the Mura and the Heath can be used to check another important transistor parameter—and that is leakage current.

Method No. 4: Check leakage

Sometimes impurities in the transistor make it conduct continuously, never completely shutting off. This causes hard-to-diagnose failures in transistor circuits. To be accurate, leakage current tests require that you remove the transistor from the circuit. If it's tested in-circuit, other components connected to it will conduct some current and throw the test off; the meter can't tell whether current is leaking through the transistor or whether part of the current is coming back through the rest of the circuit.

(The same circuit paths and components can also throw off the resistance and d.c. beta tests; but though in-circuit tests are less accurate, they're easier to make. So you might make those two tests in-circuit first, then remove suspect transistors for testing if all other tests fail to diagnose the trouble.)

Method No 5: Amplify real signals

A transistor's a.c.-signal gain—its a.c. beta—tells you more about how it will handle real signals than any other test. As with d.c. beta, an a.c. beta check compares the output and input current, but this time the current is an a.c. signal.

About the least expensive instrument for this is the Lafayette 38-01123 tester kit (\$35), also available wired as 38-01131 (\$50)—it also tests vacuum tubes. To use it, you have to know the correct lead orientation for the transistor you're checking. In most cases, that's no problem, but it can be in the event that your

transistors are unmarked or house-branded.

Both the B&K Precision 510 (\$90) and the Sencore TF 40 Pocket Cricket (\$98) eliminate this problem and speed testing even when you know which lead is which. As with the Hickok, you connect either instrument's three leads to the transistor in random order; then you move a switch through six positions. If the transistor is good, either tester will beep in at least one of these positions; and the tester will also show you whether the transistor is an NPN or PNP type, which lead is the base, and sometimes which of the other two leads is which. Either instrument can also check transistor leakage and tell you whether a good transistor is made of germanium or silicon (which determines about how much leakage current is acceptable).

Using an oscilloscope

It's not completely true that diodes and transistors conduct in only one direction between leads. Put a high-enough reverse voltage across a diode or transistor junction, and that junction will conduct backward. The voltage necessary to cause this is called "breakdown voltage."

Breakdown-voltage troubles occur when circuit voltages rise high enough to cause reverse conduction in a normal transistor, or when a sick transistor's breakdown voltage is low enough to conduct backward with the voltages normally present in the circuit.

If you know the transistor's normal breakdown voltage, you can check to see if abnormally high voltages exist. If they don't, you can check your transistor's actual breakdown voltage by removing it, putting an a.c. signal across two of its leads, and looking at the voltage output on an oscilloscope. If the input signal drives the scope's horizontal scan, and the output signal drives the scope's vertical, a curve will be traced on the screen. With proper calibration, you can read the breakdown voltage right off the screen. Eico's Model 688 Kit (\$15) simplifies the connections for this test.

Other instruments

You can also buy instruments called transistor curve tracers that plot on the scope screen a family of curves corresponding to the transistor's amplification at different voltage levels. But unless you design transistor circuits or are developing sophisticated equipment that information is of very little value. ★★

* PUT THE "IGNITION OF THE FUTURE" ON YOUR CAR TODAY!

MODERNIZE and Bring Your Car "UP-TO-DATE" with the MOST EFFICIENT Ignition ever invented!

* End "Tune-Up" Problems FOREVER caused by Points and Condenser



ALLISON XR-700

with the Exclusive...Solid-State Voltage Regulator.

The ONLY Ignition System that has COMPLETELY overcome the Problems that have baffled the Auto Industry for Years!

SO RELIABLE (99.9+%)... SO PERFECTED... that it will soon be STANDARD on most Future new Cars!

ALLISON Rated #1 by Official Testing Laboratory as the BEST "Fuel Saving" Ignition System of ALL the Different Ignition Systems Tested!

* The "XR-700" is a COMPLETELY NEW Ignition System employing the Most Advanced Technology, that replaces the inefficient Points and Condenser with an infrared Light Beam to Trigger the Latest type of Solid-State Power Components. Once installed... "XR-700" has NO moving Parts to wear out or adjust. It works without Friction or wear. Not affected by Dirt, Oil, Moisture, Vibration or extreme Engine Temperatures! RUGGED and RELIABLE!

* The "XR-700" is engineered to OUTLAST YOUR CAR!

* The "XR-700" produces the MAXIMUM "High Energy" Long Duration Spark... from your present car's Ignition Coil. This permits the Positive Firing of Spark Plugs, even under the most Adverse conditions. Also, Eliminates "Engine Misfire," resulting in more COMPLETE COMBUSTION! Thus you get IMPROVED Fuel Mileage, a HIGHER Performance Level... keeps Plugs FROM FOULING and gives LONGER Plug Life!

Customers Report:

★ "IT MORE THAN PAYS FOR ITSELF!"

- ★ INCREASES Gas Mileage up to 30%!
- ★ SAVES Money on Costly "Tune-Ups"!
- ★ Gives Continuous PEAK Performance!
- ★ QUICKER Starting in Any Weather!
- ★ Smoother Running... Faster Acceleration!
- ★ Plugs Last Up to 4-Times LONGER!"

* Reliability PROVEN in Millions of Customer Miles to be so exceptionally GOOD... that every "XR-700" has a LIFETIME WARRANTY! FREE Repair or Replacement for as long as you OWN the Unit!... and even if you CHANGE Cars, Allison will supply you the necessary PARTS to fit ANY Point-Type Distributor... FREE! (Include \$2 for Postage & Handling).

* FITS ALL CARS, Domestic & Foreign, 4, 6 or 8-Cylinder.

★ DO-IT-YOURSELF... EASY INSTALLATION!

The New "XR-700" is Completely Factory Assembled... Thoroughly TESTED! New Precision "Drop-in" Mounting Bracket, with color-coded, "Snap-Together" wire connections. No Distributor Removal necessary... Protected against "Incorrect Hook-up!"

● Thousands sold at \$59.95 ● ONLY

NOW! Allison's Production Technology offers you the same Premium Quality XR-700

\$39.95

at this SPECIAL LOW Price... COMPLETE (Cal. Res. add Tax)

THAT'S EVERYTHING... INCLUDING POSTAGE & INSURANCE

★ ORDER WITH CONFIDENCE... install the "XR-700", and prove to your own SATISFACTION that it is as advertised, or return it within 30 days for a FULL Refund of the Purchase Price

* SAVE! ORDER FACTORY DIRECT. Send Check or M.O., State Car Make, Year, No. Cylinders

* MASTER CHARGE or BANKAMERICARD Card Holders: ORDER by TOLL FREE PHONE. (800) 423-6525, Ext. 2 or Send us (1) Your Number, (2) Interbank No., (3) Exp. Date.

* SEND FOR FREE BROCHURE and Comparison Sheet.

"CB" USERS: The "XR-700" completely ELIMINATES the Major Cause of Primary (Ignition Noise) Interference.

* If you have already installed a "Capacitive Discharge" Ignition • Convert your "C.D." Unit to BREAKERLESS! INCREASE ITS EFFICIENCY with "XR-CD"... only \$29.95



* America's Oldest and Largest Manufacturer of Opto-Electronic Ignition Systems. ©

ALLISON AUTOMOTIVE CO.

1267 - PM, East EDNA PL., COVINA, CAL. 91722

PM TOOL TEST



Craftsman hammer drill

The new Craftsman $\frac{3}{8}$ -in.-capacity hammer drill has so many features it could be the one that many do-it-yourselfers would like in place of several specialty drills.

The Sears drill has a variable-speed trigger—slow speeds for starting holes, driving screws, drilling in ceramics and the like, plus high speeds (with a trigger lock button) for normal drilling, buffing and polishing.

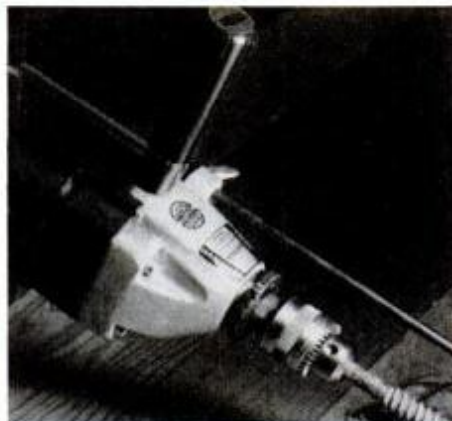
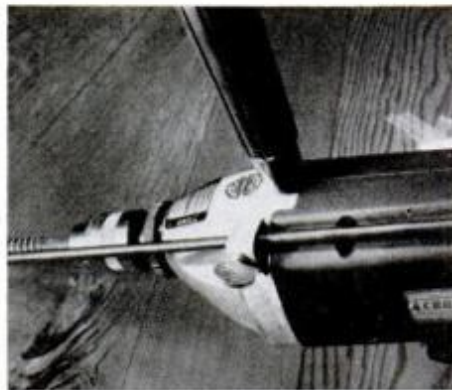
The lever near the trigger is a reversing switch that can change chuck rotation through the full speed range. The switch is spring-loaded to keep it in position for normal drilling. To reverse, you push the lever to the left with your index finger while you pull the speed trigger with your middle finger. This design prevents gear damage from reversing at full rpm.

A healthy-sized auxiliary handle can be screwed into the top of the housing for heavy-duty, two-handed operation. Getting an extra grip on a powerful drill gives you better control, especially with large bits.

What you've got now is a versatile, heavy-duty drill (it has a 3.2-amp. motor) plus one more feature—hammering action for quick drilling in masonry. You switch from drill to hammer mode by rotating a ring between the housing and chuck.

In defense of specialty tools, the hammering action of this all-pur-

Drilling in masonry goes a lot faster with the hammering action this new Craftsman drill can provide. Twist the knurled ring above the chuck to select the right mode. The beefy second handle (below) is mounted above the adjustable depth rod. A reversing lever (bottom) is located just in front of the variable-speed trigger to allow one-handed operation of both controls.



pose drill is somewhat underwhelming, but with a carbide bit it does speed up drilling time. You'll notice the difference more in concrete than in softer masonry like brick or mortar.

A rod on the housing serves as a depth gauge and is adjusted and locked with a thumbscrew. The double-insulated hammer drill retails at Sears for \$64.50. It takes high-speed bits up to $\frac{3}{8}$ in., masonry to $\frac{1}{2}$ in., wood-boring to $1\frac{1}{4}$ in., hole saws to $2\frac{1}{2}$ in., and 5 in.-dia. sander-polishers.—Mike McClintock, *Home and Shop Editor*

65,000 more technicians needed by 1980*

Learn Air Conditioning, Refrigeration and Heating.

Learn at Home With NRI's Master Course Program In Your Spare Time

Start a well-paid career in the field of air conditioning, refrigeration & heating with practical at-home training from NRI. The NRI program was developed with technical assistance from the York Division of the Borg-Warner Corporation and it uses bite-size texts, fine professional instruments and tools, and "hands-on" kits to make learning easy.

Air Conditioner System comes with Course for Trouble Shooting.

You get a Circuit Demonstrator, Control Simulator, tubing and joint-making demonstrator, leak detector, system analyzer, and a window air conditioner unit for hands-on experiments.

Optional Resident Training at Famous York Institute

Graduates of the Master Course may take advanced work at the world-famous York Institute Resident School at no extra charge. Working with expert instructors you will receive practical experience equal to months of on-the-job work.

Send for your free catalog.

Just check the card opposite. No salesman will call.

Approved for career training under GI Bill.



*U.S. Dept. of Labor Bulletin 1824

No other TV/Audio home study school puts prices in its ads. Why?

Maybe it's because they can't match these values

NRI will give you complete TV/Audio service training with a solid state 25" diagonal color TV and a 4-speaker Quadraphonic System for hundreds of dollars less than the combined tuition cost of courses at another school. Only NRI gives you a choice of five ways to learn, starting as low as \$445 with convenient, inexpensive time payment plans.

NRI pays no salesmen. We buy no outside "hobby kits" for our experiments and training kits. We pass the savings on to you, giving you the top educational value available anywhere.

Take your choice in TV/Audio training

Only NRI gives you a choice of five courses in TV/Audio servicing. Each comprehensive course features bite-size lessons, special reference texts,

special engineered "power-on" training kits, and service instructions for black and white TV, color TV, FM multiplex receivers, PA systems, antennas, radios, tube, digital circuitry, transistor, and solid state circuits.



NRI SCHOOLS
McGraw-Hill Continuing Education Center
3939 Wisconsin Avenue,
Washington, D.C. 20016



good

7 kits including Quadraphonic Stereo...\$445

or low monthly terms

A basic TV/Audio Servicing Course including 7 training kits for your experiments. You build your own 4-speaker Quadraphonic System, solid-state volt-ohmmeter, CMOS digital frequency counter, and electronics Discovery Lab. Includes 48 bite-size lessons (18 on color TV), 10 special reference texts with hundreds of servicing shortcuts, tips on setting up your own business, etc. This completely up-to-date course covers black & white and color TV, FM multiplex receivers, public address systems, antennas, radios, tube, transistor and solid-state circuits.



better

11 kits with Quadraphonic Stereo and B/W TV...\$550

or low monthly terms

A complete course in B&W and Color TV Servicing, including 48 lessons (18 on color TV), 10 special reference texts and 11 training kits. Kits you build include 4-speaker Quadraphonic System, solid-state volt-ohmmeter, CMOS digital frequency counter, electronics Discovery Lab, plus a 12" diagonal solid-state black & white portable TV to build and use. At each assembly stage, you learn theory and "Power-On" application of that theory in typical solid-state TV sets.



better yet

11 kits with 19" diagonal color TV...\$880

or low monthly terms

The course includes 42 lessons and 4 reference texts plus kits and experiments to build a superb solid-state 19" diagonal color TV receiver . . . complete with cabinet, and engineered specifically for training by NRI's own engineers and instructors. This handsome set was designed from the chassis up to give you a thorough understanding of circuitry and professional trouble-shooting techniques. You build your own solid state volt ohmmeter, CMOS digital frequency counter, and experimental electronics Discovery Lab.



best

14 kits with 25" diagonal color TV and Quadraphonic Stereo...\$1195

or low monthly terms

The ultimate home training in Color TV/Audio servicing with 48 bite-size sessions, 10 reference texts, and 14 training kits . . . including kits to build a 25" diagonal color TV, complete with console cabinet; a 4-speaker Quadraphonic Center; a wide band, solid-state, triggered sweep, service type 5" oscilloscope; digital integrated circuit color TV pattern generator; a CMOS digital frequency counter, and an electronics Discovery Lab. This gives you both TV and Audio training for hundreds of dollars less than the tuition cost of TV and Audio combined from the next leading school.

This Master Course combines theory with practice, using the "Power-On" stages for experimentation and learning. Building NRI's equipment will give you the confidence and ability to service any color TV or Audio unit on the market. And you'll have a magnificent TV and quadraphonic system for years of trouble-free performance.



advanced

Advanced Pro Color with 19" diagonal color TV...\$665

or low monthly terms

An advanced Color TV Servicing Course for experienced technicians, 18 lessons, 5 new "Shop Manuals", and NRI 19" diagonal Color TV receiver with cabinet.

Wood Projects for the Garden

• Detailed plans for 67 easy-to-build garden accessories
• Containers, tables, benches, tables, backdrops, benches—and more
• Step-by-step instructions and using tools, materials, finishes
• Easy-to-follow instructions, full-color diagrams... many variations



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2 indispensable
tools for the
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Do-it-yourself Garden Construction Know-How

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Gadgets that turn your hi-fi off for you

by William Kanner

How many times have you discovered, hours (or days) after the last record on your hi-fi system ended, that you'd left the system on? These gadgets will shut it off for you.

Audiotex's "Power-Off" is the simplest. It's available from Lafayette (24P 19513, \$13), among other dealers. It's for use strictly with turntables or tape decks that shut themselves off after play. You plug your tape or record player into an outlet on the back and your amplifier or receiver into a second outlet. (The turntable outlet handles up to 100 watts, which is plenty; the amplifier outlet is only for amps drawing 325 watts or less, which eliminates super-power jobs.)

'Auto' or 'Manual'

When the Power-Off's front panel switch is set to "Auto," your amplifier will go on when you switch the turntable or tape deck on and go off when that signal source switches itself off. In "Manual" mode, the amplifier power outlet stays live, so you can listen to FM or other program sources.

"Systems-Off," from Mantis Research Laboratories (285 North Snelling Ave., St. Paul, Minn. 55104), works like Power-Off, by sensing whether the turntable is drawing current or not, but comes in a more attractive cabinet and costs a little more (\$20).

"Control One," from Electromedia Design (Box 26, Livingston, N.J.) works on a more sophisticated and versatile principle. Instead of sensing whether or not a turntable is still running and drawing current, it senses (via a cable connected to one of the amplifier's output terminals) whether or not the system is still delivering a signal. If it hasn't detected anything for 10 minutes, Control One shuts your



Shutoffs range from simple Power-Off and Systems-Off (left) to Amp-Lay (top right) and Control One (center).

system down. If you restart the music during the 10-minute wait, Control One will reset itself.

This has several advantages: Since it works on the amplifier output (which is common to all signal sources in your system), it will shut your system down if the tone arm is lifted from the record, if the tape ends or if the FM station goes off the air (provided your tuner or receiver has muting). The 10-minute wait is long enough to give you time to get up and change the tape or record. It's also long enough to let you leave the system on standby if a phone call interrupts you while you're listening; but if you forget the music after the interruption (I find I'm likely to), the system won't stay on forever.

'Defeat' switch

Control One will switch even the largest systems or most powerful amplifiers. And if you don't want it to turn the system off, there's a defeat switch in the back. The price is \$50.

"Amp-Lay," soon to be available from Amber Electronics, 2182 Dupont Drive, Irvine, Calif. 92715, senses whether your turntable or tape deck is still drawing current, as do Power-Off and Systems-Off. But Amp-Lay also has separate outlets for both turntable and tape, so you can use it with either one without unplugging and reconnecting anything, and a trimmer adjusts for the various turntables' differing power draws. And it has a time delay, like Control One's but variable: You can set it to turn your stereo off anywhere from 10 seconds to an hour after your turntable or tape deck stops.

The handsome unit we tested was just a prototype, but production is expected to begin soon. Projected price is about \$80. ★★★

If you're creative, here's a "money-hobby" that might make you rich.

By Edward C. Lane, Ph.D.

Several years ago, while I was teaching college in Indiana, I stumbled across a hobby that has changed my life.

Oddly enough, I discovered it while browsing through magazines in a drug store. In almost every magazine there were dozens of small ads selling one basic thing — printed information.

The financial magazines contained small ads for "newsletters," "reports" and "booklets." The science and mechanics magazines were loaded with classified ads for all sorts of "how-to" books, "instructions," "plans," etc.

I was most surprised by the fact that almost all the ads were placed by individuals — not by large companies.

This was too fascinating to resist. I decided to place two small ads myself.

I put together a booklet containing some of my best wine recipes and another about Australia. A few days after the ads appeared I stopped by the post office.

When I looked through the little glass window on my P.O. box, I almost dropped my key. The box was stuffed — jammed — packed full of envelopes. Hundreds of orders containing cash and checks! I couldn't believe it.

\$9,450.00 IN 45 DAYS

When the dust finally settled around our house, I talked with other successful advertisers. I discovered . . .

1. A young graduate student in Texas markets a body-building manual for \$3.00. He uses one classified ad in six magazines. It's strictly a spare-time activity but he reports earnings of \$300.00 monthly.

2. A retired U.S. Army sergeant in Arizona wrote a 24-page booklet. His three \$17.00 classified ads brought him \$300.00 in cash orders.

3. A Kentucky woman selling a 15-page travel booklet for \$1.00 was literally swamped with orders. In 87 days her classified ad running in six magazines made a net profit of \$2,230.00 from a gross of \$3,250.00. She was 69 years of age, widowed and living alone in her apartment at the time.

4. A husband-wife team in Oregon compiled their own "how-to" booklet. They put a small display ad in one newspaper. Within only 45 days that one ad pulled \$9,450.00 in cash orders.

Don't misunderstand. This isn't a get-rich-quick scheme. It's a business, and, as such, it's speculative. But test ads are cheap (as low as \$13.50 for a national ad) and the profit potential is staggering! An Ohio man I spoke with put a large display ad in a national Sunday supplement. A few days later the orders started pouring

in — mail sacks full of cash! Within the next two months he received over \$220,000.00 in CASH orders for his \$3.00 booklet.

I realize this all sounds too good to be true. But here's a way you can actually verify what I'm saying in your home or office.

TRY THIS TEST

★ First, obtain several magazines containing classified ads. You don't have to buy them . . . just borrow them from the library.

★ Second, get old copies of the same magazines — at least 10-13 months old.

★ Third, turn to the classified sections of each and place the old magazine beside the new magazine.

★ Fourth, compare both. Cross-check each one to see how many ads in the old magazine are still running in the new edition.

THIS IS AN ABSOLUTE PROFIT TEST.

It has to be. People don't continue running ads for over a year unless they're making money at it.

WHY NOT YOU?

Consider these facts:

• It's simple to begin . . . just an hour a week can get you started at home.

• It's inexpensive to begin . . . I'll show you how to place a test ad in a national magazine for only \$13.50. Your total starting investment can be less than \$25.00.

• You don't have to write a booklet yourself. I'll show you an easy way to get hundreds of different books at wholesale prices or less.

• If your test ad produces even a modest profit you can run wild with it. The whole nation is yours.

• Your profit margin may exceed 1,000%! My wine book cost 36 cents to print yet sold for \$3.98.

• It's private. Even if you begin making \$75,000.00 a year you can run your entire business from your home or apartment.

• It's safe. Information booklets and newsletters aren't breakable, mechanical or chemical. They're easy to mail in small envelopes and can be stored in a closet.

• The market is almost infinite. My own "best-sellers" include . . . **101 Ways To Fix Hamburger, How To Win Contests, How To Stop Smoking, How To Make Champagne At Home**, and others . . .

I want you to see this for yourself. That's why I put everything . . . every secret . . . in a simple, easy-to-follow beginners guide. It's entitled, **Dollars In Your Mailbox**.

We'll show you . . .

- Where to get hundreds of books wholesale.
- Where to advertise . . . which magazines and newspapers are most profitable.
- Where to get national ads for less than \$15.00.
- How to have your own booklets printed for less than 12¢ each.
- How to save 40% on all printing.
- How to get "free" advertising and publicity.
- How to start with no money in stock or supplies.
- How to word your advertisement.
- How to start a newsletter.
- How to rent your mailing list for extra profit.

PLUS

All the forms, lists, and details you'll need to begin.

MONEY-BACK GUARANTEE

When your book arrives, take two weeks (14 days) to examine it. If you're not delighted, just return it. We'll send your refund check within 3 working days — no delays, no nonsense. There is absolutely no risk to you.

You can begin this unusual money hobby for less than \$25.00. And if you're creative, it might make you rich.

Let me show you how to begin in just a few days. First Class mail reaches us overnight.



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Send me Dollars In Your Mailbox right away. I understand I may keep it for 14 days. If I'm not delighted, I may return it for a complete refund sent to me within three working days.

On that basis, here's my \$9.95.

- Enclosed is my check or money order.
 Charge Master Charge
 Charge BankAmericard

Account #

Expiration Date (month, year)

Please Print

Name

Address Apt. #

City State Zip

- Enclosed is an extra \$1.00 . . .
send it First Class (Air).

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SCIENCE WORLDWIDE

Global earthquake network

Scientists at the University of California have started receiving data from a newly installed vertical accelerometer in Garm, a Soviet village in Tadzhikistan, a republic bordering China.

An accelerometer is a special kind of seismometer used to detect and measure long-period Earth vibrations associated with large and deep earthquakes, many of which are not felt at the Earth's surface. The Garm accelerometer is the latest of seven such instruments installed in what scientists say eventually will be a worldwide network of 15 to 20 units.

An existing network—the Worldwide Standardized Seismographic Network—has been in operation since the early 1960s. The new network, however, allows for the use of more sophisticated technology that has been developed since then. One big advantage of the new network is that inputs are recorded digitally, permitting the fast analysis of large quantities of data through a computer. The older network records data graphically.

Sailplane with jet power

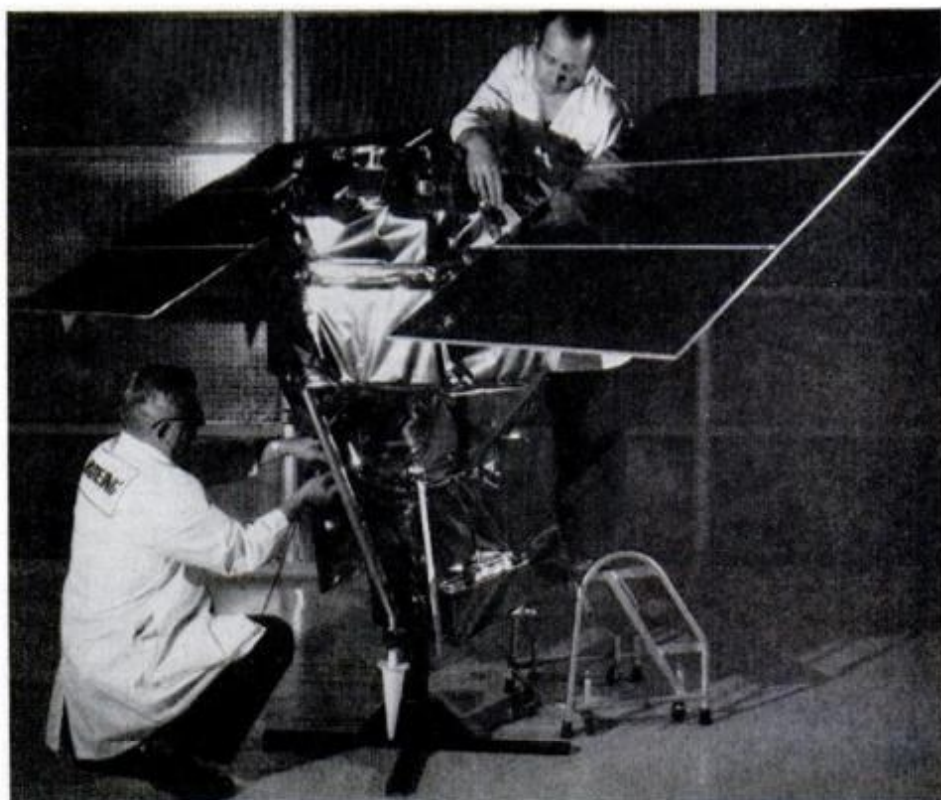


Looking for an inexpensive way to investigate new aircraft concepts, engineers of the Lockheed-Georgia Co. and Mississippi State University came up with the craft shown above. It's a high-performance Italian sailplane fitted with a 200-pound-thrust jet engine beneath and behind the cockpit. On its initial flights, the craft has been towed to altitude. Later, engineers say, it will take off under its own power.

Lockheed also is flying a one-third-scale model of the jet sailplane to obtain correlated test data. So far, the two-vehicle test program has cost less than \$250,000, according to Lockheed officials.

New heat-seeking satellite

A new satellite designed to provide thermal maps of the Earth's surface will be launched by NASA in 1978. The maps will enable



scientists to locate mineral deposits, measure soil moisture and vegetation cover, predict water runoff from snowfields and chart the flow of thermal effluents, both natural and manmade varieties.

Called the Applications Explorer Mission (AEM-A) spacecraft, it will employ a sensitive radiometer to pick up thermal radiation. A full-scale mockup of the satellite (shown above) was recently completed at a Boeing plant in Seattle.

A second satellite (AEM-B) in this series is scheduled to be built for launching in 1979. It will measure solar radiation in the Earth's atmospheric layers in order to provide data on aerosol and ozone concentrations.

Population explosion in zoos

While lions, tigers and leopards in the wild are becoming increasingly scarce due to man's influence, their well-cared-for cousins held in captivity are reproducing with such abandon that there is no more room for them in U.S. zoos and wildlife parks, according to a report in a recent issue of *Intercom*, a newsletter on population problems.

In captivity, the big female cats come into heat more often. Chuma and Prem, for example, two female Bengal tigers in the Brook-

field Zoo near Chicago, have produced 44 cubs between them.

To put an end to this kind of productivity, zookeepers are implanting time-release contraceptive capsules under the shoulder skin of female cats. The procedure is said to be simple and virtually painless, and a three-year period of effectiveness is hoped for.

A lack of space and of keepers prevent the isolation of females in heat in most zoos.

Making it hot for tumors

Heat produced by ultrasonic and electromagnetic devices has proven effective in the treatment of small surface cancers in mice, according to researchers at the Stanford University School of Medicine. Further animal tests will be made before the procedure is tried on human patients. ★★



When your taste grows
up, so should your
cigarette.

What you want from a cigarette changes.
Once I smoked just to be like everybody else. Now I
know what smoking's all about. I smoke for taste.
And Winston's real taste is what I want.
Winston is for real.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

19 mg. "tar", 1.2 mg. nicotine av. per cigarette,
FTC Report DEC. '76.

PHOTO HINTS

FROM READERS

Drying film reels faster



Photographers learned long ago that hair dryers can speed up the film drying process. But they also do a great job of drying those plastic and nylon film-tank reels that must be completely free of moisture before you load your film on them. Just stack the reels in a dish drainer rack and wave the dryer back and forth over them for several minutes.

—Kenn Oberrecht.

Easy light-stand lock



The levers that lock light stands are often too short for easy fingertightening or release. A 4-inch length of broom handle drilled out just large enough to slip over the handle will give you enough leverage to make the job easy and the stand secure.—Ed Johnsey.

Put on a happy yard...

With Finest Quality
True Temper Lawn & Garden Tools!

Swing into Spring and enjoy savings now on these specially priced tools available only at participating dealers.

Like all True Temper lawn, garden and home tools, these products offer you "quality" that is a result of hand craftsmanship combined with the efficiency of the machine age.

Look for these and other True Temper tools at stores displaying the "Put on a Happy Yard" banner and — save money!

P21 Pruning/Utility Saw

Great around home, camp. Strong tubular steel bow with rip-action tempered steel blade.

GO62 All-Purpose Garden Hoe

Forged steel blade and spring neck for flexing action — really digs into your soil.

A35 Rocket® Pruner

Almost makes pruning a fun job. Angled head for close trimming, finger fit cushion grips.

TRUE TEMPER®
An Allegheny Ludlum Industries Company

Aussie STOL is rugged performer

by Bjorn Kulkopf



After a ground roll of only 600 feet, the Nomad climbs steeply from a short runway. The Aussie STOL requires only about a 400-foot roll in landing. Powered by two 400-hp turboprops, the plane cruises at 175 knots and has a top speed of about 200. In photo at right, separations in wing indicate where trailing-edge flaps start.



New STOL (short takeoff and landing) designs usually involve exotic power systems and tricky control surfaces. Lots of bucks, too. Yet, there's no secret about what it takes to make a plane that can get in and out of small airports. The old-time barnstormers did it all the time—even from cow pastures. All you had to do was make the wings big enough so the ship could lift the load at low air speeds.

But such planes were hard to control in windy, turbulent conditions. They also could not fly very fast. These drawbacks are eliminated in various new STOL and V/STOL (vertical or short takeoff) designs, but these planes take lots of money to build and operate.

Surprisingly, a novel and simple design for a small twin-engine transport with good STOL abilities is being produced in a most unexpected place—Melbourne, Australia.

Simple design

It's a rugged turboprop called the Nomad, and it boasts remarkable performance and a startlingly simple design. It is being built in an Australian Government factory in 14 and 18-passenger versions as well as for freighter, ambulance and military purposes. The price gets up to \$500,000, but that is cheap for this kind of small airliner.

The big secret is in the wing design. The main problem faced by STOL aircraft is to maintain good

lateral control at low speeds. Lack of this ability is responsible for most STOL plane accidents. More exotic designs achieve control with fancy leading-edge slats and powered lift from engine exhaust or prop blast blowing back over the flaps.

Flaps do double duty

The Nomad has no leading-edge slats. But it does have unusual double slotted flaps that extend from tip to tip of the trailing edge. When the flaps are up in normal cruise, the outboard sections act as conventional ailerons to make the plane bank for turns. But as the flaps are extended for landings or takeoffs to provide extra lift at low speeds, an interchange mechanism gradually shifts the aileron function to a spoiler that is positioned just ahead of the conventional aileron. Thus, with the aileron now acting as a high-lift flap, the lateral control function is taken over by the spoiler.

The flaps are electrically powered and include a preselect system which automatically gives an intermediate flap setting at the touch of a button for low-speed maneuvering or for "go-around."

I saw the Nomad demonstrated and in addition to its short-field capabilities it can do tight turns in the air. This makes it particularly valuable for flying in a restricted valley where the ship might have to make tight circles to get onto a short strip. ★ ★ ★



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SEND FOR FREE BOOKLET

VelvetCRAFT Marketing Div.
215 Kee Way, Suite 309 P-2
Des Moines, Iowa 50309

Gentlemen: Please send me the FREE booklet on the VelveTouch Electrostatic Applying Process.

Name _____

Address _____

City _____

State _____

Zip _____

Crown of Fairhope
Solid Walnut Grandfather Case Kits
FROM UNDER \$100

- All miters pre-cut—no extra charge
- All screwholes pre-drilled
- All critical parts pre-drilled
- All hardware including screws
- Selected kiln dried 3/4" and 1" American Solid Black Walnut
- Maximum sap wood removed
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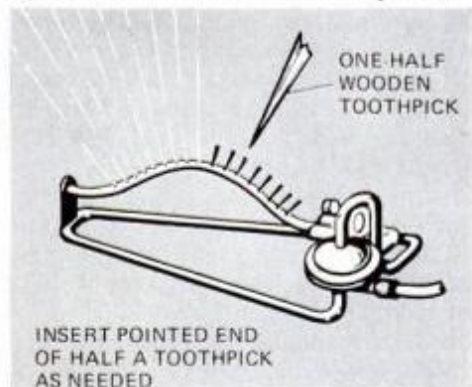
FROM READERS

Tab your tape



Save a little time and avoid a lot of fumbling and frustration by leaving a short folded-over pull-tab on electrical, adhesive, masking and other rolls of tape.—*Dan Googins*

Sprinkler control with toothpicks



Direct water from your lawn sprinkler where it's needed, not on passing pedestrians. You can plug each water outlet hole that isn't needed with the pointed end of half a wooden toothpick.—*Frank P. Fritz*

Rubber mat parts catcher



Use a rubber mat to catch small parts when you disassemble photo or electronic equipment. It will keep the parts in sight and save you time searching for them.—*Peter Ohlinger*

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Ray Roberts takes a minute from his workday to drop another idea into the suggestion box. Since 1965, he's picked up over \$100,000 in bonuses!

King of the suggestion box

Giving your boss a better idea may be the route to riches, as Ray Roberts found out.

By Robert Lund
DETROIT AUTO EDITOR

Raymond Roberts makes about \$6.63 an hour punching out metal sheets at a Chevrolet plant in Indianapolis. His actual pay is \$265 for a 40-hour week. Minus deductions.

Roberts' take-home is about average for a worker in an automobile plant. But no better. His weekly paycheck is the only average thing about Roberts. He is an extraordinary man, unique among American workers.

On occasion, Roberts has made more money on an hourly, daily or weekly basis than his foreman, his plant manager, even more than the president of General Motors.

You can't really draw a comparison between what Roberts makes and what GM executives make because the executives are paid by the year—an annual salary—and Roberts is paid by the hour. If he takes off to go to the dentist or gets hung up in a snowstorm on the way to work, it comes out of his pay. Even if he worked 24 hours a day, 365 days a

year, Roberts couldn't catch up with the president of GM on an annual basis. (Don't bother figuring it out. The most Roberts could make working 24 hours a day, 365 days a year, would be \$58,078.80. The president of GM makes \$270,000 a year, plus bonus.)

So how has Roberts managed to make more money on a per-hour, per-day, per-week basis than the head guy at GM?

Ray Roberts is king of the suggestion box. He has made more money putting ideas in the suggestion box than anyone else in the United States. His claim to the title has been confirmed by a group—the National

(Please turn to page 60)

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That's for Dodge D100 conventional cab pickups with a standard 225 Six engine and manual transmission†. Your actual mileage may differ, depending on how and where you drive, the condition of your vehicle and its optional

equipment. Dodge's exclusive four-speed overdrive transmission† is also available as an option to help improve fuel economy.

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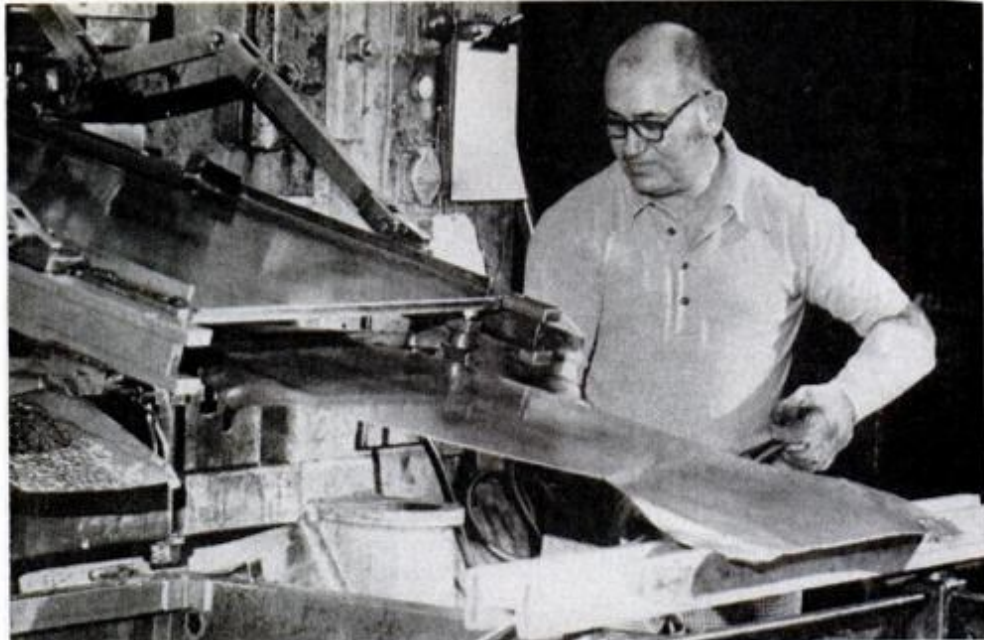


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At his work station at the Chevy plant in Indianapolis, Roberts runs sheet metal through the press to produce blanks for making various automotive parts.

KING OF THE SUGGESTION BOX

(Continued from page 58)

Assn. of Suggestion Systems—that keeps track of how much money companies pay out for suggestions from employees.

During the past 11 years, Roberts has averaged better than \$9000 a year in bonuses for his ideas. His best year ever was 1975 when he earned \$31,000 in awards. His total take since 1965: \$101,508.57. That was the figure as of the time this story was written. He may have hit another jackpot by the time you read this, because he had just turned in another idea when PM interviewed him.

Long on ideas

Roberts is not an easy interview. Not that he objects to being interviewed. But he is as short on conversation as he is long on ideas. He replies to most questions with a "Yup," "Nope" or "Right." No small talk, nothing volunteered beyond a brief answer to a question.

The only time he became voluble during our conversation was when the subject of his father came up. I asked how far he, Roberts, had gone in school.

"Eighth grade."

There was a pause while I waited for him to elaborate. But the elaboration wasn't forthcoming. "Why did you stop at the eighth grade?" I followed up.

"There were 12 children in the family. It was during the Depression—I'm 53 years old. There wasn't much money around with 12 children. So I dropped out and went to work before I was 15."

"You went to work to support the family?" I asked.

"I helped out, but wouldn't say I supported the family. My dad wouldn't like it if you printed that I said I supported the family." Another pause. Roberts speaks in a soft, apologetic drawl with no emotion in his voice, no highs or lows for emphasis. During the pause while I was thinking of the next question, he raised his voice for the first and only time during our conversation.

"My dad is a great man." He said it almost aggressively, as if challenging contradiction. Silence again.

"How do you mean he's a great man?" I asked.

"Well, he's 82 years old. I imagine he still has an income of \$30,000 a year." Another wait, another silence.

"Doing what?" I nudged again.

"He runs a mill down in Brown County. Sorghum mill. Sells all kinds of different things. Cider, things like that."

Then we were back to "Yup," "Nope" and "Right."

Roberts' inspiration

Roberts is a late bloomer as an idea man. He has worked at the same GM plant for 30 years. "Started for \$1.19 an hour in 1947," he remembers. He worked at the plant 18 years before submitting his first idea. He doesn't remember the specifics of the idea or how much he received for it. "Somethin' to do with safety and I think I got \$10 for it," was the best he could recall.

Roberts says inspiration for his ideas comes to him while he is working. But he does a lot of thinking

(Please turn to page 62)

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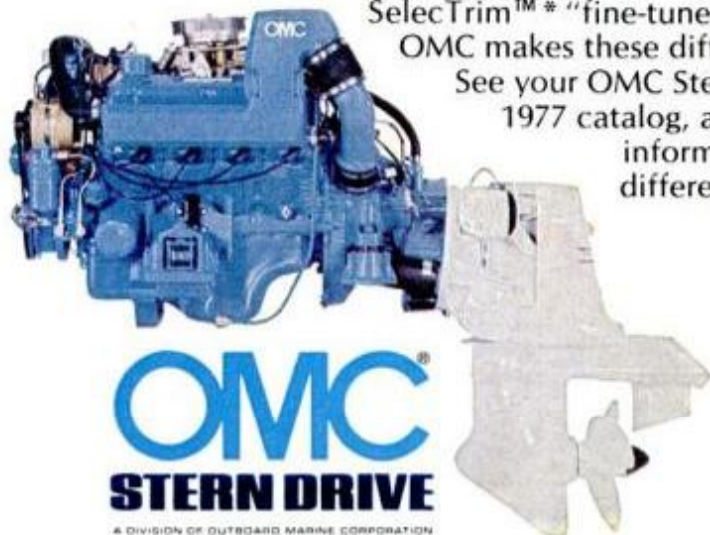
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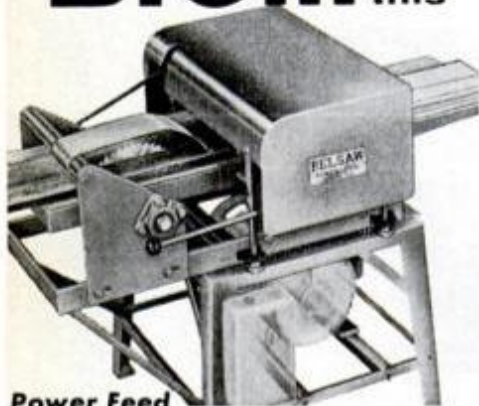


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KING OF THE SUGGESTION BOX

(Continued from page 60)

and refining of the ideas on his own time. "Drivin' to work, going home, most anytime." He lives in Franklin, Ind., 20 miles south of Indianapolis, and the drive to work takes about half an hour. He leaves for work at 6:00 a.m. to punch in by 6:30 and is back home by 3:30 in the afternoon.

Factory work, according to some sociologists who never did a lick of it, is supposed to be degrading and monotonous. Workers suffer from a mental discontent known as "the blue collar blues." That doesn't apply to Roberts. Nor is he a work-a-holic. He likes his job, but isn't married to it. I asked if there was something he'd rather do.

"Always things a guy'd rather do."

Is there anything he dislikes about the job?

"Not particularly."

For all the money he has made with his suggestions, Roberts' batting average on the number of ideas he has sold versus the number he has submitted is good but not particularly spectacular. He comes up with about three duds for every winner. He has turned in 130 ideas. GM has turned down 101 of the 130, paid him for 28 and is now considering one.

How he gets ideas

Isn't it discouraging to know the odds are four to one that an idea is going to be rejected?

"I'll explain that. Lot of times you hear somethin' you think is going to take place. Say the metal

is going to be reduced for a certain part. So you look for a thinner steel to make the part. I might turn in five or six different suggestions. If it doesn't come about that the metal is reduced, you don't win any of them. I don't feel bad about that."

If GM rejects an idea, how about trying to sell it elsewhere?

"Nope, never did that."

Roberts' talent for coming up with winning ideas did not surface until he was promoted to his present job in 1965. He was hired as a metal finisher in 1947 and worked at that trade for 18 years. The ideas didn't begin to percolate until he was promoted to his present job as a press metalworker in '65.

Steel for making parts arrives at the Indianapolis plant in giant 32,000-pound coils. Roberts runs an automatic press that decoils the steel, rolls it flat and then punches out blanks in various shapes—much like a baker might use a rolling pin to smooth out dough and then stamp out cookies with a cutter.

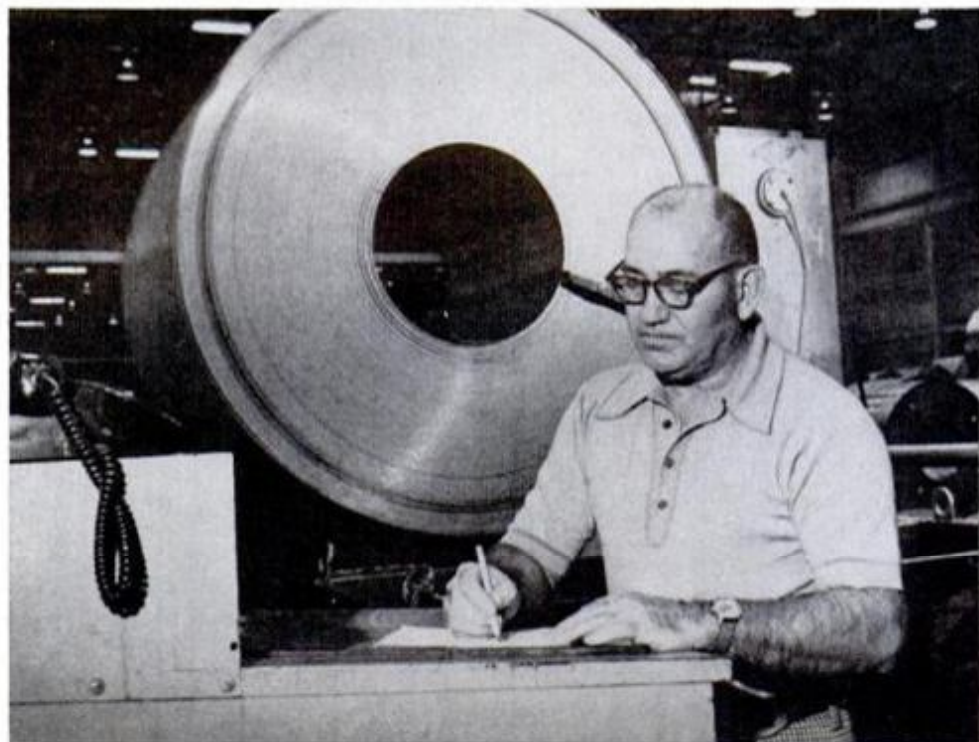
Big ideas

Ideas that have paid off big for Roberts have to do with getting more blanks out of a sheet of metal, redesigning the press to punch out more pieces at a time or perform more operations, reducing the amount of scrap metal or making greater use of it.

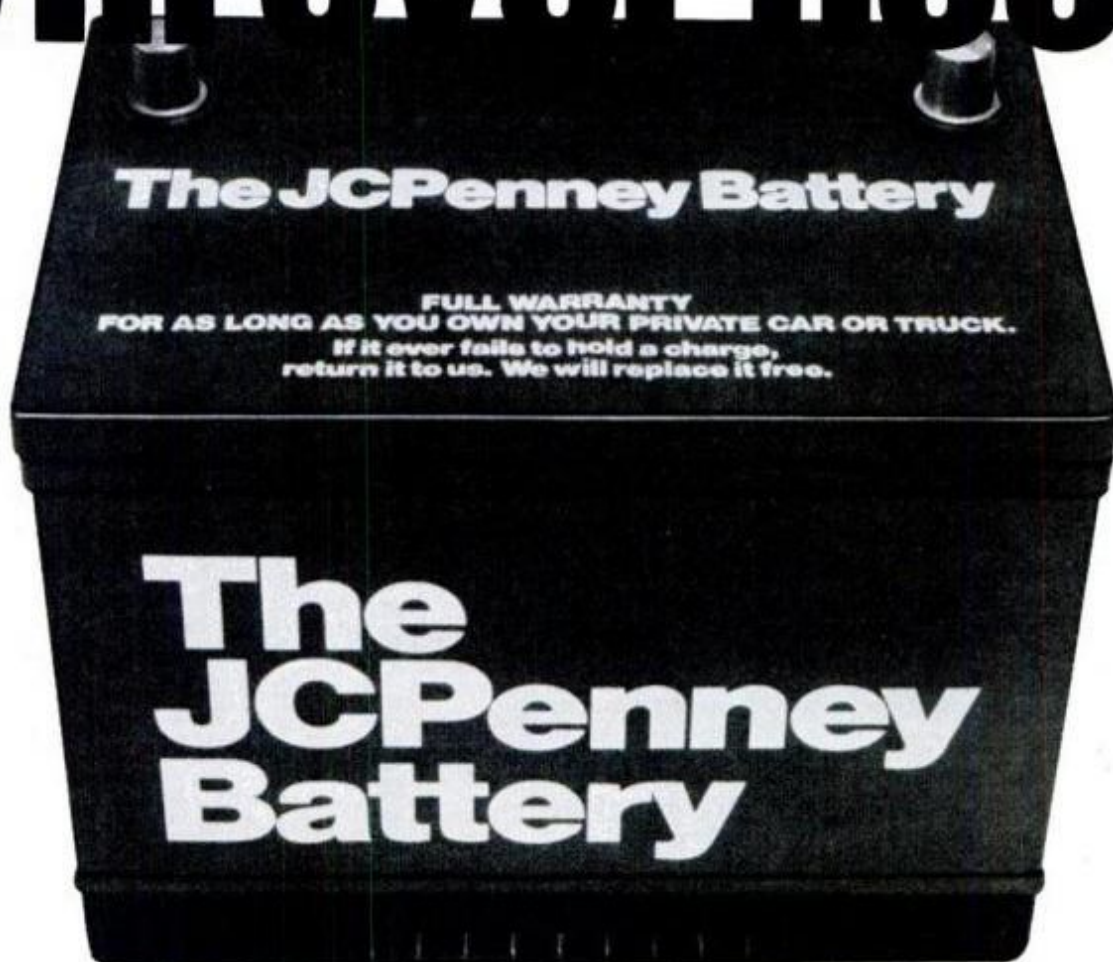
GM pays anywhere from \$25 to \$10,000 for an idea. The reason Roberts received only \$10, instead of the \$25 minimum for his first idea back

(Please turn to page 64)

Sitting by a 32,000-pound roll of steel, Roberts puts another suggestion down on paper. He's batting one for four on the ideas he turns in—three duds to every hot one.



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KING OF THE SUGGESTION BOX

(Continued from page 62)

in the '60s is that the payoffs were smaller 10 years ago. Roberts has received 12 maximum awards, more than any other GM employee. Some awards were made before GM bumped the top prize to \$10,000, so he has not received 12 times \$10,000.

There's a lot of competition for suggestion awards at the Indianapolis plant and it's not a case of Roberts looking good because he's the only guy feeding the suggestion box. In 1975, Roberts' best year, GM paid off on 11,500 suggestions from Indiana employees, and workers at the Chevrolet plant earned 10 maximum awards, more than any other plant.

The only question Roberts declined to answer was when I asked if he had trouble putting his ideas on paper—expressing himself.

"I'll let Paul answer that," he countered. "He's the one who gets 'em all."

Paul Suding runs the suggestion system at the Indianapolis plant.

No frills

Suding says Roberts' ideas "are concise and to the point. He gets the basic idea across without any frills. He gives the present dimensions of the part or blank and describes what he proposes to do with it. More often than not, he will include a sketch to help explain the idea and to sell it."

What does Roberts do with all the loot he has earned from his ideas?

His biggest personal indulgence has been the purchase of a 19-foot outboard to cruise the Ohio River. He has also helped his sons, Donald, 28, and Larry, 33, buy homes.

He also has three cars—a 1977 Buick Electra, 1962 Buick and 1950 Ford. The new Buick is his working car, to drive back and forth to work, and the old cars are for putting around.

The old cars suggested a good picture for this story: the self-taught inventor rebuilding an old car.

"Don't do much of that," Roberts said in his gentle way. "I sometimes change the oil and filter, but don't do my own service work."

Well, how about a picture of him doing something around the house? In his workshop, something with carpenter tools, a plumbing or electrical job, the hands-on stuff?

"Don't do much of that, either," Roberts said. "I do a few things that need to be done. Nothin' major."

"You know," said the man who has made a small fortune showing General Motors better ways of stamping out car pieces, "I'm not what you'd call mechanically minded." ★★★

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PFC Craig Nichols, Fort Carson, Colorado

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Revolving worktable makes painting easier

It also doubles as a handy storage unit for supplies and equipment.

by Robert C. Barnes

Until you've used a revolving worktable, you can't imagine the many different jobs you'll be able to do faster and more easily than on a conventional stationary bench.

One of the most important uses of the rotating top is in simplifying spray painting. As the photo at right shows, you can control the speed and direction of rotation with one hand while spraying with the other. The time spent on upholstering small to medium-size pieces of furniture such as chairs and ottomans is also reduced by using the revolving worktop.

At our house the biggest use of the worktable is in assembling and finishing picture frames. An easy quarter turn of the table takes you from one mitered corner to succeeding corners without moving a step. Spraying or brush painting the frame is just as easy, as each side rotates past your position—which

can be on a very comfortable stool. Even preparing large quantities of food for a family outing or decorating a cake is made easier with the table.

Materials used

As an extra bonus, the materials used to build the table are leftovers from other jobs. A piece of 1/4-in. hardboard is enough for the cabinet back and two drawer bottoms. The cabinet sides, top, bottom and 30-in.-diameter turntable surface are made from scrap pieces of 5/8-in. particle board. Plywood can be used, but it is much more expensive. All of the solid wood parts are 3/4-in. pine. The four corner posts are glue-ups of two 3/4-in. pieces of pine 29 in. long. Even the drawer pulls are fashioned from dowels and pine.

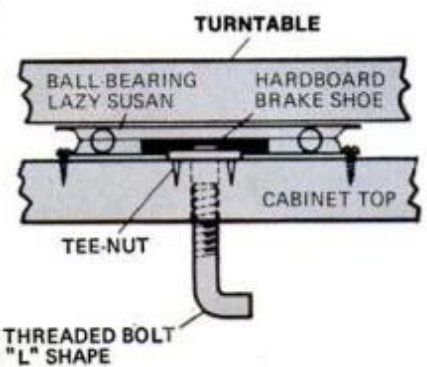
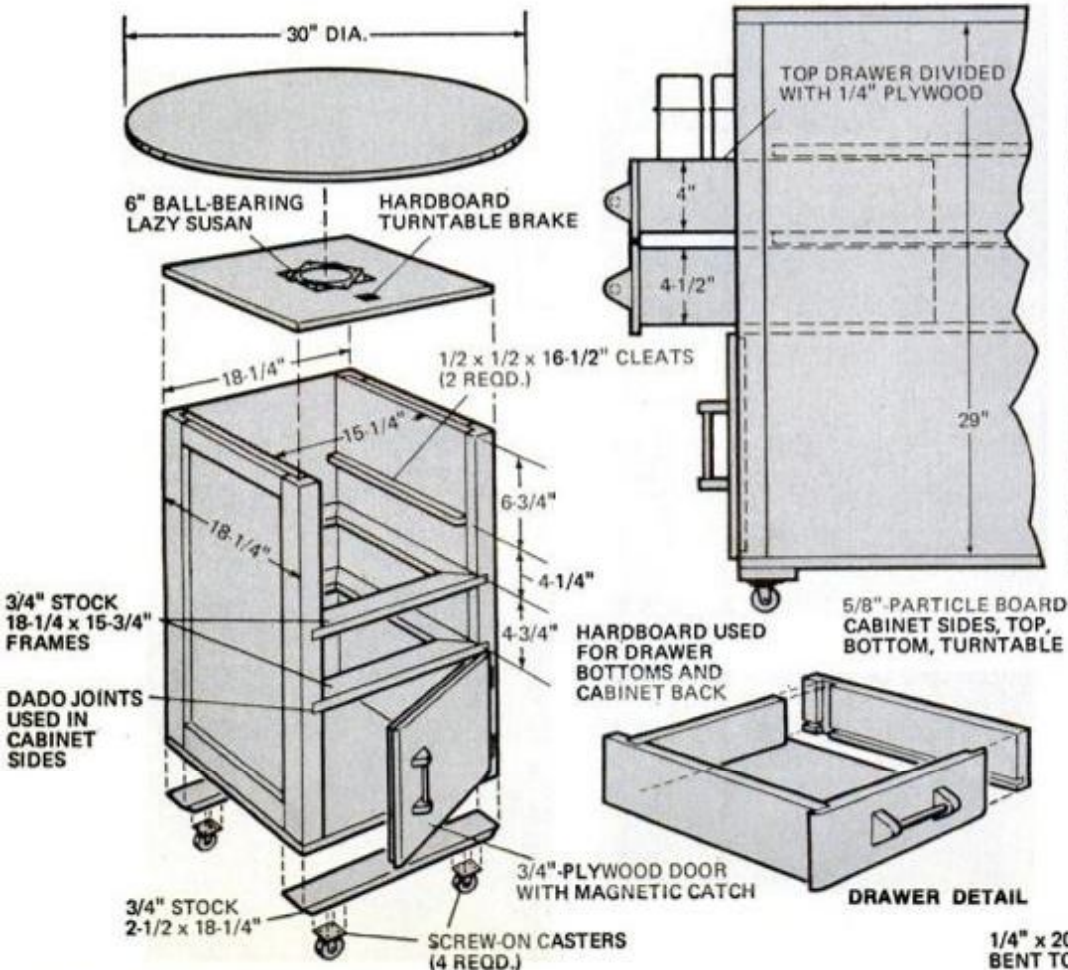
The only money spent was for a 6-in.-diameter ball-bearing lazy Su-

(Please turn to page 70)



Spray painting is one of the many jobs made easier by use of the revolving worktable. You can move the turntable with one hand while you apply paint with the other. How's that for ease?

The worktable is made from scrap lumber. Top and sides are 5/8-in. particle board. Corner posts are two pieces of 3/4-in. stock glued together. Drawer supports are glued and screwed into dado joints. Cleats serve as runners for the top drawer to keep it in place when you're reaching for items in the back.



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The Mileage:

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REVOLVING WORKTABLE

(Continued from page 68)

san pivot, four screw-on casters and a pair of hinges for the door.

Cabinet details

The two drawers slide on mitered corner frames that are screwed and glued into dado joints in the sides of the cabinet. The top drawer is handy for storing tall containers like spray cans. You can divide the drawer to fit your own needs with 1/4-in. plywood dividers to keep the containers from tipping over when the drawer is opened. The center drawer makes a good storage area for brushes, paint rollers and sandpaper. The bottom door compartment can hold larger equipment from pressure spray attachments to power sanding tools.

The 6-in.-diameter lazy Susan is equipped with 70 1/4-in. ball bearings and has a load capacity of 500 pounds. It supports the 30-in.-diameter turntable. You can purchase the lazy Susan at hardware stores complete with installation directions for a few dollars.



Screw-on casters make your worktable mobile. They're held on firmly by being mounted into 3/4-in. stock. Use long screws and glue to anchor the stock.

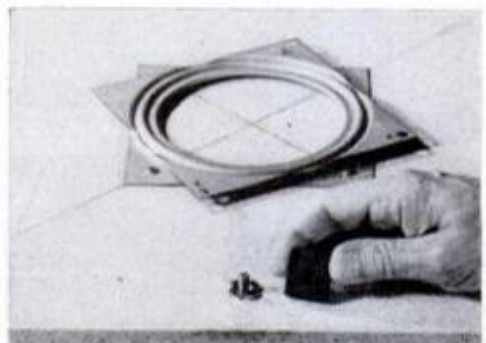


The top drawer with 1/4-in.-thick plywood dividers is used here to store tall cans of spray paint. Drawer handles are fashioned from dowels and pine.

Brake controls speed

The ball bearings allow you to revolve the turntable at a fast rate. In fact, you need a brake to slow it. Use a piece of hardboard 1 to 1 1/2 in. square pressed against the underside of the turntable as a brake shoe. To install it, drill a 5/16-in. hole and drive a 1/4-in. Tee-nut into the cabinet top at the center front.

Thread a 1/4-20 bolt through the Tee-nut. Drill a 1/4-in. depression part way through the hardboard square and secure it on top of the bolt. If you bend the bolt at a right angle it will be easier to adjust the brake pressure.



A small 1-in.-square hardboard shoe prevents the turntable from spinning too fast. It's operated by moving a bolt on the underside of the cabinet top.

Other worktable uses

If you want to refinish or reupholster any fairly large piece of furniture, you can temporarily fasten a larger top to the 30-in. turntable using a few wood screws. Reupholstering and refinishing are a snap when the work can be rotated. You can make the permanent turntable larger than 30 in., but a larger diameter won't roll through a standard-size door.

Assembling models and doing other craft work are easier with the help of the revolving worktable. You can lay out the many small parts in the order needed, placing them toward the center of the table. Revolve the table as the parts are needed. Carving and sculpturing on the worktable also has its advantages. You can rotate your project

as you cut or mold each of the sides.

Before you begin building the table you might consider using perforated hardboard for the cabinet sides in place of the particle board. The perforated hardboard can hold tools and work rags on snap-in hangers within easy reach as you use the table.

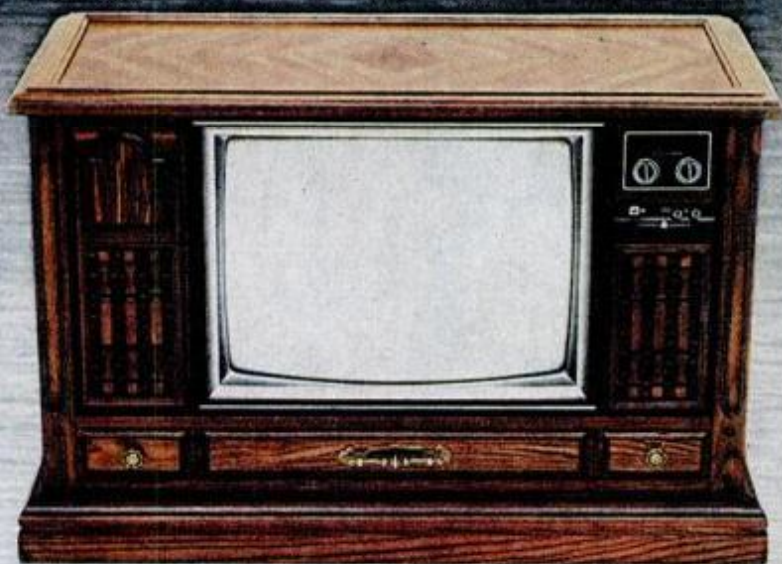
Considering the countless ways it can be used and the many storage spaces it provides, the revolving worktable could well become indispensable in your workshop. ★★★



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There's a set that can use it now.

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GENERAL  ELECTRIC

Build this organizer panel for your darkroom

by Will Fitz

All the electrical devices in a modern darkroom can easily turn it into a clutter of electric cords. This panel centralizes all my darkroom's wires and controls, and it's ready to move to another house whenever I am.

Construction is simple: The basic panel is a 2½ by 3-ft. hardboard sheet framed with 2x2-in. lumber and fastened to the wall with 1-in. angle brackets.

The perforated storage section was drilled, using a piece of perforated hardboard as a template, and a ⅛-in. bit. Make sure none of the wiring runs behind the perforated section so there's no chance of wires being dripped on when wet equipment is hung up to dry. Pegboard hooks hold the equipment.

The panel's main power source is a 25-ft. No. 12 cable. It enters from the top of the panel, away from wet trays, and is a three-conductor type with a U-ground plug to minimize shock hazards.

Circuit can be flexible

The panel's wiring should suit your needs; my circuit is just a suggestion. The two end switches control the safelight and the white light visible in the picture, while the switch for the radio (good darkroom company) separates the other two to minimize mistakes. (The radio, on a shelf when this shot was taken, is now built into the panel with the back of its case removed; that gives me better bass response as well as a neater look.)

Note that the safelight gets its power from the enlarger timer (not shown); the timer turns the light off when the enlarger's on for easier focusing. Outlets are not switched, as I use them chiefly for timers which I prefer to control directly. If your setup includes equipment you'd like to switch on and off at the panel, just wire in a switch for that outlet.

★★★

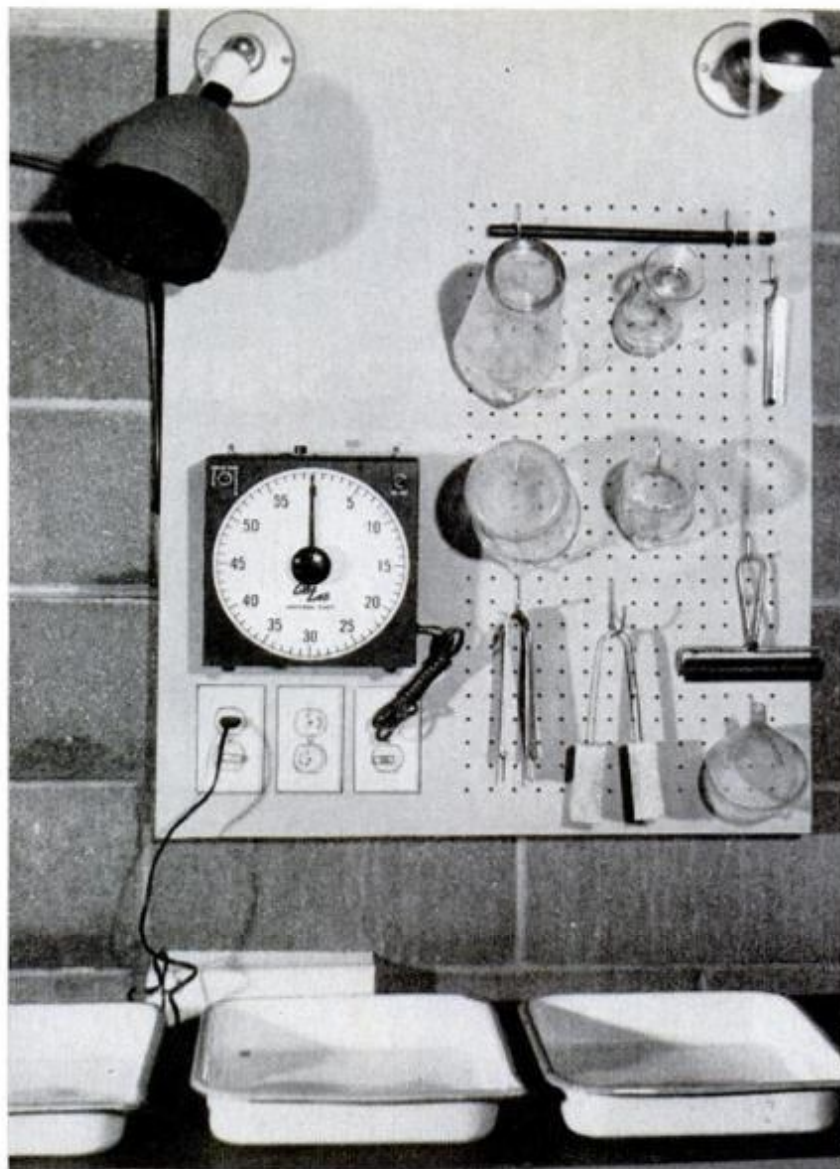
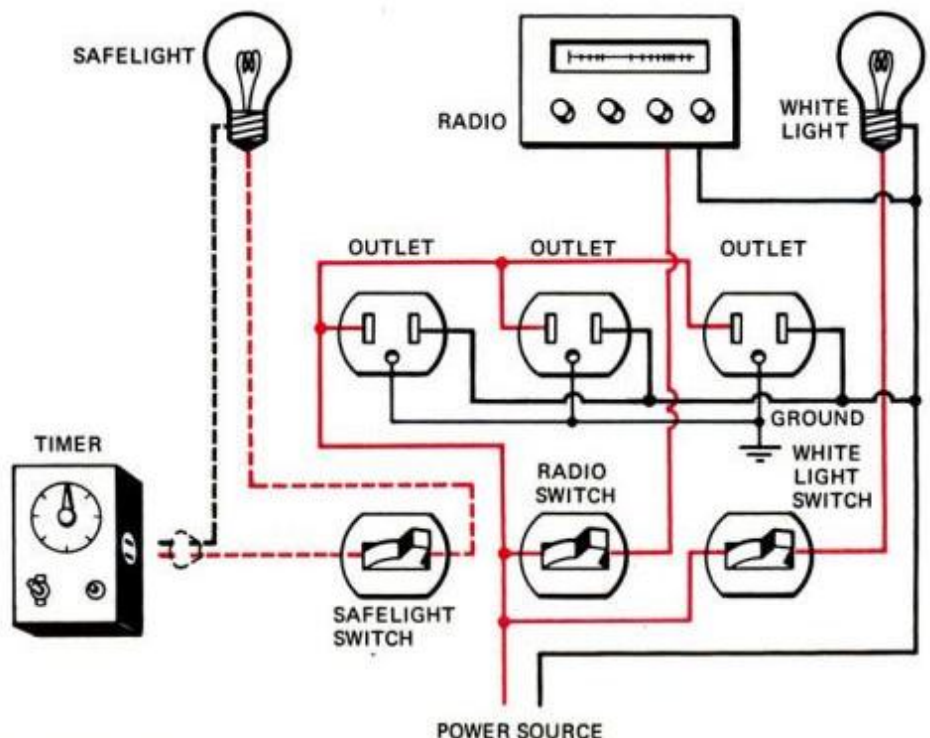


Photo by the author

Uncluttering a darkroom is easy with this simple panel which combines most of my wiring and switching with storage space for odds and ends. Wiring diagram below explains my setup—but feel free to make yours differently if another arrangement suits your equipment better.



PM art: Walken Graphics

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A cowboy wearing a light-colored hat and a yellowish-brown jacket is riding a light-colored horse in a field. The scene is dimly lit, with a strong light source from the left, creating a silhouette effect and highlighting the textures of the horse and the cowboy's clothing. The background is dark and textured, suggesting a field of tall grass or brush.

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HOW TO BEAT THE ODDS WHEN YOU DRIVE AT NIGHT

Travel deaths at night are nearly three times greater than those during the day. You can cut the odds.

by Bill Hampton

It was late, well after midnight, when the wife of a back-country farmer telephoned a state police barracks in upstate New York to report that two cars—at least she guessed it was two cars—had just smacked into each other along the road in front of their house.

She said her husband had thrown an old jacket on over his pajamas and had run out to see if there was anything he could do, but that he hadn't returned, so she didn't know exactly what had happened, or whether anyone had been hurt. She said the noise of the crash had awakened the whole house.

The officer taking the call thanked the woman, hung up, and immediately got on the radio to dispatch a patrol car to investigate. Then, noting the time and weather (clear and dry), he entered the report in his log. "Probably kids," he said to himself, "or maybe a couple of drunks."

Investigation of the accident, however, revealed that it didn't involve either speed-happy youngsters or juiced-up drunks. Two perfectly sober drivers, one in his late 30s, the other in his mid-60s, had sideswiped each other on a narrow, dark country road. The younger man suffered a broken arm, the older man a nasty gash on his forehead. Both were treated at a nearby hospital and released. Insofar as America on wheels after dark is concerned, it was a routine thing.

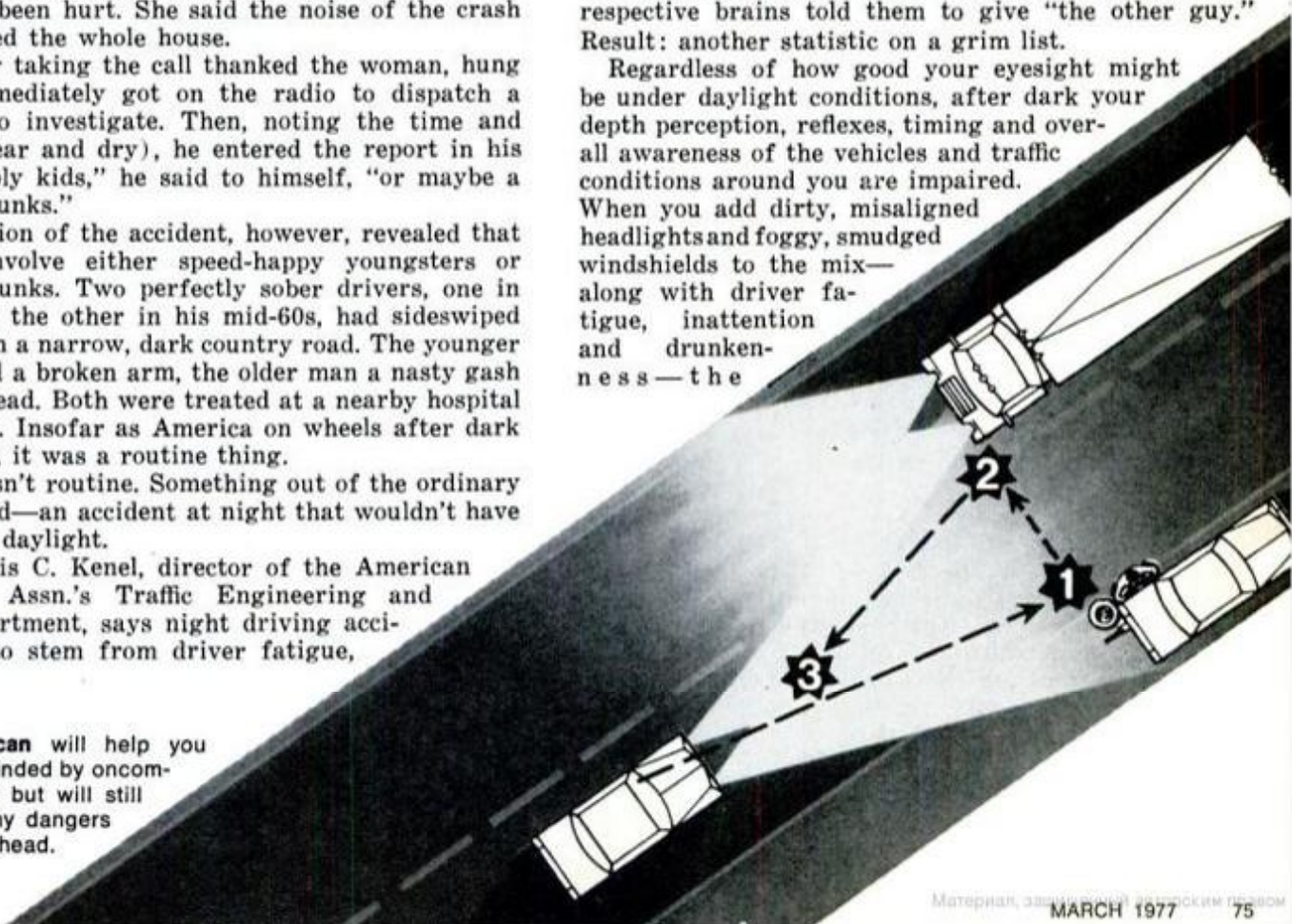
But it wasn't routine. Something out of the ordinary had happened—an accident at night that wouldn't have happened in daylight.

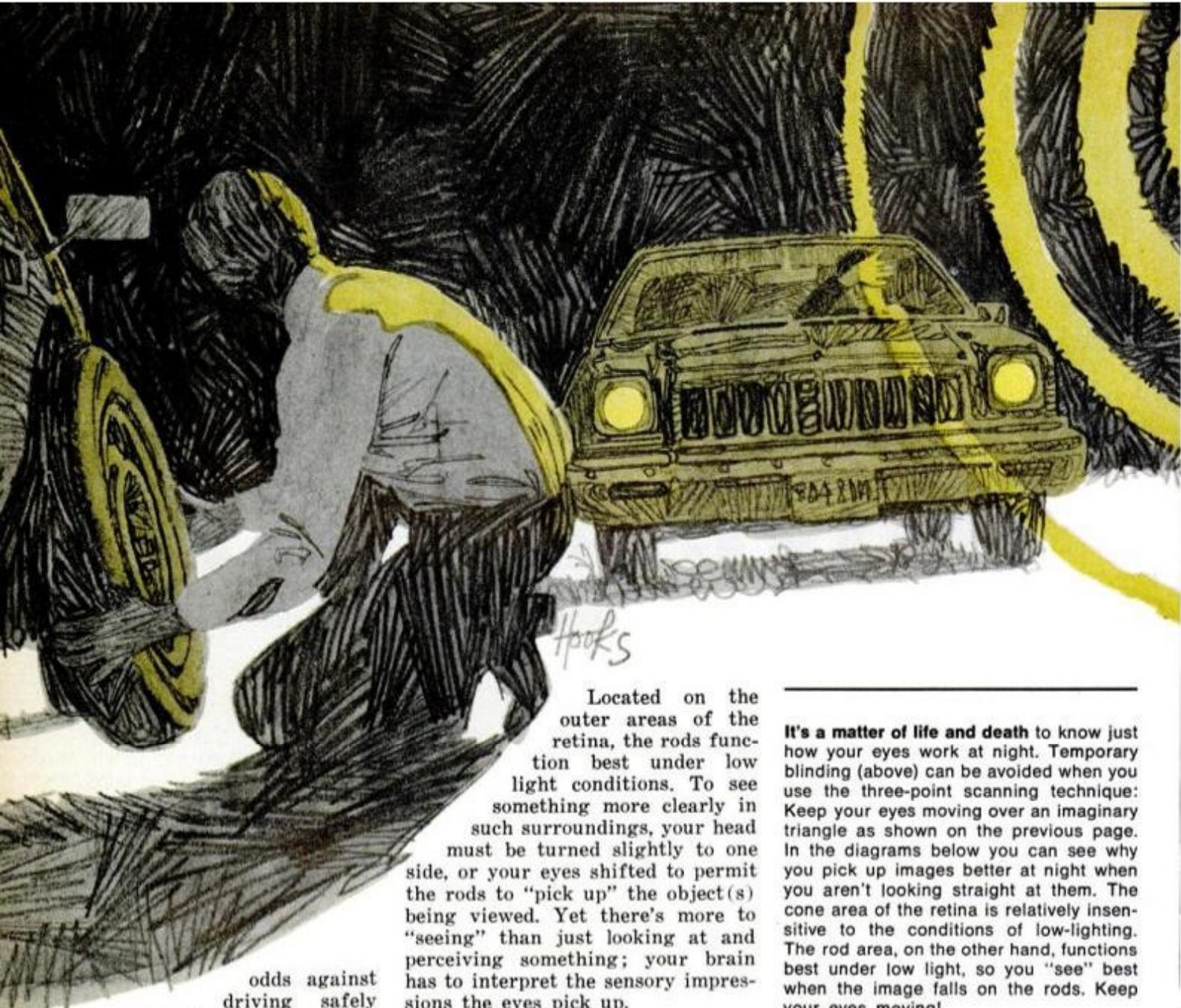
Dr. Francis C. Kenel, director of the American Automobile Assn.'s Traffic Engineering and Safety Department, says night driving accidents tend to stem from driver fatigue,

inattention, drinking or combinations of all three. True, but traffic experts also point out many night driving accidents occur because motorists—you and "the other guy"—just can't see that well in the dark. That's what happened on the narrow road in upstate New York: Approaching each other at what were conceded to be appropriate speeds, the two men—their vision affected by the dark and each other's headlights—simply misjudged the amounts of road room their respective brains told them to give "the other guy." Result: another statistic on a grim list.

Regardless of how good your eyesight might be under daylight conditions, after dark your depth perception, reflexes, timing and overall awareness of the vehicles and traffic conditions around you are impaired. When you add dirty, misaligned headlights and foggy, smudged windshields to the mix—along with driver fatigue, inattention and drunkenness—the

Three-point scan will help you avoid being blinded by oncoming headlights but will still let you see any dangers on the road ahead.





Located on the outer areas of the retina, the rods function best under low light conditions. To see something more clearly in such surroundings, your head must be turned slightly to one side, or your eyes shifted to permit the rods to "pick up" the object(s) being viewed. Yet there's more to "seeing" than just looking at and perceiving something; your brain has to interpret the sensory impressions the eyes pick up.

odds against driving safely at night climb alarmingly.

In fact, not only are there more traffic fatalities at night, period, but the ratio of deaths to miles traveled in the dark is almost three times higher than it is in daylight.

To improve your chances of not becoming a nighttime driving accident statistic, you need to develop your "night sight"—ability to see more effectively in the dark. And in the process you must learn to anticipate and compensate for "the other guy's" visual shortcomings.

The eyes have it

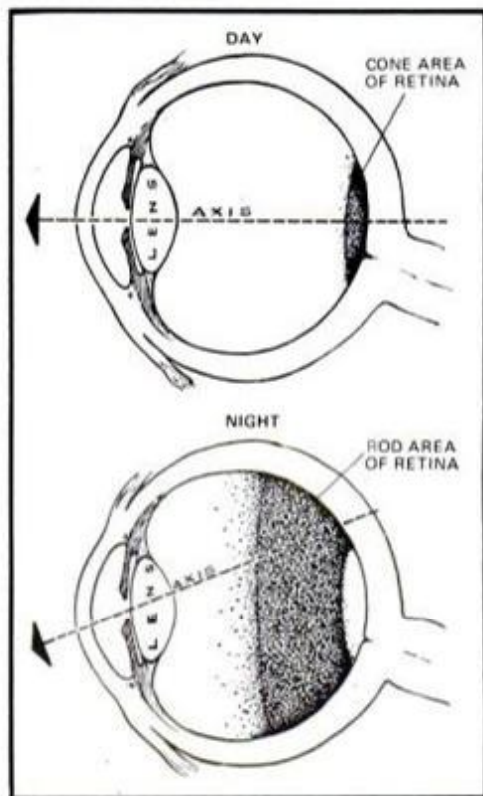
In daylight, the central areas of your eyes provide the sharpest vision when you look directly at something. This is because light sensors, called "cones," are concentrated in the central portion of the retinas at the back of your eyes. At night your cones are relatively insensitive to low light conditions, so the central area of the retina becomes a "blind spot." Then other sensors, called "rods," come into play.

Seeing with your mind

Because vision is ultimately a mental process, some drivers—even those with good eyesight—have difficulty seeing well under certain conditions. Psychologists, in fact, have a term for it—"mental set." Applied to driving, it means that a driver fails to take appropriate notice of certain things. This lack of concentration increases his chances for an accident. A good example of "mental set" is the motorist who doesn't seem to be aware of any vehicle smaller than his. He may actually "pick up" a motorcycle or a bicycle, but it doesn't register as such; he doesn't "see" it.

What's scary is that most of us suffer from various forms of "mental set" at one time or another. For example, when we become preoccupied with a problem while driving, we not only lose concentration on what we're doing—driving—but we actually restrict our visual perception. Amazingly, however, by willing

It's a matter of life and death to know just how your eyes work at night. Temporary blinding (above) can be avoided when you use the three-point scanning technique: Keep your eyes moving over an imaginary triangle as shown on the previous page. In the diagrams below you can see why you pick up images better at night when you aren't looking straight at them. The cone area of the retina is relatively insensitive to the conditions of low-lighting. The rod area, on the other hand, functions best under low light, so you "see" best when the image falls on the rods. Keep your eyes moving!



Concours: The ultimate car-care contest

When's the last time you took a toothbrush to your timing-chain cover?

by Wallace Alfred Wyss

This is a contest fought with polishing rags and secret waxes. Special polishes are used that make a 40-year-old paint job shine like new. "Concours" literally means "contest," and there are dozens of Concours d'Elegance going on each weekend around the country.

What does a Concours prove? It's pride of ownership in its ultimate sense, but for a spectator it could be more. A grandfather might exult over a Model A phaeton just like the one he took on his honeymoon, where a younger man might find himself drawn to an MG-TD like one he bought for \$100 while in high school.

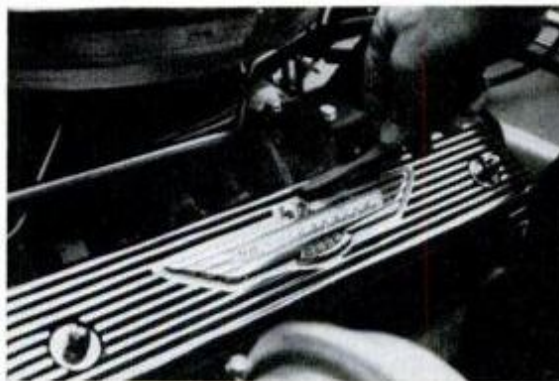
Most Concours, unless they are a one-make, one-model affair, are divided into 6 to 10 classes averaging 5 to 10 cars per class. At a recent event held in Montecito, Calif., there were seven classes:

- Horseless carriages
- Antiques
- American classics
- European classics
- Special interest
- Sports cars under \$5000
- Sports cars over \$5000

There are arbitrary placements of some cars in some classes, but the judges have to create *some* order. For example, in the under-\$5000 Sports Car class at Montecito, there was a 1937 AC that looked as expensive as a Bentley, but it was barred from the European Classics class because of its low price when new. Even so, the owner wouldn't have had a chance of stealing the prize in European Classics from such indisputable gems as a 1939 Mercedes 540-K, or a 1926 Hispano-Suiza H6B Town Car.

Even the value category is inaccurate by today's standards. At least

Special sheepskin mitt worn by Gary L. Wales takes the dust off the hood ornament of his prewar Jaguar. A toothbrush is perfect for cleaning grooves in the original finned valve cover on the 1957 Thunderbird below. Doesn't look 20 years old, does it? When you polish a magnesium wheel like the one at right, below, on a Ferrari GTC, it looks like chrome plating. Ah, there's nothing like tender loving care.



half the cars in the Sports Cars Under \$5000 would fetch twice that if put on the auction block, but again the price classification is based on *original* cost.

The judging

Most Concours entrants hope for a Best of Class award. Beyond that, however, there is a Best of Show award for the entry the judges decide is the outstanding car at a given show. The Best of Show at Pebble Beach, the most prestigious Concours held in America, is almost always awarded to a large, very expensive European or American classic, such as a Mercedes, a Bugatti, a Pierce-Arrow. At other Con-

cours, they have additional overall awards such as Best Restored, which could conceivably go to a low-priced car, or Most Elegant which often goes to a car with rakish lines but which is not as pure-bred as the judges would like (such as a Rolls or Packard rebodied to suit some movie star).

Sometimes elegance is judged as part of Best of Show, which explains why it would be virtually impossible for a 1961 Studebaker, for example, hardly elegant originally, to win Best of Show at an event like Pebble Beach.

Rick Busenkell, a Ferrari restorer who has judged at Pebble, explains: "At events like Pebble, elegance can

count as much as one-sixth of your total points, yet elegance as such is an ambiguous term. But there's no doubt an Hispano-Suiza is going to be more elegant than an MG-TD."

Special Interest

The Special Interest classification didn't exist at Concours events before the war, or at the posh European events held in the early '50s at which the Concours was secondary to the partying. The class was added in the hopes of mollifying enthusiasts who expend great effort in restoring cars too new to be classics (the Classic Car Club of America lists classics as those cars made from 1925 to 1942, with the exception of the first postwar series of Lincoln Continentals). It's a "grab-bag" class in which you might find anything from a 1954 Hudson Italia to a 1936 Austin Nippy roadster.

Almost all Concours have a cutoff date to discourage too many owners of newer cars from entering. At Pebble Beach, the cutoff date of 1964 enrages some owners of 1965 models (like Rolls-Royces with custom Continental coachwork) whose cars are identical to pre-'65 models.

Judges at a Concours are chosen generally from the ranks of sports-car or vintage-car club members, but often well-known automotive writers are selected in the hope they will take a broader view. The judges are assigned clipboards and scoresheets, and, with appropriately serious expressions, march forth to detect such sins as copper flash seen through chrome, excess chrome where the factory never offered it, or overspray on the paint.

Just how far a judge will go in inspecting a car depends on his own standards. No one judge decides the winner of a class. If two cars look like they are in a tie, the judges might reinspect more thoroughly, feeling for grease on the chassis, or for something the owner couldn't resist adding that wasn't part of the original.

In order to stop museum owners from simply entering cars that have been living a hermetically sealed existence, most Concours judges insist a car be startable. One year at Pebble Beach, a magnificent 1911 Simplex, perfect in every respect, was eliminated because it wouldn't start. The attitude of the judges was firm: Cars aren't sculpture; they have to run as well.

There is always a little resentment at Concours between those who carry on in the grand tradition and drive their entry in on its own four wheels, and those who trailer their entry in. You can't fault the trailering crowd; they are saving themselves a lot of cleaning. Yet the fun of seeing the cars on the road on the way to the Concours is lost when entrants trailer their cars in. Who can forget seeing former world champion driver Phil Hill on his way to a Concours at Pebble Beach, wailing along Pacific Coast Highway in a British Racing Green Blower Bentley, top down even in the rain?

Why enter your car in a Concours? For one thing, it's an excellent way to meet fellow enthusiasts for a car that, up 'til now, only *you* have appreciated. Clean up your car, take it to a Concours, and other Triumph Mayflower enthusiasts, say, will materialize before your very eyes.

How to impress a judge

In addition to spending hundreds of hours on their cars, Concours entrants also become adept at documentation of their particular marque. A typical display accompanying a car might include: 1. An original window sticker with the price as sold. 2. An original showroom brochure. 3. Original ads from magazines of the car's era. 4. Snapshots of the car depicting the condition the owner found it in before restoration.

While bringing along all this paperwork might seem like ego-tripping, it can help should a judge express doubt as to the authenticity

of some item. When you can produce a showroom brochure showing that, yes, 1966 Shelby Mustangs *did* have a supercharger option, you may have won your case.

What does all this have to do with you—a guy whose "stable" might consist of two cars, the most "special" of which is, say, a '66 Corvair? Well, if you hunt long enough, in special hobbyist publications like *Hemmings* and *Old Cars*, you'll find that there is probably a club for your marque. And if there's a club, there's a Concours. Even if you don't have your dream car yet, joining the Alfa Club, or Jaguar Club, or you-name-it might provide a tip as to where you can find that car you deem worthy of restoration.

Having a Concours-class car not only does wonders for your ego, but it helps your pocketbook should you decide to sell it. There are people who will pay big money for a 10 or 15-year-old car brought to Concours condition.

The preparation

The secret of preparing a car for a Concours is to allot enough time to do the job properly . . . that and having the right tools. There are no shortcuts. "Instant" wax jobs, for example, and inadequate equipment can do more harm than good.

To find out how many Concours entrants prepare their cars, we talked to several owners and two semi-professional Concours "detailers"—Bill Larzelere, of Burbank, Calif., and Tony Anton, of Fullerton, Calif. Larzelere specializes in Porsches and Ferraris, while Anton works on Duesenbergs and Packards.

Lacquer: The only choice

Larzelere and Anton agree that for any car to be seriously concoured, it should be lacquered rather than enameled. Lacquer dries instantly, so there's less chance floating particles will land and be embedded in the paint.

Many expensive foreign cars, such as Jaguar, Mercedes and Porsche have extra-cost lacquer paint jobs even today. But with "two-stage" lacquers that use a coat of "clear" over base-color coats, there is often a yellowing of the clear layer, particularly if the car has been parked in bright sunlight. American two-stage paints are a little more durable than the foreign paints.

Detailers like Anton and Larzelere start work only after a car has a perfect paint job. Both say the secret of a perfect paint job is preparation of the surface. Larzelere describes a process in which a car is



A tale of two tool kits: Above is the rolled leather pouch type; missing tools can't be replaced with nonoriginals.



Complete factory tool kit is in trunk of Gary Wales' Jaguar. It's a lovely setup, to be envied by any Saturday mechanic!

(Please turn to page 170)

Материал, защищенный авторским правом

Mr. Rent-a-Wreck

Would you rent a very used car from this man?

by Michael Lamm
WEST COAST EDITOR

He's built along the lines of Woody Allen; looks a lot like Woody Allen—same red hair, same quizzical expression. Maybe a little taller, but he even sounds like Woody Allen.

His name is Dave Schwartz, and he's obviously enjoying himself running a wildly successful if somewhat scruffy-looking car-rental agency in Los Angeles called Bundy Rent-a-Wreck.

Hertz or Avis he's not, but Hertz and Avis might learn a little something from Mr. Rent-a-Wreck. He started business 16 years ago selling used cars. At that time his used-car lot across the street was known as Bundy Auto Sales.

"We sold junk," he says in his very open way, "but we didn't try to put anybody on. If a car needed something, I just told them so. Like if I sell you something and I know it's bad, it all comes back to me anyhow. I didn't have time to argue with people; anyway, I believe in karma—that it all comes back to you. And it's really true. It really does happen that way.

The truth doesn't hurt

"So people couldn't believe it. They'd come in to look at a car, and I'd say 'Well, you know, this one's got a leaky radiator—you have to watch the water. Or that one must have an electrical short in it somewhere because about every five days the battery's dead.'

"They couldn't believe some guy could tell them that. By this time we'd changed the name from Bundy Auto Sales to Bundy Used Cars and then to Bundy Very Used Cars. Pico Blvd. at Centinella, near Bundy, has always been our location.

"What happened—we built up this reputation that people could come to me at Bundy Very Used Cars, and I was going to tell them the truth. And it really worked. It was so sim-



Boss-man Dave Schwartz poses on lot of his booming rent-a-car business. At left he stands by one of his stock in trade—old, dinged and dented, clapped-out cars.

ple—terrific, you know, so we sold a lot of used cars.

The girl and the Corvair


"Well, one day I sold a car to a girl—a 1960 Corvair. It broke down that same day, and she didn't know what to do. I told her I'd give her

her money back. She said she just needed a car for three months—could I rent her another car for three months for the same \$225 that she'd paid for the Corvair?

"I sort of hesitated, but she was desperate and real nice, so I said I'd do her a favor. So I rented her a 1964 Buick Skylark for \$225. Didn't hear from her for three months, but then exactly three months later she brings back the car. So here I've got the money and the car, too. I figure that's not such a bad deal.

"So I start playing with the idea of renting used cars in addition to selling them. For about the first year I did it just on monthly deals, where

(Please turn to page 158)



20 ways the world could end

by Isaac Asimov

End of world is grimly depicted above as giant meteoroid roars toward Earth, thought possible though not too likely. Belching, fire-breathing volcanoes could also devastate Earth if they all were somehow triggered into erupting at the same time.

PM art: Ed Valligursky

Are we living on a doomed planet? If one decides the world has a beginning, then surely it must have an ending, too. Generally, if it is thought the world began not very long ago, it is natural to suppose it should come to an end not very long from now.

The somber mythology of the Norsemen saw an end to the world that was not to be long delayed, for instance. There would come Ragnarok, the Twilight of the Gods, when the gods and heroes would march out to meet their deadly enemies, the giants and monsters, in the last climactic battle that would destroy the world.

Similarly, the Bible, which tells of the beginning of heaven and earth in the first book of the Old Testament, speaks of the end, too, in Revelation, the last book of the New Testament. It tells of a climactic battle at Armageddon and a final Day of Judgment.

The Bible does not give the actual time of the Day of Judgment, but the early Christians appear to have expected it to come soon since the Savior had appeared and completed His mission. The end did not come,

but in each generation there were those who proclaimed it imminent.

The year 1000 brought panic to some Christians who took the Revelation's reference to the 1000 years that preceded the end to mean the 1000 years that had just passed. When the end did not come, other calculations were made—over and over.

In the 1830s, a New York farmer, William Miller, calculated the end would come in 1843 and many people sold all they had, donned white robes, and waited on hilltops. Nothing happened, but the movement gave rise to the Adventists, who still wait.

In 1879, Jehovah's Witnesses came into being as an offshoot of the Adventists and they waited for an imminent end. They still wait. They are still sure it is imminent.

Others have expected more secular ends. Comets have always been feared as omens of disaster and destruction. As late as 1910, when Halley's Comet made its most recent appearance, uncounted numbers feared that Earth would be destroyed in its passing. Just a few years ago, there were amusing



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A noted science commentator ponders cosmic catastrophes that could scorch, freeze, flood or smash the Earth—plus one very real disaster that could strike within the next half century.

mystics who predicted that the passing of the small planetoid, Icarus, would cause California to fall into the Pacific Ocean.

Nothing so far has happened, but those who wait for the end to come are always ready with a new prediction.

What, then can we say about catastrophe? Can we laugh and say the world will not and cannot come to an end? No, for there are ways the whole universe might end and that would mean the end of us.

Expanding universe

For instance, we know that the universe is expanding. As it expands, the stars of which it is composed consume their fuel and finally can radiate no more. The birth of new stars is no longer possible when all the hydrogen (the basic fuel in the universe) is consumed. The universe will then have run down and if the end for us has not come before, it will surely come then. Still, the general rundown of the universe will not happen for many trillions

of years. There are other catastrophes that will come before then.

Weakening gravity

Accompanying the expansion of the universe is the possibility of a change in its fundamental laws. Some scientists speculate, for instance, that the force of gravity is slowly weakening as the universe expands. This has the potential of catastrophe for us, except that it would take a billion or more years for the effect to become noticeable, let alone catastrophic.

But then the universe need not expand forever. Under certain conditions (and astronomers are not certain whether those conditions are actually met or not) the expansion would gradually slow down and eventually come to a halt. The universe would then begin to contract again, contracting faster and faster.

Fatal radiation

This, however, does not give us a new lease on life, for a contracting universe pushes radiation ahead of itself into a more and more energetic form that would be fatal to all life. However, even if the universe does enter into a contraction cycle, that will not happen for perhaps 25 billion years and there again we are in no immediate danger.

It may be, too, that superimposed on the general expansion of the universe are local contractions brought about by violent events in the history of giant stars and clusters of stars. These contractions may force matter together so densely as to form "black holes" from which nothing can emerge. It may be that black holes already exist and that they continually grow and encroach on matter until everything is gone.

Caught in a black hole?

When will a black hole engulf us? Are we on a collision orbit with one? Astronomers have detected a few objects they suspect might be large sun-sized black holes, but they are so far away that again possible collisions must be billions of years away at the very least.

Some astronomers suspect that

We may be due for another ice age. Could we survive it? Man has lived through four past glacial advances, but may now be too "civilized" to withstand a fifth.



Sudden warming of the Earth's atmosphere, even if only slight, would melt polar ice caps and glaciers, raising sea level hundreds of feet to cause vast flooding.

black holes can come in all sizes, down to very tiny ones no larger than atoms. There is even a suggestion that the 1908 incident in Siberia, in which a whole forest was leveled without any signs of a meteorite strike, was the result of the passage of such a microblack hole into Siberia, through the body of the Earth and out the Atlantic Ocean.

Black holes are difficult to detect. If they do exist, there is no way of knowing as yet whether any are on the outskirts of our solar system or not.

Dying sun

Then there's our sun. If we are content to admit the universe won't last forever, surely our sun won't. In fact, our sun should last a far shorter time than the universe does. The sun has now been shining at the expense of its hydrogen fuel for some 5 billion years or so. Eventually, that fuel will run sufficiently low to cause the sun to swell up into a red giant. When that time comes, the Earth will heat up to a point where life on it will not be possible.

This, however, is not expected to happen for some 8 billion years and by that time humankind (if not killed off by some other prior catastrophe) may have moved on to other, younger stars.

Even if the sun remains in its



present form, might there not be minor variations, insignificant to the sun itself, but deadly to the Earth? There could be changes in its sunspot activity or in its interior that will cause it to warm slightly or cool slightly—*slightly*, but enough to boil our oceans or freeze them, and in either case end life on our planet. There are indications, though, that the sun has been fairly stable for billions of years and ought, therefore, be stable for billions more.

What about the rest of the solar system? Is any part of it going to crash into us?

Velikovsky and his followers believe that in the recent past—only 3500 years ago—Venus, Earth and Mars kept undergoing near-collisions.

Rational astronomers find it impossible to take this seriously. There is every indication that the solar system is dynamically stable, that the major planets have kept to their orbits for indefinite millions of years in the past and will continue to do so for indefinite millions of years in the future.

The meteoroid fear

But the solar system is filled with debris—with minor planets (asteroids) of all sizes, from a few that are hundreds of miles across to many thousands that are only a few miles or even a few hundred yards across. There are uncounted particles ranging in size from a few feet across down to microscopic bits of dust. Some of these minor bodies are close at hand. There are asteroids a mile or two across that have orbits that can occasionally place them within a few million miles of Earth. And there must be bodies smaller still that can come closer—that can even collide with us.

Tiny micro-meteoroids are indeed constantly colliding with Earth by the millions and burning up in our atmosphere (the larger ones visible as "shooting stars"). Particularly large meteoroids, from several inches to several feet across, can survive to strike the Earth as "meteorites" and these can cause damage if they score a direct hit on human beings or their works.

The larger the meteoroids, the more damage they do. In primordial times, the craters on the moon, Mars, Mercury and the satellites of Mars and Jupiter were caused by collisions with sizable bodies. One left a crater in Arizona over half a mile across, formed, perhaps, only 10,000 years ago. There are signs of other craters, some even larger, formed longer ago. Nowadays, the collision of a meteoroid capable of forming such a crater might wipe out a city. If it struck an ocean, it might cause a splash that would devastate the coastlines of the world with towering waves of water.

What are the chances of a devas-

tating meteoroid strike? It's hard to say. On the one hand, there are fewer such bodies in space now than ever before since every one that has already struck something else means there is one less to strike us. On the other hand, a strike today on our densely populated, heavily industrialized planet could produce much more damage than in the past when there were fewer people more widely scattered. The chances are, however, that really bad strikes come only tens of thousands of years apart. Perhaps before the next one comes technology will have reached a point where there will be a "meteoroid watch" in space just as there is now an iceberg watch in the North Atlantic.

Antimatter could strike

We might compound the disaster by imagining that a meteoroid strike is one of antimatter. Antimatter is composed of particles of a nature opposite to those composing ourselves and the Earth. Antimatter combines instantaneously with matter to give rise to a release of energy (including radioactive radiation) about a hundred times as great, size for size, as that of a nuclear bomb. A small piece of antimatter would therefore do as much damage as a much larger piece of ordinary matter. (Some have speculated that the great 1908 Siberian strike was caused by a small bit of antimatter.)

Antimatter can exist and some astronomers suspect that there may be whole universes built of it or, within our own universe, whole galaxies of it.

Earth slowing down

Is there any chance that the axis of the Earth may tip over? Something called the law of conservation of angular momentum makes this unlikely. The conservation of angular momentum does not, however, prevent some of the turning effect from being shafted from the Earth to the moon. This means that the moon is slowly drifting away from us and the Earth's rotation is gradually slowing down. As the day



Deadly nerve gases, spread from the air, laser-beam "death rays" and killer germs are among "sophisticated" weapons modern man could use to destroy himself. Above, desperate, starving hordes wander in search of food as famine sweeps world—a disaster that could come in 50 years.



lengthens, temperature differences between day and night and between winter and summer would grow more extreme until Earth becomes unfit for life. This change takes place so slowly, however, that it will be many millions of years before its effects will be significant.

The surface of the Earth moves. It is made up of plates that slowly shift. Since the plates are in contact, enormous pressures build up along their boundaries, producing instabilities. It is along these boundaries that volcanoes are formed and that earthquakes take place.

Ordinarily, volcanic eruptions and earthquake tremors occur infrequently and cause only local destruction. But what if there were some effects that could suddenly intensify earthquake and volcanic activity to a catastrophic level?

Solar wind could trigger quakes

There are speculations that the Earth might be affected by the solar wind (particles that shoot out of the sun in all directions) and that the solar wind is, in turn, possibly affected by tidal effects in the sun caused by the planets. Some planetary configurations can cause unusually large tidal effects, possibly leading to a sharp rise in the solar wind. If some fault is on the point of yielding to cause a disastrous earthquake, the changes brought on by the solar wind might just nudge it over the top.

Another ice age?

What about catastrophes that affect the oceans and atmosphere? What about changes in climate? For instance, every quarter of a billion years, the Earth seems to undergo a period of recurrent ice ages where huge glaciers advance for thousands of years, then retreat for thousands of years. Scientists have speculated on the causes of these periods, but have as yet reached no consensus. We are in such a stage now. Over the last million years, glaciers have advanced and retreated four times.

Are the ice ages over? Perhaps

not. The glaciers may someday advance a fifth time. We have survived the previous four advances, but human beings were then few in number and were tribal hunters who could move with the slow advance or retreat of the ice. Now we exist by the billions and are tied to the land by our farms, mines and cities. A fifth advance would be a catastrophe.

However, the interval between glacial advances is tens, even hundreds, of thousands of years. By the time the glaciers are due to come again, we may have developed the kind of climate control that would prevent them from doing so.

Disastrous floods

What about the reverse possibility that the Earth might grow a little warmer, causing the glaciers that still exist in Antarctica and Greenland to melt? This would raise the sea level 200 feet and result in disastrous flooding along all the rich and populated coasts of the world. Again, sophisticated climate control might prevent this.

A more subtle danger involves the cosmic-ray particles that steadily bombard the Earth from star explosions and other violent events in the universe. In smashing through living things, these rays can produce harmful mutations that could drive whole species to death and extinction.

Death from cosmic rays

Much of the cosmic rays are warded off by Earth's magnetic field, which thus keeps the incidence of particles to less-than-harmful levels. But this magnetic field waxes and wanes irregularly for reasons we don't understand. At present, it is waning, and in a couple of thousand years it may pass through a period of centuries in which it is virtually zero. At this point, the incidence of cosmic-ray particles reaching Earth's surface will rise sharply, especially if, at the same time, there are star explosions relatively near our solar system. The extinction, 70 million years ago, of the great dinosaurs

might have been caused in this way. Fortunately, the combination of magnetic-field minimum and cosmic-ray maximum is not too likely.

Plagued by plagues

What of danger from other life forms? We no longer fear lions, tigers or other large predators, but what of smaller animals? What of rats that grow ever more vicious and clever? What of insects that grow immune to insecticides? What of epidemic diseases?

In the 14th century, the Black Death struck without warning, killing as many as one-third of all human beings then alive in just a quarter of a century or so. This was the greatest catastrophe ever to strike humankind in recorded history. Many people then thought that the world was coming to an end.

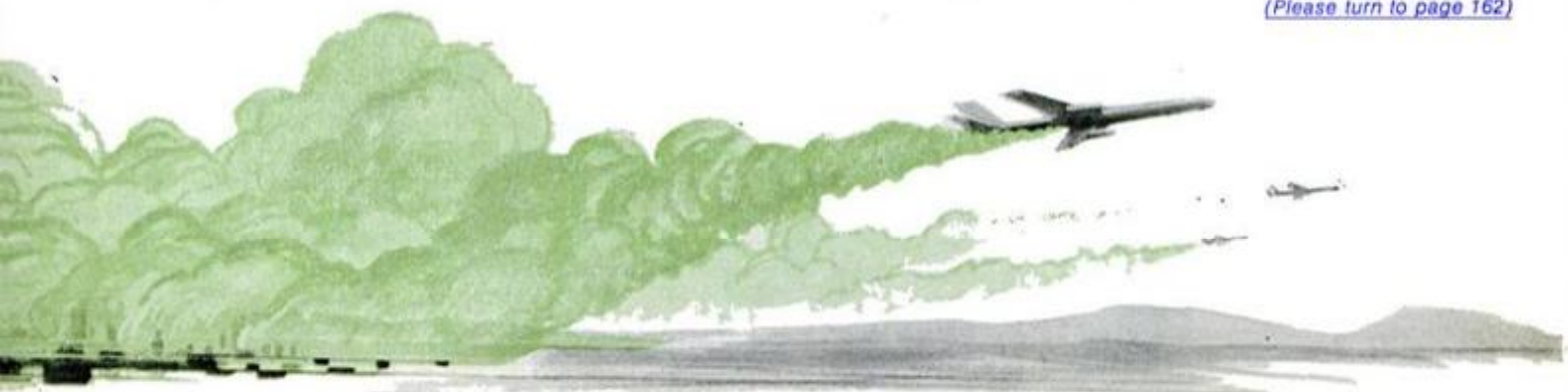
There have been other plagues—cholera, smallpox, typhus, yellow fever—though none as deadly as the Black Death. As late as 1918, a worldwide influenza epidemic killed almost as many people as the Black Death (though the percentage of deaths to total world population was far smaller).

Might another vast epidemic arise and wreak incredible destruction? It's a possibility. A plague, or a growth of vermin, could strike at any time, but modern medical science is also better able to deal with such threats than ever before.

Polluted atmosphere

What, then, of *human* activities? Is humankind itself hastening its own end? Man has, for instance, been burning carbon-containing fuel—wood, coal, oil, gas—at a steadily accelerating rate. All these fuels form carbon dioxide. Some is absorbed by plants and the oceans but not as fast as it is produced. This means the carbon dioxide content of the air is going up—slightly but nevertheless up. Carbon dioxide retains heat, and even a small rise means a warming of the Earth's atmosphere. This may result in the melting of the polar ice caps with

(Please turn to page 162)



PM OWNERS REPORT: ELECTRIC CARS

Fine for in-town commuting, but lots of kinks to work out

A nationwide survey based on 465,598 owner-driven miles

by Michael Lamm WEST COAST EDITOR

Photos by the author

Lots of teething problems here, and no owner feels just ho-hum about his electric car. The gamut of emotion runs from wildly pro to equally con. Here's a typical sampling of the 1000 electric car owners we surveyed recently. (Ninety-five percent of those surveyed own Sebring-Vanguard Citicars; five percent have Elcars. Thus most comments in this Owners Report apply to Citicars only—1975 and 1976 model years.)

"We feel we bought a lemon," states an Indiana mailman. "Instead of being 'a practical dream,' this car has been a nightmare. The batteries were supposed to be good for 12,000 to 18,000 miles, but at 2500, the car won't stay running long enough for us to test the claim.

"The electrical controls have burnt out twice," he continues, "the brakes and lights aren't dependable, and the heater had to be replaced. If workmanship were even average, we wouldn't have had this many problems. The car also has a **terribly rough ride**. It would be very easy to lose control."

Yet a Denver psychiatrist counters, "I bought the Citicar for reasons of ecology and economy. It's the most logical car for my needs—short-distance driving at city speeds. My only difficulty has been a burned-out relay, due to my own inexperience, and a mysterious drop in power in low range (still being investigated)."

An RN wife and her resort-owner husband exult: "Wonderful little car. We took it to Chautauqua, N.Y., where the hills are as steep as any you'll find. The Citicar went up and down them better than any other type of car. With these narrow, crowded streets and limited parking, the Citicar is made to order. It's so easy to get around with . . . takes up so little space in the garage . . . low maintenance . . . low cost of operation . . . We've noticed very little change in our electricity bill."

An Oregon experimental research technician: "I live in a small town on rather steep ground. These hills slow the electric down quite a bit. It's designed for flat ground at city speeds, and for that it's great. If a person has a 15-mile commute a day at 30-35 mph, an electric merits serious consideration. One problem in my case is that I live 65 miles from the nearest dealer!

"Luckily I've had no major problems—just replacement of front disc pads and a set of motor brushes. My only minor gripes are the high-pressure tires and short wheelbase, which make the ride stiff. But while an

electric will outlast other vehicles, it won't replace them. Everybody needs a toy, and I can't think of a more practical one!"

A Houston housewife and her architect husband feel differently. "We bought the Citicar because we thought there would be gasoline rationing. We never get over 30 miles to a charge. Dealer service is poor—they also don't stock parts. We've had problems with the brakes dragging; also the rear axle broke in two, the motor brushes and some cables burned up, and the accelerator spring keeps breaking. Service is slow. Even when the horn wouldn't work they kept the car three days. I had to pay freight on the axle, even though the repair was under warranty. I wish I could paint a rosier picture—the idea of an electric car is great. But no, I wouldn't buy another one. We've had it!"

A Tennessee hog farmer: "I use it for short trips around the farm. No engine warm-ups, and it's real handy. No complaints or problems in 1600 miles."

A New Mexico minister: "The drive mechanism seems good, the body poor. It squeaks, rattles, comes unglued, is brittle. The only real problem, though, was a loose battery connection that kept arcing and finally burned up the battery post. Sebring-Vanguard replaced the battery under warranty."

A Texas golf-course owner: "The dealer's service people thought I was a little crazy to buy this car in the first place. They don't know anything about electrics and could care less. It's fun to drive, though, and very inexpensive. I live five miles from work and can plug it in either place. The Citicar needs a better door/window system, with locks. I like the car but don't think I'd buy another one unless they make a lot of improvements."

What does it actually cost to run an electric car? Owners hardly agree as you can see on our summary chart (page 92). Manufacturers and electric-car dealers like to mention "a penny a mile," but that's only for electricity. Owners, however, parrot the penny quotation without—apparently—much research.

Some, though, put operating costs as low as $\frac{1}{10}$ th of a cent per mile, while others go as high as 22 cents. Much depends on how you figure it; especially whether you include cost of batteries.

A retired North Carolina engineer presently involved in solar energy told us he keeps a very close check on the cost of driving his Sebring-Vanguard Citicar: "I figure .55 kilowatt-hours per mile, times 3.3 cents per

Yet 50.7 percent rate dealer service as "good to excellent."

But cold weather cuts battery performance considerably.

Not an isolated complaint—nearly 30 percent agree.

Here's an unusual comment. Most owners want more power for hill-climbing.

Early models had sliding windows; others pushed open. Neither gives very good ventilation.

More like this one.

Battery replacement seems to be the biggest expense of running an electric car.

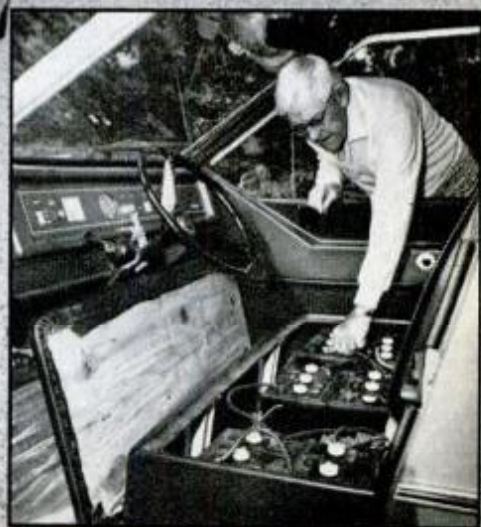


Elcar 2000 is a two-passenger electric car from the Elcar Corp. in Elkhart, Ind. The power pack is a bank of eight batteries that slide out on a tray which is suspended under the chassis. Car is plugged in for recharge as shown above.

Citicar is a wedge-shaped, two-seater electric from Sebring-Vanguard in Florida. Shown here is Chester E. Jones' 1975 Citicar that he uses every day around his home in Walnut Creek, Calif.



Batteries of Jones' Citicar are under seat. His '75 model uses six; newer models, eight. This is his second electric. The first was an old Goggomobil that he converted to electric. Only problem he's had with his Citicar was dragging front disc brakes. He fixed the problem with rubber bands!



kwh, equals 1.83 cents a mile for electricity alone. Add to that 2.85 cents per mile for parts, .027 cents a mile for labor, and the total comes to 8.95 cents a mile, excluding batteries. I now have nearly 4000 miles on my 1975 Citicar and will soon have to replace the batteries."

This engineer's batteries have lasted about average. If he buys eight 6-volt golfcart cells at \$40 each, that's another 8 cents per mile, which brings his total expense to nearly 17 cents a mile. And that still excludes insurance and depreciation, which most fleet-car accountants do include.

Unlike this engineer, though, most owners of electric cars have no conception of their true operating expenses (nor do most drivers of gasoline vehicles). A Michigan pastor stated, "It cost me 1/30th of a cent per mile in electricity plus two gallons of distilled water a year at 59 cents a gallon." And a self-employed Floridian added, "Two bits a day." A number of people said, "I can see no difference in our electricity bill."

What do owners like best about their cars? A retired Florida schoolteacher says, "It's inexpensive, convenient, easy to park, fun to drive, and a conversation piece. I conserve fuel, don't pollute, and I also own an electric motor for my boat and my bicycle."

An Arizona physician: "For long trips, the Lincoln; around town, the Citicar."

A Kentucky prison superintendent: "It's a safe car. In December 1975 my son was driving the Citicar through a shopping-center parking lot. A speeding car came from behind a building and struck the Citicar in the right front corner. The Citicar was spun around and rolled over. My son had his seatbelt on and didn't receive a scratch. Damage: \$200. Incidentally, only about a cup of battery acid escaped, and not one battery was broken."

Recent government allocations indicate that research ought to move ahead.

Bluebooks don't list electrics, and used electrics present an unknown risk to most used-car buyers.

This comment popped up again and again—they're fun and attention-getting.

Question: Where will the energy come from to charge even more efficient batteries?

Here are some representative complaints. "The concept isn't developed," opines an entertainer from Florida, "because it's too hard to check whether something's about to go wrong. If you forget to pour oil into your Pinto, any filling station attendant will catch it. Besides, a light will flash when your oil-pressure gets low. But in an electric, it's hard to inspect the motor brushes. No one wants to do it, and no light tells you when the brush springs are eating into your commutator. That's what happened to me at 5000 miles."

A Virginia TV company owner: "Short range, very rough ride, poor speed control method, unsafe and flimsy body construction."

Minnesota teacher: "Built too cheaply, isn't reliable enough, and you can't resell it."

"Comfort leaves a lot to be desired," chides an upstate New Yorker. "Rough ride, hard seats, no heater, poor sealing windows, and doors that don't close. Cold weather also severely cuts battery performance."

Rhode Island TV engineer: "The real problem is the lack of serious competition in the electric-car field. We need more research into battery development to get more range."

Only 61 percent of our respondents said they'd buy another electric car as their next automotive purchase. Some said they favor electrics but wouldn't buy another Vanguard or Elcar. Others said "no" because they found it hard or impossible to get insurance.

We leave the summing-up to a Georgia manufacturing executive: "The electric car, in its current state, is not up to present-day gasoline automobiles but is remarkably good for something so totally different. Remember—it took Henry Ford 18 years to evolve from the Model T to Model A, so let's give electrics a fair chance." ★ ★ ★

Summary of Electric Car Owners Reports*

Car type:		Have you replaced batteries?		Workmanship opinion:		Family size:	
Sebring-Vanguard	95.4%	Yes	27.1%	Excellent	11.0%	1	9.1%
Elcar 2000	4.6	No	72.9	Good	31.3	2	39.6
Total miles driven	465,598	Why did you buy an electric car?		Average	22.5	3	12.8
Length of ownership:		Economy	70.7%	Fair	18.7	4	20.1
1-6 months	30.1%	Different	10.9	Poor	16.5	5	11.0
7-12 months	22.7	Environmental reasons	7.5	What changes would you like?		6	4.9
13-18 months	31.3	Had any mechanical trouble?		Better ride	16.9%	7	1.2
19-24 months	12.0	Yes	74.0%	Window style (dislike push-outs)	15.1	8	0.0
24 months plus	4.0	No	26.0	Longer range between charges	13.9	9 plus	1.2
Miles on a single charge?		Type of mechanical trouble:		Better styling	10.2	Specific likes:	
10-20	8.1%	Brakes	36.6%	More power	9.6	Economy	67.4%
21-30	21.9	Fuses and related	15.7	Comfort opinion:		Handling	40.6
31-40	34.4	Brushes	9.7	Excellent	7.8%	No pollution	7.4
41-50	33.1	Broken electrical connections	7.5	Very good	6.7	No likes!	7.4
51-60	1.2	Did you repair it yourself?		Good	28.3	Specific complaints:	
61-plus	1.2	Yes	38.9%	Fair	33.3	Ride	28.9%
When do you recharge batteries?		No	61.1	Poor	23.9	Brakes	11.0
Daily	80.7%	Was dealer repair satisfactory?		Number of cars owned:		No heater	9.2
Two days	9.9	Yes	58.3%	One car	7.0%	Lack of power	8.7
Three days	3.7	No	41.7	Two cars	61.0	Would you buy another electric car?	
Four days	1.9	Dealer service opinion:		Three cars	22.7	Yes	61.1%
Weekly	3.7	Excellent	20.3%	Four cars	8.7	No	38.9
Cost of operation per mile?†		Good	30.4	Five cars	0.6	State reply came from:	
1 cent	54.4%	Average	11.6	Other cars owned:		Florida	20.7%
2 cents	22.3	Fair	6.5	Chevrolet	16.4%	Michigan	7.3
3 cents	4.9	Poor	31.2	Ford	15.1	Georgia	5.6
4 cents	1.9	Dealer sale opinion:		Oldsmobile	13.8	Illinois	5.6
5 cents	6.8	Excellent	34.4%	Cadillac	11.9	Oregon	5.6
6 cents	1.9	Good	32.5	Volkswagen	6.9	Texas	5.6
7 cents	1.0	Average	7.9	Buick	6.9	Age distribution of owners:	
8 cents	1.9	Fair	9.9	Plymouth	6.9	15-29 years	9.5%
9 cents	1.0	Poor	15.2			30-49 years	44.0
10 cents	1.9					50-plus	46.4
11 cents plus	1.9						

*Percentages might not equal 100% due to rounding or insufficient data. †Many owners pointed out that this cost is 1/2 to 1 1/2 cents per mile, but is 5 cents per mile if battery replacement cost is included. Both kinds of answers were received. ‡Many owners reported buying direct from factory or from dealers who have gone out of business. And there was the fellow who got 35 miles per charge, but his dealer was 100 miles away!

Homebuilts and conversions

There's also a totally different electric car—the sort built at home. Such cars often begin as hobby projects, but some end up being serious pieces of R&D.

Bob Steinfeld of Redwood City, Calif., electrified his Beetle in his garage workshop at home. Before that, he'd converted a 1964 NSU Prinz.

John Newell, Belmont, Calif., put together an electric fiberglass sport



Paul Howes's homebuilt costs 4 to 5 cents a mile to operate—1 for electricity, 3 to 4 for batteries.

coupe now being used as a club project car and test vehicle.

Duane Bretzke, Cupertino, Calif., transformed his 1963 Fiat 600 to battery power in 1971 and has driven it daily for the past 29,000 miles.

These are typical members of a growing fraternity of do-it-yourself electric carmakers proving you don't have to buy one to drive one.

They're also members of a California-based club called the Electric Auto Assn. (EAA). Founded in 1967 by San Jose's Walter V. Laski, a retired research engineer and inventor, the group has grown to 300 grass-roots enthusiasts, many of them engineers. While strongest in California (where warm weather helps battery performance), the EAA now has chapters as far-flung as Ohio and Pennsylvania.

Most EAA members got their first



Datsun conversion by Electric Engineering, East Lansing, Mich., was done for Amos D. Bridge's Sons, a Hazardville, Conn., firm.

urge to build electric cars during the 1974 gas crunch. Between them, they've now built 100 cars, plus several electric motorcycles and tri-cycles. Owners of commercially built electric vehicles aren't excluded from EAA, but most members build their own cars.

If there were such a thing as a "typical" homebuilt electric car, it would be something like this: VW Beetle, Renault or Fiat unitized body with the internal-combustion engine removed but the transmission retained (the clutch is kept in about half the conversions). Instead of a normal engine, this car would have a government-surplus 2CM77 aircraft starter-generator, most likely 28 to 36-volt d.c. in 200 to 400-amp. ratings, weighing 45 to 55 pounds, and made to identical government specs by GE, Westinghouse or Jack & Heintz.

These generators may be used directly as shunt motors when mated to a standard transmission. The gearbox provides reverse plus several different speed ranges. The clutch isn't really needed, but it sometimes aids shifting.

The 2CM77 generators are sometimes converted to series motor use by rewinding field coils with heavier-gauge wire and rejoining the field and armature in series.

Converted cars usually carry from 8 to 14 six-volt golf-cart batteries. These are deeper cycling and last 5 to 10 times longer than ordinary 12-volt car batteries.

Your speed-control mechanism would be a set of relays for series-parallel switching. The aircraft motor will develop about any power you want, depending on voltage. The idea is to have a set of battery-switching relays that let you change voltage at will from 6 to 72 volts.

Cost? It's tough to say, but government-surplus aircraft motors like the 2CM77 now bring about \$75 each. Golf-cart batteries cost between \$30 and \$50 apiece, depending on brand and how many you buy (the EAA buys in quantity for its members).

Batteries the top cost

The basic car itself, plus little items and labor to convert it, might come to another \$1500. So the typical conversion with 10 batteries costs around \$2000, excluding labor. Even so, EAA member Joe Satariano boasts that his converted



Jake Ziegler calls his homebuilt the Volectra since it started life as a standard production VW Beetle.

1969 Subaru cost only \$700 complete.

"The biggest cost in driving an electric," observes Paul Howes, a maintenance engineer from Pacifica, Calif., "isn't the cost of electricity but the cost of batteries. I've got a watt-hour meter on my charger, and I once calculated that over a period of time, electricity alone runs me only about 1 cent a mile. But the golf-cart batteries, which last me 10,000 to 12,000 miles a set, run the cost up to about 4 to 5 cents a mile."

While most home-grown electric cars began as hobby projects, a number have turned into research-and-development test beds for possible commercial ventures. Bob Steinfeld, an electronics engineer and teacher, now sells adapter kits that mate electric motors to the VW transmission bellhousing. He has also written a book telling prospective do-it-yourselfers how to convert small gas-engined cars to electrical use but it's presently out of print.

Vaughn Burlingham of Sausalito, Calif., converted an Aurenthetic electric motorcycle to a suburban three-wheeler and also sees com-



Bob Steinfeld's electric VW is his second electric-car conversion. His first started out as an NSU.

mercial possibilities. He'd like to go into production.

Several EAA members, too, have come up with or are working on new switching mechanisms.

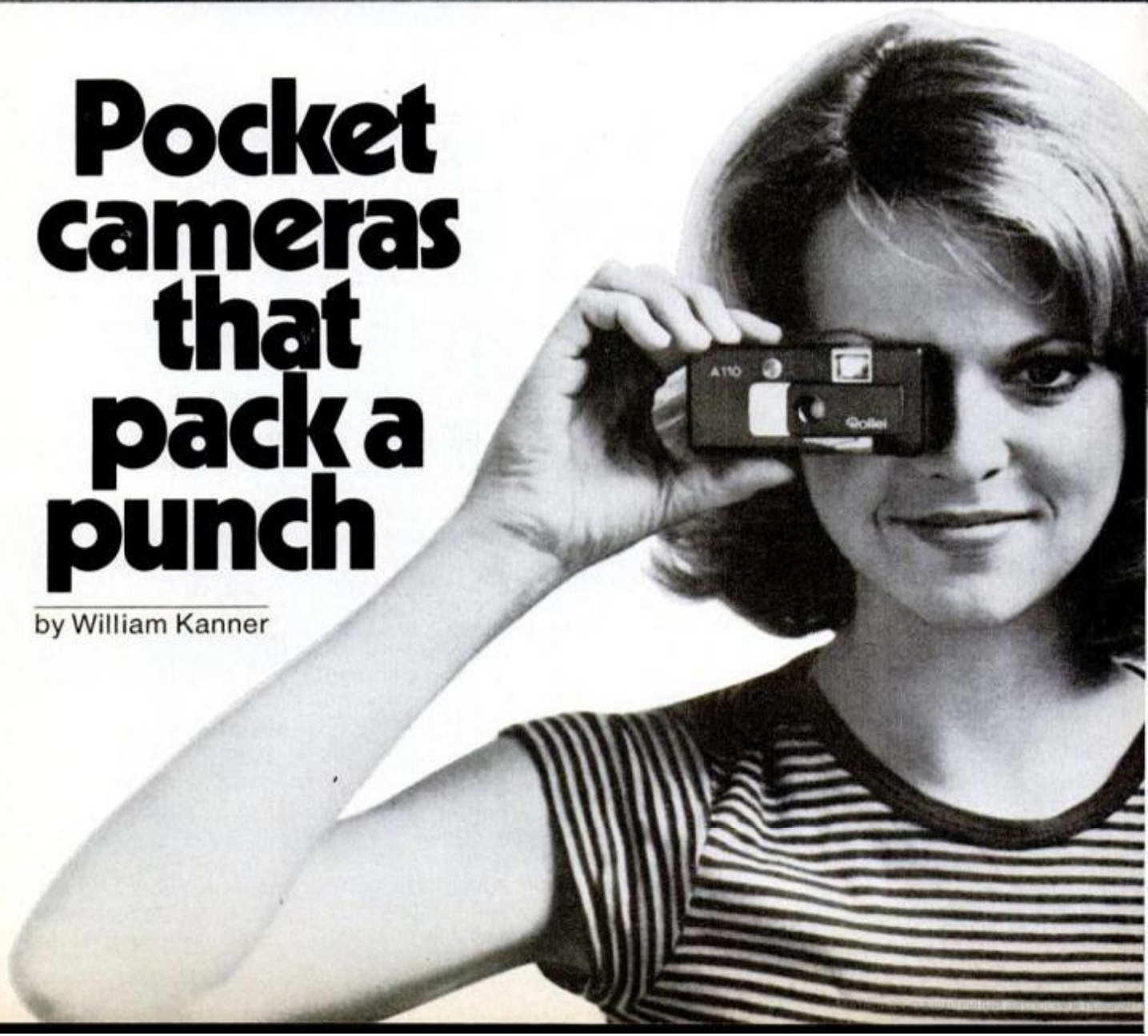
EAA founder Walter Laski has

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Pocket cameras that pack a punch

by William Kanner





Pocket-sized cameras usually have rangefinder (RF) focusing and electric-eye (EE) exposure.

The 35-mm models include: **A.** Leica CL with interchangeable, 40-mm f/2 lens, RF, manual meter, \$585. **B.** Minolta Hi-Matic F, EE, RF, f/2.7, \$130. **C.** Konica C35EF with pop-up electronic flash, EE, f/2.8, \$160. **D.** Voigtlander FV202, EE, RF, f/2.8, \$140. **E.** Minox 35 EL, folds ultra-compactly, EE, f/2.8, \$183. **F.** GAF Memo 35EE, RF, EE, f/2.7, \$108. **G.** Olympus 35 RD, RF, EE, f/1.7, \$175. **H.** Rolleiflex 35S with retractable f/2.8 lens, \$244.

Pocket 110 cameras include:

I. GAF 20/20, f/9.5, fixed-focus, \$24. **J.** GAF 20/20S with electronic flash, \$50. **K.** Tiny Rolleiflex A110, EE, f/2.8, \$300. **L.** Minolta 110 Zoom single-lens reflex, 25-50-mm f/4.5 zoom lens with macro-focus to 1 foot, EE, \$265. **M.** Minox 110S, RF, EE, f/2.8, \$220. **N.** Fujica 350 Zoom, 25-42-mm f/5.6, EE, \$95.

The ideal camera would take perfect pictures every time, and be so small you'd always have it with you. So we tested 14 cameras that just about match that ideal.

As expected, the 110-cartridge models fit most pockets (and pocket-books) best, but the 35-mm models paid for their greater size and weight with sharper pictures from their bigger negatives. But the 110s—especially the Rolleiflex—were still nice and sharp; and though the Minolta 110 is as big as a small 35, it has the features of a larger, 35-mm reflex.

Focusing systems

For sharper focusing, all the 35-mm models (except the Rolleiflex, Minox and Konica) and the Minox 110 have coupled rangefinders, and the Minolta 110 zoom has a reflex ground glass with a microprism focusing spot.

The others (except the fixed-focus GAF 110s) required that you estimate the distance and then set the lens. Sharp pictures still resulted, since these short lenses aren't too critical to focus; and distance scales in the finders of the Rolleiflex 110s and Konica made it easy—the others made you take your eye from the finder to check the setting, a minor nuisance. Even so, a focusing camera lets you shoot in closer.

Exposure control

Electric eyes controlled exposure automatically in all but the Rolleiflex 35S and Leica CL (which had man-

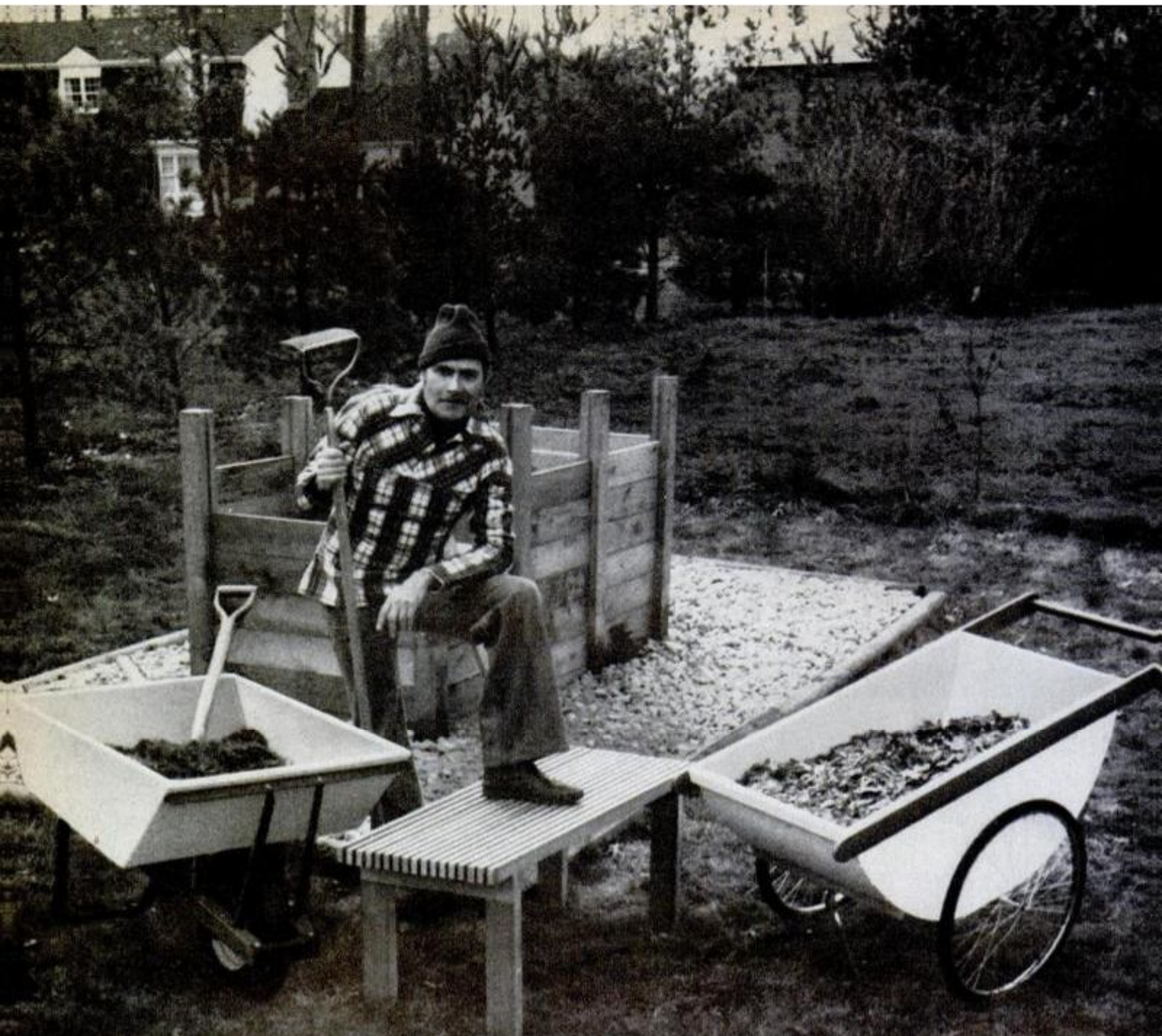
ual meters) and the GAF 20/20 models (which had no adjustment).

If you wanted to alter the electric eye's setting, the Minolta 110 zoom gave you an override control, and the Olympus 35RD had manual exposure settings, too. You could out-think the meters on the other 35s by resetting their film speeds; but not on the 110 models. The Fuji had no meter, just a scale you set according to cloud conditions.

Most electric eyes are programmed to deliver a middle shutter speed and middle f-stop most of the time. But the two Minox models, the Voigtlander, and the Minolta zoom 110 let you alter the balance by controlling its f-stop; and the Voigtlander, GAF and Minox 35s had finder scales that showed your shutter speed (the Konica showed your f-stop).

Easy flash

Flash was easy on most of these cameras. Nearly half (the GAF 35, Konica, Minolta 35, Minox 110, Olympus and Rolleiflex 110) could automatically link their f-stop and focusing to compensate for light fall-off as camera and flash moved away from the subject, and the Fuji lets you do it manually. The GAF 20/20S and Konica had built-in electronic flash. All but two models could use electronic flash; the GAF 20/20 had a FlipFlash socket, and the Rolleiflex 110 had a compact flash-cube adapter. But the Rolleiflex's flash required manual turning (easy to forget). ★★★



4 PM projects for successful summer gardening

You can make our garden cart, planter bench, wheelbarrow and compost box to lighten the load of summer yard work.

by Mike McClintock HOME AND SHOP EDITOR

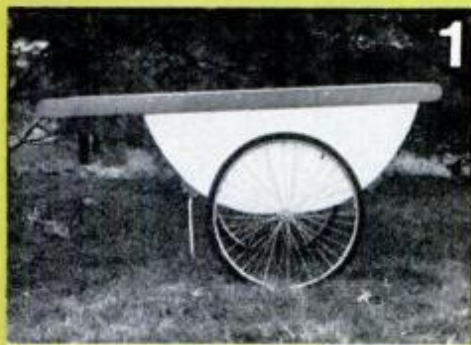
Taking care of your yard is a lot easier when you've got the right tools. But high-quality, durable equipment can be costly, so here are four useful projects you can make yourself.

The big-wheel garden cart is a nifty-looking vehicle that's so light and well balanced you can push it around with one hand.

The slatted redwood potting bench for indoor or outdoor gardening can be used for a seat or, with few modifications, beefed-up and used as an outdoor table.

The large, extra-heavy-duty wheelbarrow is extremely durable—its $\frac{3}{4}$ -in. A-C exterior-grade plywood bucket sits on $\frac{3}{4}$ -in. pipe legs and is fiberglassed to protect it from the weather indefinitely.

The eight-post, three-compartment compost box is a PM design that makes it unnecessary to sink your money into fertilizer and exotic lawn and garden conditioners.



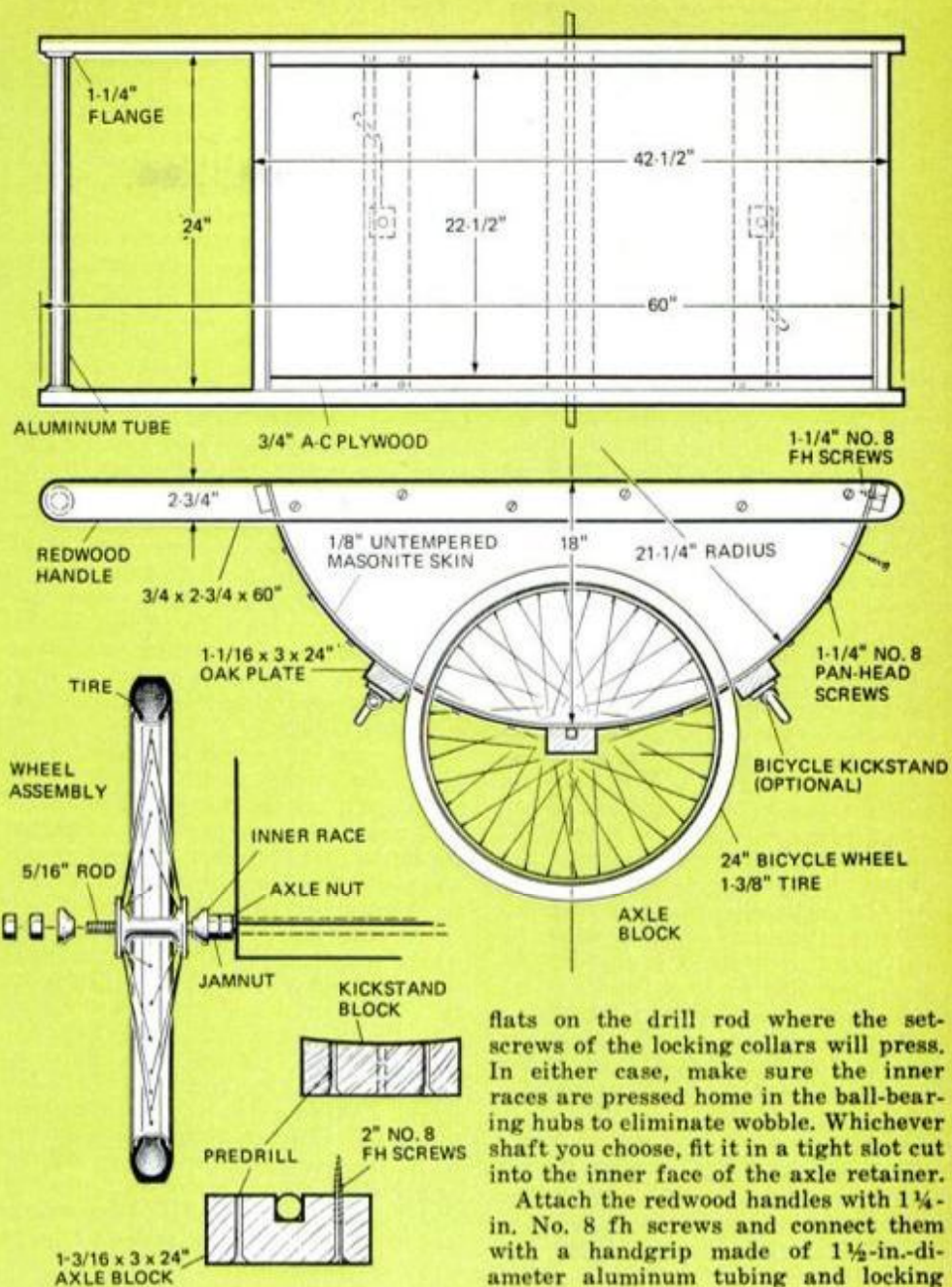
1

GARDEN CART

■ Predrill the 34-in. A-C plywood sides $\frac{3}{8}$ in. in from the edges and attach the $\frac{1}{4}$ -in. untempered hardboard with $1\frac{1}{4}$ -in. No. 8 pan-head screws. Cut two pieces of oak $\frac{3}{4} \times 1\frac{1}{2} \times 24$ in. and attach to the hardboard ends with $\frac{3}{4}$ -in. No. 8 fh screws from the inside. Bend a mending plate to fit each corner for reinforcement, then paint the bucket assembly.

Make one kickstand support (the front stand is optional) from $\frac{3}{4}$ ($1\frac{1}{16}$ -in.) oak with a slight coving to match the curve of the bucket. Drill and counterbore the inside to accommodate your kickstand and screw the support to the plywood side panels. Cut a $\frac{3}{4}$ ($1\frac{1}{16}$ -in.) piece of oak $2\frac{1}{2} \times 24$ in. to retain the axle. Apply several coats of varnish to these pieces.

To install the wheels, remove the wheel nuts, jam nuts, inner races and short axles from two 24-in. bike front wheels. Heat the inner races red hot (we used a Bernzomatic oxy-propane torch) and allow them to cool naturally to anneal them from their hardened condition. Now there are two ways you can go. For light duty, tap the races, jam and axle nuts to fit the threads of a $\frac{3}{16}$ -24 rod and reassemble so the inner axle nuts fit just outside the oak axle retainer. (For heavier duty, drill the races to $\frac{3}{16}$ -in. inner diameter, discard the jam and axle nuts and assemble on a $\frac{3}{16}$ -in. drill rod with locking collars. If you choose the latter method, file small



flats on the drill rod where the set-screws of the locking collars will press. In either case, make sure the inner races are pressed home in the ball-bearing hubs to eliminate wobble. Whichever shaft you choose, fit it in a tight slot cut into the inner face of the axle retainer.

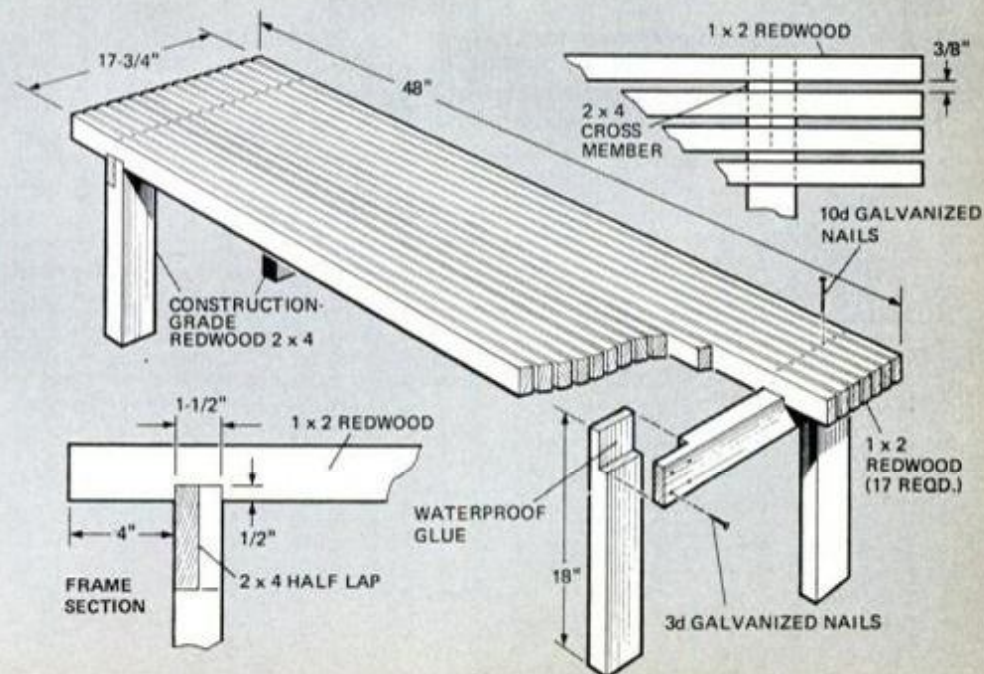
Attach the redwood handles with $1\frac{1}{4}$ -in. No. 8 fh screws and connect them with a handgrip made of $1\frac{1}{2}$ -in.-diameter aluminum tubing and locking flanges. To finish, seal the redwood and paint the handgrip to suit.



2

PLANTER BENCH

■ Make up a pair of legs from construction grade redwood 2 x 4s. You can machine the half-laps by making repetitive cuts on a radial-arm saw or with a circular saw to the correct depth. Then clean the cuts with a chisel, apply glue and nail. Clamp the redwood slats together and make the notches on all of them at once to assure uniformity. Pre-drill for the nails.





WHEELBARROW

■ This durable wheelbarrow has oak rails and wedges, a fiberglassed $\frac{3}{4}$ -in. A-C plywood bucket, $\frac{3}{4}$ -in. National Pipe Thread pipe legs and a stock wheel and axle that's supported by hefty pillow blocks.

When you cut out the bucket sides, save the angled front and rear scrap cutoffs. You can use them to set the saw angle for the front and rear bevel cuts on the bottom panel and the base bevel cuts on the front and rear pieces.

Dry-fit all pieces to assure a good assembly, then glue them together and secure them with 2-in. No. 8 FH screws. When the bucket assembly has dried, sand all edges flush and fit $\frac{3}{8}$ -in. half-round molding along the top edges.

Fiberglassing the bucket will preserve it indefinitely. Mix only as much resin and catalyst as you can use at one time. You'll need about 2 oz. for each side surface and about 4 for the large panel. Do this work with rubber gloves. Apply the resin to the wood with a 6-in. squeegee (or similar tool), lay on the glass and screed the resin down smoothly and evenly.

When the resin has cured for about an hour or so at 70° F., or when it feels tacky, apply another coat, giving special attention to the edges. If you wait until the first layer is completely dry, you'll have to sand between coats. When you've finished one surface, sand the edges and carefully and accurately overlap the glass from the next surface.

For a good-looking project, get colored resin or add color to clear resin. Be sure to work in a well-ventilated area.

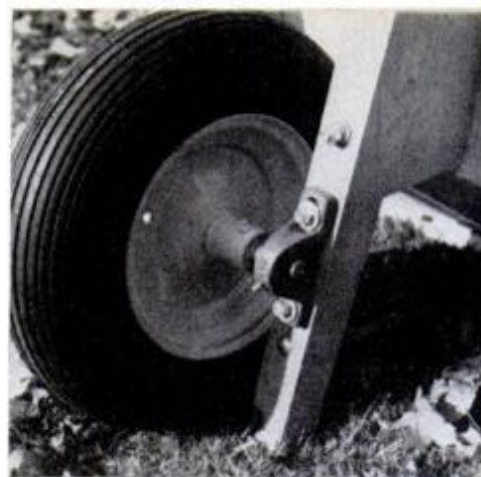
The rails and edges are made from $\frac{1}{2}$ (1 $\frac{3}{4}$ -in.) oak. Drill attachment holes to accept the pillow blocks (ours had 3 $\frac{1}{2}$ -in. centers). Industrial-grade blocks have a floating or self-aligning bearing which allows you to mount them parallel to the rails. You can substitute a less expensive block supplied by Sears (No. GT 27502 for $\frac{3}{8}$ -in.-dia. or GT 27503 for $\frac{3}{4}$ -in.-dia. shafts). You'll have to mount this unit skewed to the rails and perpendicular to the wheel since its bearings are fixed. Make sure you check the diameter of the wheel hole so that it is compatible with the shaft and blocks.

The leg assembly is made from $\frac{3}{4}$ -in. N.P.T. pipe and stock components. First grind the flats on all four flanges for a flush fit against the wood. Then assemble the structure as shown in the drawing. Final adjustments are made on the rail, wedge and bucket so wait to drill the mounting holes until the leg structure is built.

Determine the wheel hub size ($\frac{3}{8}$ or $\frac{3}{4}$ -in. dia.) and match a cold-rolled steel shaft, locking collars and blocks to it. Attach this group to the rails after the bucket has been installed so you can align the wheel and leave clearance at the lower front edge of the bucket.

Use carriage bolts, washers, lock-washers and nuts to fasten the rail-wedge assembly to the bucket. Then attach the front wheel unit and the pipe legs. Predrill holes in the bucket and attach the angle stiffener, then the nose-guard pieces. Make a careful check for wheel clearance. Finish by attaching the front support struts with stove-bolts. You can paint the bucket with an exterior semigloss prior to assembly and be sure to put a metal undercoating and finish coat of rust-resistant paint on all metal parts.

The fiberglass coating will protect the plywood for years of heavy-duty use.



Industrial-grade pillow blocks have a floating or self-aligning bearing that can mount in line with the oak rail.



A fixed-bearing pillow block is available from Sears. It must be mounted square to the wheel and therefore skew to the rail.



Coat the plywood with the resin mixture, apply the strips of fiberglass and then screed the mixture down smoothly.



COMPOST BOX

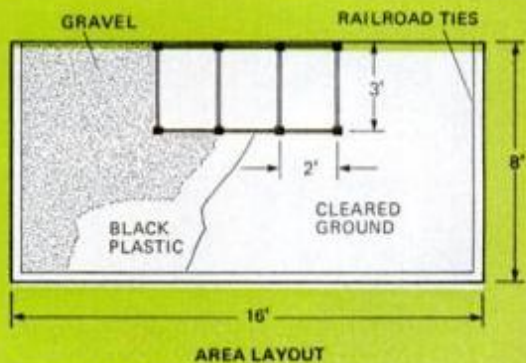
■ You can recycle the clippings and leaves from your yard by using this three-stage compost box. Lay out the area according to the plan and dig eight holes for the posts. Rent or borrow a post-hole digger to make this operation easier.

Cut the grooves in the posts (above grade only) so that the slats can slide

into place. If you cut the grooves with a router, make several passes to clear the slots thoroughly and soak the ends below grade with creosote, applying several coats, particularly to the end grain.

To keep equal distances between the posts, mark off the spaces on 1x2s (two for each side). As you set the posts in the ground, tack one 1x2 at ground level, plumb the posts carefully and tack another 1x2 across the top. Then repeat this procedure for the other side. Brace the four-post side sections to each other with 1x2s and then check the entire layout to make sure that it's both plumb and square. After you're certain it's correct, check it again because post alignment is critical.

As you fill in around the posts, tamp the earth down firmly with the end of a 2x4. Check the dimensions between the grooved posts once more before cutting the slats. We set up the box in a gravel bed. ★★★



A gravel bed surrounded by railroad ties adds a finishing touch to the compost box project and will help keep the area clean.

pots or wafers which can be set out as soon as the danger of frost has past.

Plot B is bordered with tall pole beans. Grow these on 6 or 7-foot poles spaced 2 feet apart. The tomato plants can be tied to trellises. Corn is sown in hills of four or five seeds each, or 8 to 12 inches apart in single rows. All three vegetables are tender and must not be above ground until the danger of frost is past. The beans and corn are sown directly into the garden and the tomatoes set out as plants, purchased or started indoors.

Head lettuce, onion sets or plants and cauliflower are hardy and can be planted early into Plot B.

Preparing the soil

With a fork, spade or shovel dig up and turn over the soil, breaking it up as fine as possible. Rake it smooth after it ceases to be sticky. Make a ball in your hand to test the soil. If it comes apart when you open your hand, the soil is ready to smooth. If it is heavy and sandy or claylike, humus must be added, preferably a 2-inch layer of peat, leafmold, compost or manure. The humus should be mixed in well with the soil.

Your garden will need fertilizer. Ask a garden supplier to recommend a fertilizer with the proper mixture of nutrients for the soil in your area. The amount usually used is 5 pounds per 100 square feet—7½ pounds for each plot. Work several pounds in when preparing the soil, and mix the balance in under the rows where the roots can readily

reach it at planting time. Later, during the growing season, hoe in about 1½ pounds parallel to the rows and a few inches from them once a month. If the soil is acid as proven by a soil test, work in 2 to 3 pounds of ground limestone per 100 square feet yearly for several years.

Planting and plant care

When planting the seeds, make rows 1 to 2 in. deep using the corner of the hoe for large seeds like corn and beans. Make rows ½ in. deep for small seeds like carrots and beets. Spread seeds thinly, cover lightly and tamp gently to firm the soil. If the soil is dry, water gently.

When plants appear, thin them and loosen the soil every week or two to prevent crusting, watering as needed. If the season is dry, you can cover the ground with a 1 to 2-inch mulch of grass clippings, buckwheat or ground corn cobs to retain moisture.

If pests appear, spray or dust as necessary, but not more than needed. Relatively safe materials like rotenone, malathion or Sevin are best.

Harvesting your bounty

For tender, flavorful vegetables, pick them while they're still young. Then use them as soon as possible.

In the fall, compost or destroy all garden waste promptly to prevent insects or diseases from wintering over to plague your garden next year. ★ ★ ★

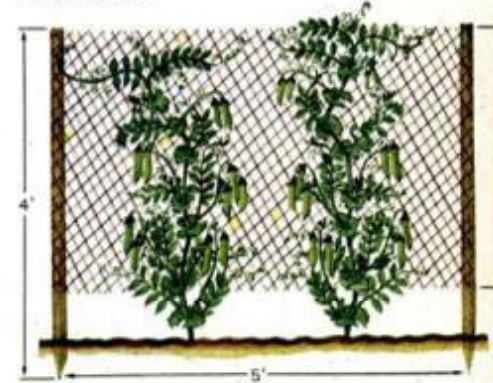
Author Edwin Steffek has written, edited or collaborated on some 36 horticultural books. In September 1975 he was appointed editor emeritus of *Horticulture* magazine, where he served as editor for 12 years.

Tomato trellis

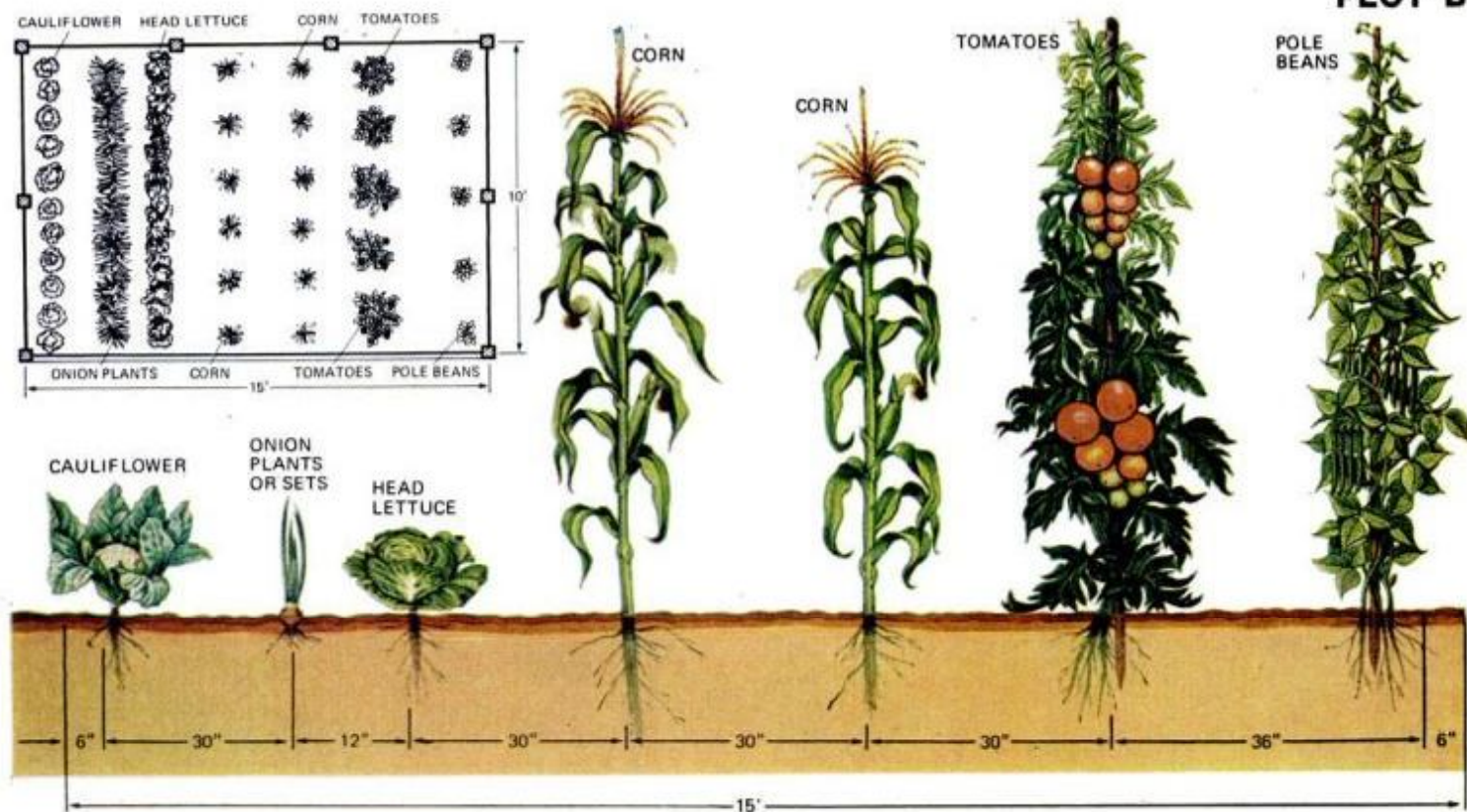


You can make a tomato trellis with three 4-foot-high stakes, 2 feet apart, and three cross slats nailed to the stakes. Paint will preserve it for years of use.

Pea wire



To make permanent pea wires, staple 3 feet of galvanized chicken wire to 4-foot-high stakes 5 feet apart. You can make a continuous wire as wide as your garden. Paint the wood to preserve it; roll it up at the end of the season for compact storage and reuse next year.



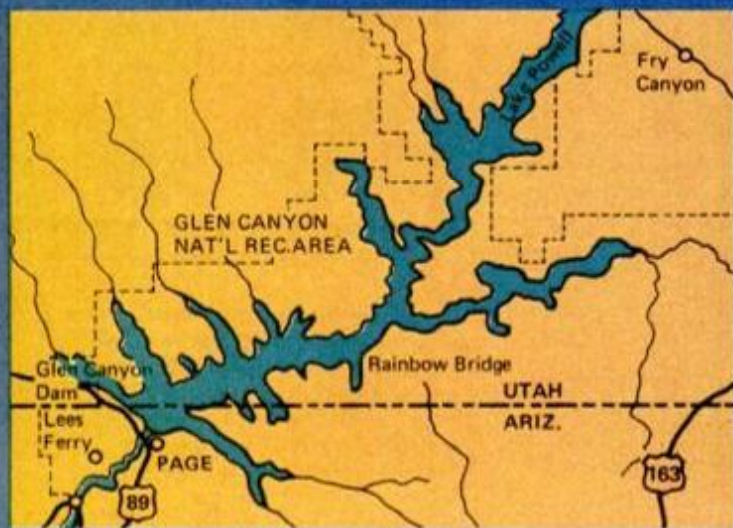
PLOT B

ON-THE-GO
CAMPING

Four-wheel drive for back-country boating

It takes an off-roader and an inflatable to explore some of the best adventure areas.

by Bill McKeown OUTDOORS EDITOR



Where the Colorado River fills Glen Canyon to form Lake Powell, a 4WD can cross the familiar western cattle guard (below) and follow the shoreline to remote launching spots and campsites.



Only 50 miles upriver from the depths of the Grand Canyon, the mighty Colorado broadens out into what has been called America's most spectacular lake. Here unmatched scenery waits to reward campers willing to try a new form of amphibious travel—a four-wheel-drive vehicle with an inflatable boat aboard.

Loading backpack and blowup boat into a Jeep, Blazer, Scout, Bronco, Ram Charger or Land Cruiser can be practiced anywhere there are suitable back-country trails and water. We have four-wheeled and paddled Connecticut's Housatonic, the Androscoggin and Merrymeeting Bay in Maine, salty waters of Florida's Everglades, and crystal lakes in northern Minnesota and Colorado. Gear for each is similar, but the red cliffs and canyons edging Lake Powell's 1900 miles of Arizona



Over yonder can mean almost anywhere a 4WD and pack raft can take a backpacker exploring country above Grand Canyon.



Inflated and ready for rougher waters, a kayak can ride in the back of a 4WD or be pumped up at the launch site.



PM photos: Lorraine McKeown

and Utah shoreline demand a camera and color film as well.

Exploration can be based at comfortable Wahweap Lodge, across Glen Canyon Dam from Page, Ariz., or at one of the public or private campgrounds of the Glen Canyon National Recreational Area. Regularly scheduled boat trips from the lodge up to the Rainbow Bridge National Monument provide a preview of the boating and fishing waters, and rental houseboats and cruisers are available at the Wahweap Marina.

Scouting trip for a start

But for an introduction to the desert trails, a scouting trip in a four-wheel-drive from Overland Tours at the Wahweap Lodge is the best way to start. In a Chevy Scottsdale Suburban, Walter Bieseker of Canyon Tours helped scout shoreline

campsites and launching spots, pointed out a remote, hidden ghost town where a number of Western movies have been filmed, indicated mountain landmarks that were sacred to centuries of Navahos before the white men came.

Even on the open prairies of the West, it is important to learn where off-road vehicles can travel without damaging the landscape, and where it is safe to drive. Even a 4WD can bog down in quicksand, hang up while crossing boulders or run out of gas many miles from help and shade. The drive-float system may take a camper far enough from civilization so that survival skills may be tested.

The ideal boat for four-wheel portaging needs to be light but rugged, easy and quick to inflate and deflate, simple to paddle and maneuver in fast water, safe and reasonably dry.

Carrying capacity should handle the weight of a large adult plus a well-stocked backpack. On Lake Powell we tested a yellow Pack Raft and a Pyrawa inflatable orange canoe. The Pack Raft is smaller, lighter and is fine for fishing near shore. Fitting aboard and rowing is easiest while wearing your pack.

The larger 10-foot Pyrawa can carry two or stow a pack behind a center seat. With a double-bladed paddle, it is faster and easier to maneuver. Both rode choppy water well and were light and easy to pull ashore for overnight camping.

Accessories should include an approved life jacket, charts of the local waters, and watertight stow bags for clothing inside the backpack plus the sleeping bag. Extra vehicle equipment might include a front bumper winch to help haul your rig out if stuck in soft ground. ★★★



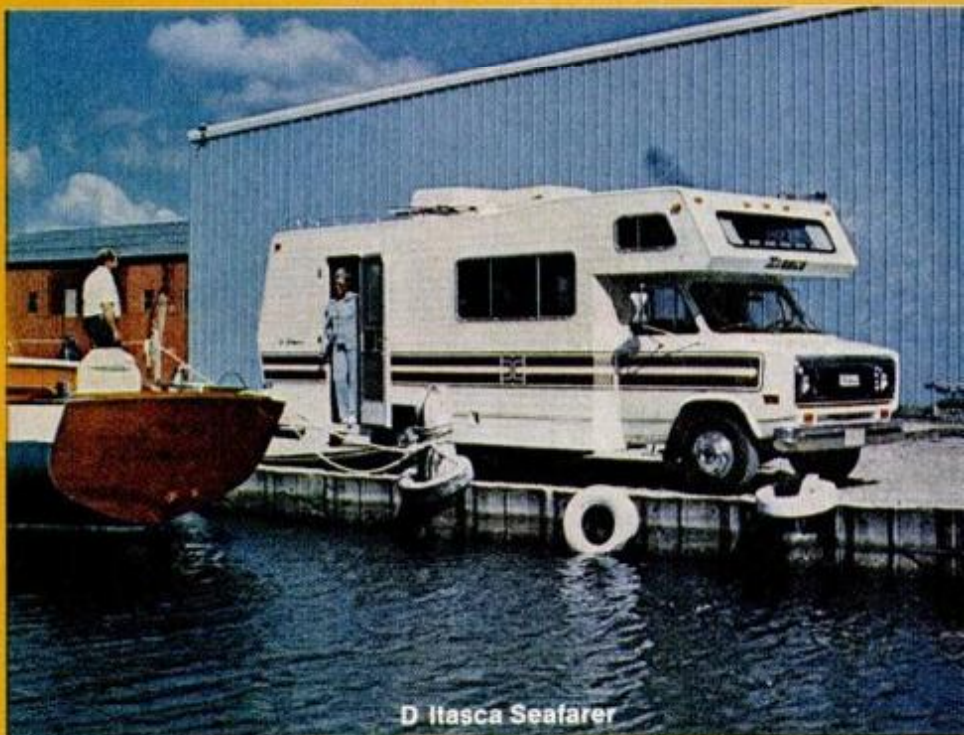
A Winnebago Minnie Winnie



B Coachmen Regency motor home



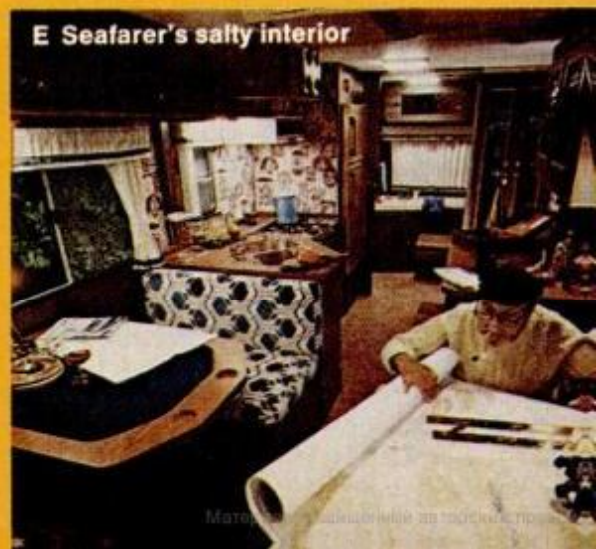
C Holiday Rambler T-27 tandem axle



D Itasca Seafarer



F Matching tow-van club car
Holiday Rambler Presidential trailer



E Seafarer's salty interior

More information available on motorhome trip

ON-THE-GO
CAMPING

New on-the-go gear for camping

This year, look for many more recreation vehicles, and many that are really different. Focus on the highways and you'll see that the RV boom is back, with new camp-car trends and equipment. Never mind recession and fuel prices, threat of gas shortage and high costs for everything—present predictions are that sales of RVs this season are going up 30 percent.

If your choice of a new rig is influenced by what others have found they like the most, here's what you might pick now according to present trends. Last year during the touring season, 136,900 travel trailers were sold, much more than any other category and up 32 percent over the previous year. Leader in the popularity parade, however, is the Type C motor home with 59,000 sold—up 95 percent in sales in just one year. This is the so-called chopped van mini-motor home—built on a van chassis with all the body except the cab trimmed off, and selling for about \$7500 to \$15,000. Next were the big conventional Type A motor homes that can

Smaller motor homes with larger choices in accommodations are growing fastest in popularity. Called chopped-van mini-motor homes in the industry, these versatile rigs—like the Winnebago Minni Winnie for sportsmen, the Itasca Seafarer with nautical decor, and even the Holiday Rambler T-27 tandem-axle 27-footer at left—all provide compact self-contained facilities and reasonable gas mileage. Bathtubs and microwave ovens are even available in some units. The Holiday T-27 is said to have an improved ride and handling for a lighter unit by using a MOR/ryde solid-rubber spring rear suspension. Larger models include new 29-foot Coachmen Regency motor home and 32-foot Holiday Rambler Imperial Limited travel trailer. Travel/tow van for it is a "club car" conversion of a Ford window van with exterior and interior styling trim by Holiday to match the trailer in tow.

PM'S PAINT-JOB PHOTO CONTEST

Do you have a rig that's as imaginatively decorated as the van at right? Or maybe yours is even better?

Send us a photo, preferably a color transparency or print, with your name and address on the back. Include a stamped, self-addressed envelope if you want it returned.

If your pride-and-joy is one of the six best, you win \$100. The six winners will appear in August PM. Entries must be received by May 1, and will be judged by the Popular Mechanics staff.

Mail photos to:

Paint Job Photo Contest
Popular Mechanics
224 West 57th St.
New York, N.Y. 10019



A winning deal is claimed for customized Chevy van with deck-of-cards decor and an interior fitted for parties or camping.



Sleek style for practical pickup, Ford's latest Ranchero is powered with 302 V8, has looks like a lavish sedan but carries the load of a small truck. Cap covers are available.



Tow van designed to match the trailer behind it, the Coachmen Ford Travel Van provides comfortable seating during trip plus accommodations to supplement trailer.



Full headroom without an oversize look, the new Xplorer 307 Xtrava arranges over 6-foot headroom, comfortable sleeping, as at left, for up to seven for \$30,000.

cost \$10,000 to \$35,000 (or more). Last year sales were up 54 percent with 35,800 sold.

Then came van conversion (Type B) motor homes that sell from \$6000 to \$11,000. These were up 48 percent with 28,000 sold.

The big fifth-wheel trailers were up 30 percent in sales with 16,000 sold. Camping trailers that unfold to set up were 14 percent at 44,000 sales. The only group to show less growth than the previous year was the pickup truck camper, down 14 percent below last year with 34,000 sales for the slide-in rig. The industry doesn't keep the same kind of figures for the little covers with windows that fit into the cargo box of pickups, usually level with the top of the driver's cab. Over 200,000 were sold in '76 for about \$250 to \$1000, many to sportsmen who want a quick, easy and cheap way to turn a work vehicle into a rig for hunting and fishing, with room for sitting headroom, a couple bunks, and sometimes a stove and sink inside. Call them caps, shells, covers or toppers, they offer fast shelter for back-road and off-road sports.

All recreation vehicles are carrying more and better conveniences aboard. Even the mini motor homes mount a bathtub in some models, and new rooftop air conditioners, sometimes powered by auxiliary generators, are being added. Notable on new RVs in all sizes are larger windows and brighter, more simple decor. Awnings roll out from the side to offer shade, dropped floors in some vehicles add to the headroom, and butcher-block countertops give a useful modern touch.

Microwave ovens are a cooking ex-



Newest Apache comes with a motor as well as solid sides. Noted for solid-state camping trailers, new Vesely Apache and Empire mini motor homes are 20 to 23 ft.



Titan Bantam is the new micro mini from Champion Home Builders. Only 17 feet long, the unit is planned as a second car in camping, party van and wagon models.



Ultimate camper? The Heli-Home helicopter conversion from the Itasca Div. of Winnebago may be the last word in luxury camp travel, and all for a \$300,000.

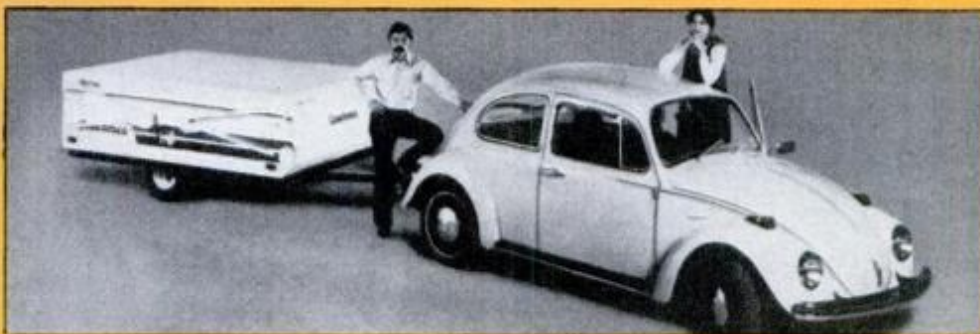




Extra seating in a pickup without a cap cover is possible with the Kid-Napper from Kid-Nappers Manufacturing, Alliance, Neb., for a 27-inch unit at \$424.



Can cap covers be classy? Winnebago gives its answer within a Super Truck from its Kap Div. Package includes pickup cover, windows, spoilers, air scoops, boot, carpeting and interior mirrors, lights.



Small tent camper to match small cars, the new Sun Puppy trailer from Coachmen Industries is a 14-footer with 800-lb. axle weight which allows towing by subcompacts.



Four-wheel-drive camping is easier with Chevy Blazer Chalet rig that sleeps four.



Motorcycles and mini-cars can trail the \$945 four-sleeper from Time Out Corp. They also make an even smaller \$745 230-lb. 3x5 foot two-sleeper just for motorcycles.



Testing a Tioga

For a family test of Fleetwood's Tioga motor home, we decided to explore what may be the country's most scenic proving ground—Utah and surrounding states.

Driving east from Los Angeles, we first stopped at Camperland behind the Sahara Hotel of Nevada's neon oasis, Las Vegas. Then, on across the desert to Zion National Park in Utah, we found at once that the Tioga rolled comfortably over long miles and that the airconditioner could handle the heat of dessert canyons. For sons Matt, 10, and Mark, 11, the cabover bunk was just right for nights and travel naps.

Stops at the Grand Canyon, Bryce, Otter Creek Lake, Flaming Gorge and fishing spots between showed the little Tioga had big livability.—Bruno Michetti



Camping trailers are offering new styling and options. The Viking (above) comes in lengths of 14 to 21 feet with variety of floor plans, options for sleeping eight, three-way refrigerator, a furnace, boat rack. Glasstite (right) now makes new Toyota toppers.



ON-THE-GO CAMPING

tra in larger rigs, and big motor homes like Vogue feature a bar with built-in TV, or a wine cabinet and laundry corner with washing machine and drier that we spotted in a new Flagship-35. A Heritage Park model had living room and bedroom pull out sections for luxury living when the trailer is set up for a month or so at a summer or winter resort. Many models make living easy for a retired couple, but few of this year's travel trailers and motor homes that we previewed seemed to make allowance for aging owners who might find wider aisles with room for a walker-aid or wheel chair a bonus convenience.

Particular credit should go to Bud Coons, innovative president of Coons Manufacturing, maker of the Diamond RV line. The new Scentry Gas Vapor Detector for motor homes which he developed with Aqua Meter Instruments is sensitive enough to warn of the presence of gasoline or butane fumes, carbon monoxide, sulfuric-acid battery fumes or smoke. The unit will be standard equipment on his 22 and 19-foot Diamonds and optional for the 17-foot Micro-Mini-home.

RV shoppers should find the Starcraft Travel Star 240 that sleeps six of interest, and Starcraft tent trailers with pressure water systems for built-in shower that also feature an emergency exit. Bright decor of the Cobra Caravelle 17.5 also deserves attention. Note the International diesel Scout II with tent extension or Ayr-Way shell covers as the probable start of a trend. Chevy's Cheyenne 4WD pickup even has a convertib'e cap cover. Holiday Rambler knows how to decorate with mirrors to help make a rig feel roomy. AMF Skamper's SK 072S and 100S increase truck camper space with a pop-up rig.

Though jazzed-up vans with timbered ceilings, fake fireplaces and recessed lights will still be much in evidence this year, Robert Honke, Ford's noted RV sales manager, points out the van popularity is expanding to what he calls MPVs—multipurpose vehicles with windowed sides and interior fittings to make them popular for all the family. ★★

And to take along . . .

New highway camping accessories range from add-ons and appliances usually installed on RVs by the builder to useful personal extras to stow aboard. Power to operate added air-conditioners, electric ranges and heaters can be provided by new more compact and quiet auxiliary generators from Kohler and Onan. The RV Products Div. of the Coleman Co. is introducing seven new mini-under-counter RV furnaces, plus a 12-volt self-priming water pump said to be notably quieter and capable of delivering water to a number of outlets simultaneously.

Add-ons include awnings of various forms to be attached at the campsite or permanently mounted to the RV. Some feature zip-on sides which enclose the shaded area into a screen-protected room.

Considerable gear for backpacking, boating, hunting fishing and picnicking can also be carried along. Thermos, for example, has a new Sun Packer cooler with a flip-over top that becomes a fitted serving tray.

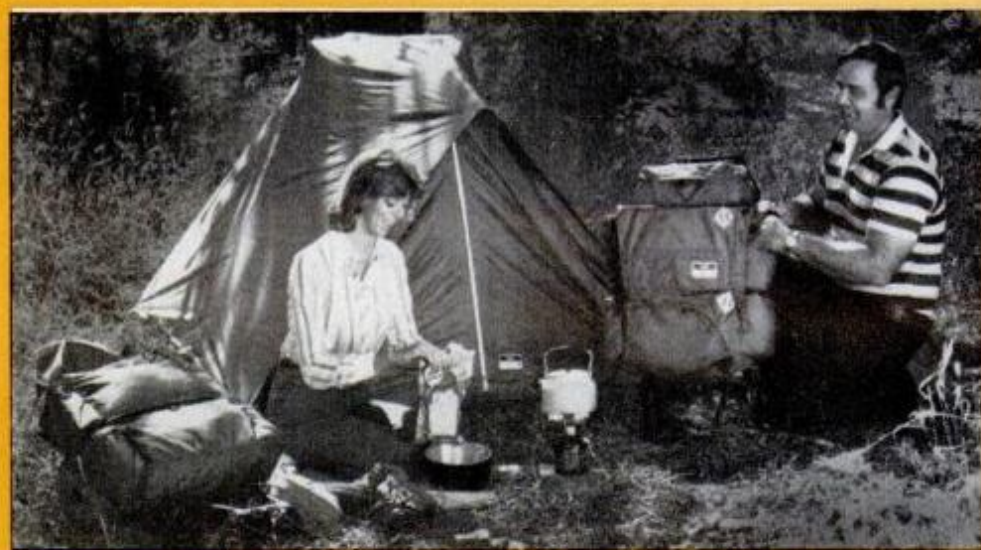
"Roughing it" this year is only optional, since most comforts of home can now be packed up and brought along.



Soft touch for a heavy sleeper, the new Air Lift multichambered mattress slides in inflation tubes.



System sleeping is name Camp 7 uses for new bag that can be combined with Vapor Barrier liner and Polar Guard Pioneer shell outer cover.



New backpacking division of Coleman, Peak 1 has a clever flexible frame, back and day packs, sleeping bags, two-man and four-man pack tents and a compact pack stove.



Even awnings are being styled up by Carefree of Colorado. Firm's Indy Spoiler Awning mounts on the back of a van as an air foil and scoop but opens to offer camping shade.



The prettiest campsite we found on our trip was the New River Beach Provincial Campground, N.B. It overlooks the Bay of Fundy, where tidal rise and fall create one of the world's great spectacles.

Bunkhouse on wheels: A great way to go!

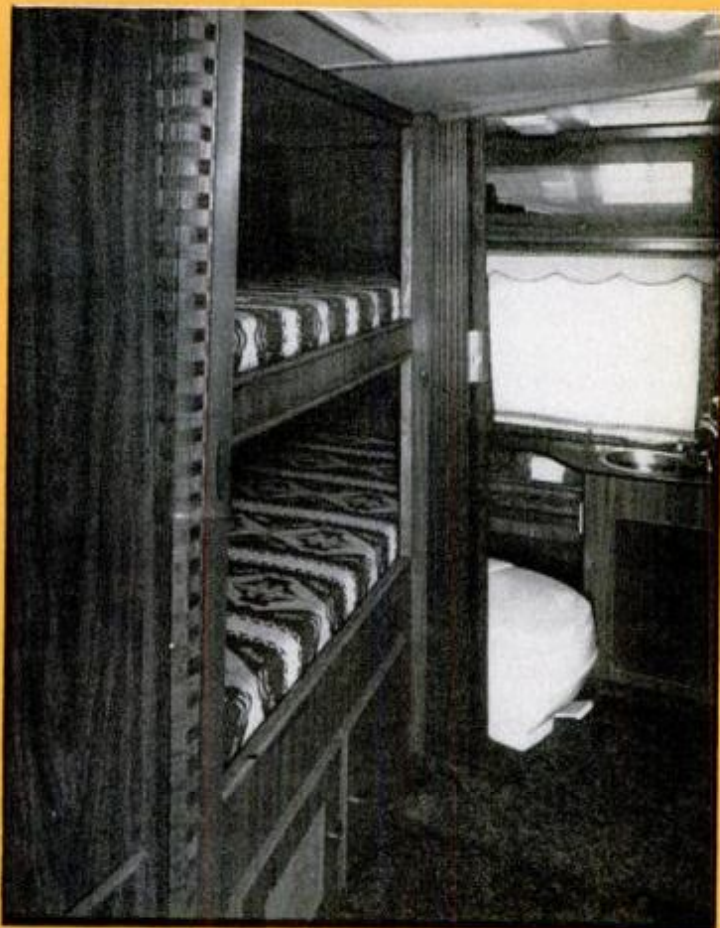
Twin bunks stacked in the right rear quarter of the 1977 Fleetwood Tioga Model L give the rig its nickname—Bunkhouse—and make it one of the handiest RVs for camping with the kids that we've seen in a long time.

My wife and I took the new Tioga—actually the first Bunkhouse model off the production line—on a 2000-mile trip from Connecticut to Prince Edward Island, Canada. One youngster, with us for part of the trip, helped prove the worth of the always-ready bunks by sacking out for his entire ride.

Driving this popular "chopped van" type of motor home surprised me. I had seen lots of various makes and always felt they had a sort of overloaded look. But on this first-time drive, I found the Tioga was responsive, braked exceedingly well and rode with great comfort over some fairly rough paving. It did, however, take me a few hours (and a couple of bounces off curbs when I turned too tight) to remember that the camper body sticks out about nine inches on each side behind the driver's field of vision.

The Tioga interior is handsomely finished and has lots of storage—drawers, closets, and compartments (and more compartments outside). There aren't any dark corners inside when you're in a campground; overhead lights are everywhere. And the windows are equipped with blinds so you can have complete privacy.

The Model L is on a Dodge Sportsman van chassis equipped with a 360-cu.-in. V8, automatic transmission, power steering and power brakes. Its overall length is 22½ feet; width, just an inch under 8 feet; and gross weight rating, 10,500 pounds. We found we averaged 8.53 mpg on the trip which included a couple days of strong headwinds.—*John A. Linkletter, Editor*



In addition to these two permanent bunks, there's a double cabover slider bed plus a dinette conversion for two.



Leave the highway to head for the hills—and your tires have to take on every kind of terrain and still provide traction.



Guide to off-road rubber

by Mort Schultz

Tires for vehicles that travel off-road are better than ever, but for best results you have to choose the right ones.

The optimum tire—one that works equally well on snow, rocky terrain, sand, mud and highways—“hasn’t been made yet,” says Dick Cepek of South Gate, Calif. Dick should know—he owns one of the largest of off-road tire companies, supplies the local beach and Baja buffs, and sends mail-order tires all over the world as well.

Cepek suggests buying the best compromise tire you can—“The one that fits your needs most of the time. Or buy two or three sets of tires so you can match the set to the terrain.”

But since two or three sets could cost you up to \$1000, let’s talk *one* set and “compromise.”

Unlike most heavy recreational vehicles equipped with truck tires, pickups and vans usually come factory-equipped with passenger-car tires. If you use your truck or van for light loads on paved roads, they should be adequate. When you haul heavy loads and/or take your vehicle off-pavement, however, you need truck tires to get traction in snow or flotation in sand, impact resistance on rocks and through ruts, adequate load-carrying capacity and general overall maximum life.

Tire terms

■ **Traction** is the ability of a tire to overcome the resistance of the surface, thereby developing sufficient force to permit motion. We use the term in reference to driving on snow in particular. No tire provides good traction on ice, although in some cases studs help. Your best bet on ice is a set of tire chains.

■ **Flotation** refers to the tire’s ability to overcome the effects of sand and mud, minimizing penetration and compaction.

■ **Load-carrying capacity** is the load a particular size tire can handle at a given inflation pressure.

What to look for

Selection of our best compromise is going to be influenced by three important factors:

■ **Tire construction** for trucks and passenger cars is basically the same. There is bias construction (cheapest), belted-bias (better but more expensive) or radial (best but most expensive).

The bias tire has plies on top of one another in alternating directions, running on the bias from bead to bead. Plies are layers of fabric that make up the cord body.

A belted-bias tire is a bias tire with belts (normally glass fiber) added that encircle the circumference beneath the tread. Belts provide extra strength plus greater impact and puncture resistance. They also stabilize the tread area so it grips the surface more firmly, reduces tread squirm and increases tread life.

Radial body plies run in a straight line from bead to bead. Two or more belts, usually steel, are added. Radials give the greatest impact resistance, best tire mileage, quickest steering response, best cornering control and highest fuel savings.

So which should you choose?

1. If you are carrying heavy loads primarily on paved roads and want the least expensive tire, though with more limited life, buy bias.

2. If you are doing an equal amount of off-road and highway driving and want to save money for moderate tire life, buy belted-bias.

3. If you are doing mostly off-road driving and want the best heavy-duty tires, buy radials.

■ **Load range ratings** for truck tires are B, C, D, E, F and G. Load range is the same as ply rating but is a more modern designation.

(Truck-tire ratings start at B; the A rating applies only to passenger-car tires.)

Load range	ply rating
A	2
B	4
C	6
D	8
E	10
F	12
G	14

Load range identifies a tire’s load and inflation limits, not its comparative strength or weakness. Tires that can accept higher inflation pressures can take heavier loads. For example, some L78-15 tires have a B, C or D load range. The maximum inflation pressure that load range B can accept is 43 p.s.i. Inflated to 32, the tire can handle 1970 pounds. The L78-15 tire with C load range can be inflated to 36 p.s.i. maximum and accepts 2100 at this inflation. With a D load range,

(Please turn to page 186)

CONVENTIONAL AND TRACTION TRENDS



BIAS—BELTED-BIAS—RADIAL



Tread design and tire construction determine grip on ground, durability and cost. Traction design always has open edge ribs.

CATALYTIC HEATER FOR MORE WARMTH

Big motor homes come with furnaces for warmth when the engine heater is off. Vans and small camp rigs aren't that lucky, but it's easy to install a catalytic heater. The Therm'X Mark 2A, from Therm'X Corp., Box 268, Reedley, Calif. 93654, is thin enough to fit flush in a door panel and can be installed in one afternoon. Catalytic heaters work at temperatures far below those necessary to support flame-type combustion. Leaving a window slightly open provides necessary air.

Installation requires a sabre saw with metal-cutting blade and some quick-disconnect hardware which avoids any flexing problems of a permanent gas line. Trace the heater outline on a cardboard template or the door panel itself and sabre-cut the opening for the heater. Check for heater fit and drill a hole in the bottom of the door a few inches away from the cutout. Using Teflon pipe tape on threaded joints, secure the male fittings to the door and hook up for a test with a disposable propane bottle or larger tank. Soapy water on the joints will form bubbles to warn of gas leakage. Cover with a piece of paneling if desired. Heat should cost about 30 cents an hour from bottled gas, 4 cents from a refillable tank.—*Joseph P. Greeves*



Shape of heater is traced on pattern for marking and sabre-cutting the van door.



Quick-disconnect fittings make permanent gas line (and chance flexing) unneeded.

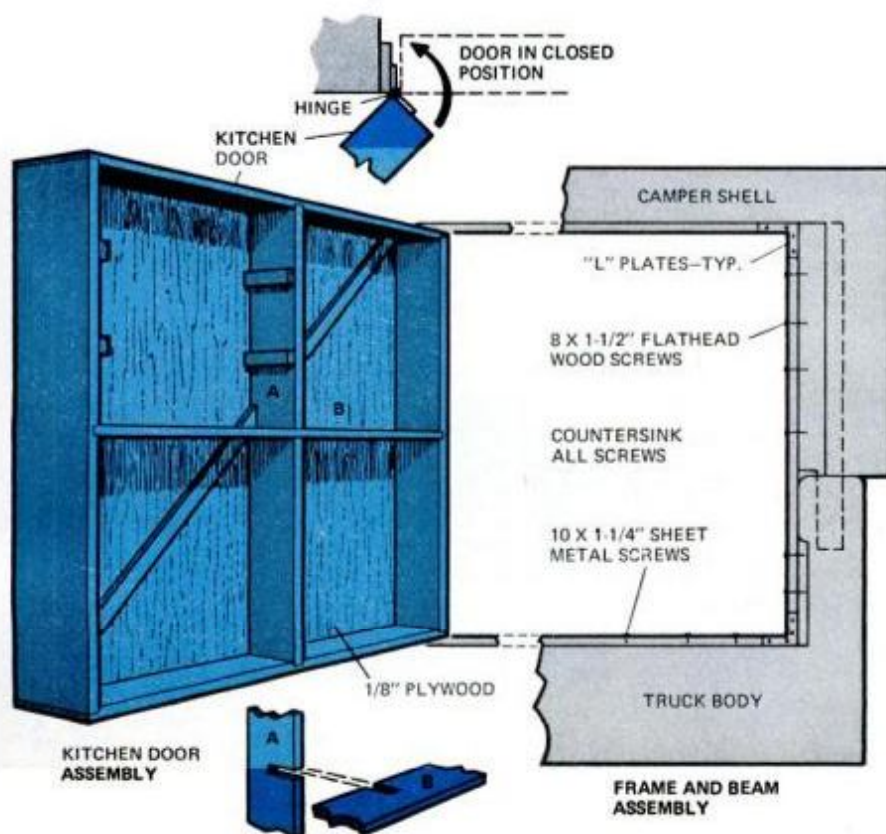


Balancing act allows hookup of lines and securing heater with sheet-metal screws.



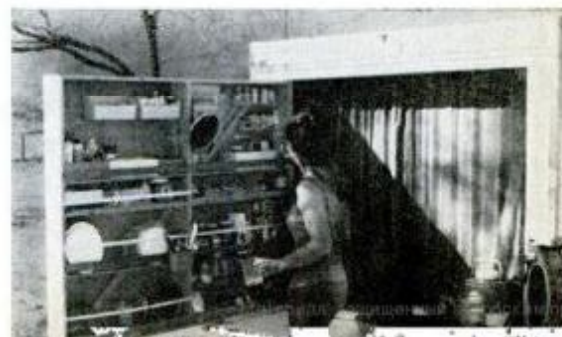
Installed heater, inset away from latches, can have panel covering when not in use.

Two built-ins for camper comfort



BACK-DOOR KITCHEN

Mount a storage door at the back of the camper shell enclosure in your pickup truck and there is no need to unpack every mealtime. With the stock door removed, notch pine or fir beams to fit into the rear stake holes. Then a frame of 1x4-inch pine is assembled and screwed to these supports and the truck bed. Some spacer blocks may be necessary. The door, built 1/2-inch narrower and 1/4-inch shorter than the frame, is of 1x6-inch pine backed with 1/8-inch plywood and hung with a piano hinge. The tailgate holds the door closed or drops to form a counter.—*Bud Tassano*



Comparing Buick's new Japanese Opel with the German original

A nationwide survey based on 1,224,567 owner-driven miles.

by Michael Lamm WEST COAST EDITOR

Photos by the author

General Motors bought a controlling interest in Adam Opel AG in the late 1920s and has run Opel ever since.

Opel, of course, builds cars in Germany, so it came as something of a surprise to many longtime Opel customers that in 1976, GM decided to substitute Japanese-built "Opels by Isuzu" (actually Isuzu Gemini coupes) for the German-made Opels that Buick dealers used to sell in this country.

Today, the only Opels brought into the United States are those from Japan. Apparently GM had little choice, though, because German Opels were becoming too expensive to qualify as economy imports. Reasons were rising labor costs in Germany plus several upward re-evaluations of the deutschemark against the dollar. It's been reported that GM lost about \$1000 on each German Opel sold by Buick dealers during 1975.

Now that Opels come from Japan instead of Germany, what do owners think of them?

Well, they're not especially bothered by the switch in nationality. We can't speak for people who refused to buy a Japanese "Opel,"

Engine and drivetrain are nearly identical to those in the Chevy Luv pickup; many parts interchange.

The abbreviated rear seat leaves it comfortable only for children and pets.

but 18.5 percent of our respondents had owned German-built Opels previously. Thus we can cite some comparisons.

A Wisconsin physician, for example, says, "I bought my first Opel in 1969, drove it for seven years, was very satisfied with its performance and durability. The workmanship of this Opel Isuzu is good but not quite up to the quality of the first one. The Japanese Opel, though, is a very comfortable two-passenger car, with fine gas mileage."

A California engineer: "I had an Opel before and was pleased with performance and service at the local Buick-Opel dealer. This [Japanese] car is comfortable, reliable, economical, and although better than comparable American-built cars, the room allowed for driver and passengers is quite limited."

A West Virginia speech clinician: "I was very pleased with the service my 1973 Opel Manta gave. I feel the new car's workmanship is good but inferior to previous Opel quality, yet far superior to other cars in its class."

An Iowa industrial engineer: "I've owned three previous Opels, and we presently have



five in the family. The Japanese Opel needs more weight in the rear end, and quality was better in the German Opels."

At that, Opel Isuzu owners gave their cars very high marks on workmanship: 48.7 percent rated is *good* and 35.5 percent *excellent*.

We asked owners to list their specific praises of the Opel Isuzu. The following represents a cross-sectional sampling.

"I like the way it handles," states a Michigan bookstore manager, "also the snappiness of the manual four-speed transmission. It gives you the feeling you control the car, not the other way around. Workmanship is excellent. Wheels from my previous German Opel Kadett fit the Opel Isuzu, so I bought seconds

The standard model, however, comes pretty bare-bones, with a limited choice of options. ▶

◀ Handling received much praise, and acceleration puts the Opel in the Rabbit's performance class.

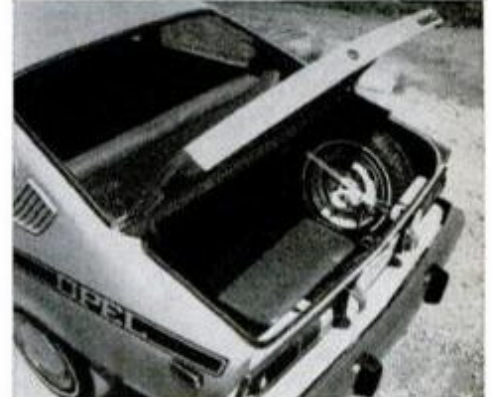
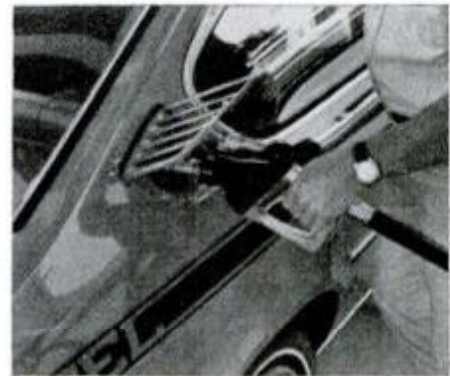
for snow tires. Trunk is very roomy for a small car, and I save two-thirds on gasoline per week compared to my Buick LeSabre."

An Illinois market analyst: "I'm impressed with the big-car feel in so small a car. The deluxe version is well appointed, and the price was surely right. The car is very tight—fit and finish are very good. I'm over six feet tall, and there's enough room in the front seat so there are still a few inches over my head; also the dash panel is positioned so I don't get claustrophobia."

A Louisiana treasury agent: "I find the car a pleasure to drive—good handling, good gas mileage, very smooth transmission, com-

(Please turn to page 185)

Opel by Isuzu is only in coupe body style. With front seats all way back, rear legroom suffers. Deluxe equipment includes console, tachometer instruments backed with warning lights. Four-speed manual trans comes standard, with Turbo Hydra-Matic optional. Continuously blowing vent system received some criticism.



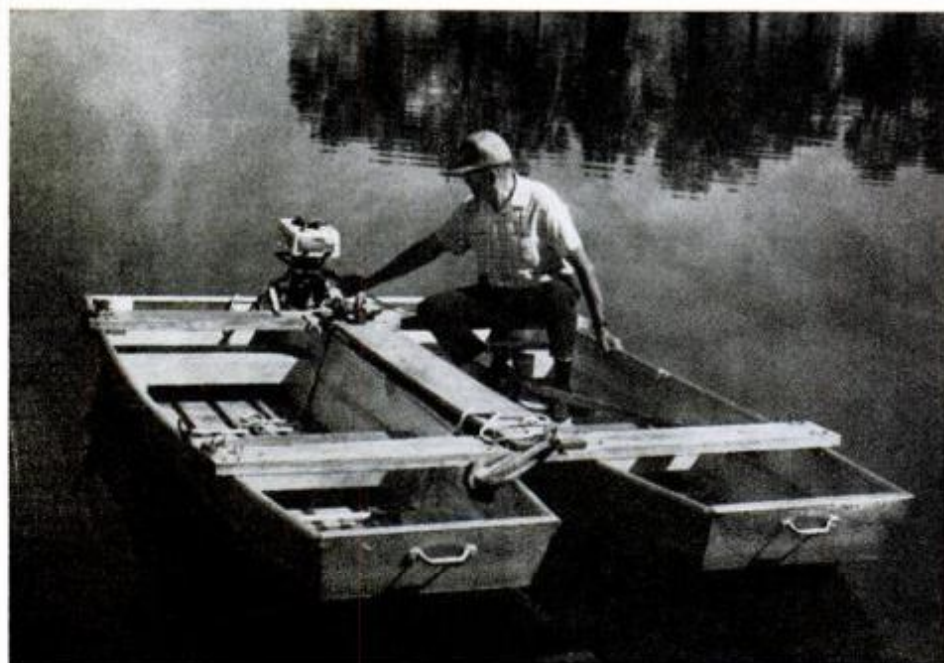
Deep, flat-floored trunk holds 12.7 cu. ft. of cargo. Sohc Four delivers 80 bhp; owners praise snappiness and economy. Mechanics like underhood work space.

Summary of 1977 Opel Isuzu Owners Reports*

Total miles driven 1,224,567	Trunk space16.9	Comfort opinion (rear seat):	Good29.2
Average miles per gallon:	Specific dislikes:	Excellent9.8%	Average14.2
In town (EPA, 23 manual)23.1	Rattles13.8%	Very good19.2	Fair10.2
Long trips (EPA, 36 manual)29.5	Dealer service13.0	Good24.7	Poor14.6
Transmissions:	Not enough legroom8.3	Fair27.5	
Four-speed manual62.6%	Poor vent system5.5	Poor18.8	Number of vehicles owned:
Three-speed automatic37.4	What changes would you like?	Had any mechanical trouble?	Opel Isuzu only38.9%
Tr'm level:	More legroom12.2%	No55.0%	Two cars43.3
Deluxe58.5%	Fewer rattles7.3	Yes45.0	Three cars14.9
Standard41.5	Better vent system6.9	What type of trouble?	Four cars2.2
Why did you choose Opel Isuzu?	Better materials4.5	Carburetor21.3%	Five or more cars0.7
Economy40.0%	Workmanship opinion:	Brakes12.3	Makes of other cars owned:
Styling20.7	Excellent35.5%	Electrical10.7	Buick34.5%
Price18.9	Good48.7	Transmission10.7	Chevrolet15.5
Size18.9	Average9.5	Oil leak9.0	Ford13.1
Owned Opels previously18.5	Fair5.1	D'4 you repair it yourself?	Volkswagen7.1
Specific likes:	Poor1.1	No95.1%	Age distribution of owners:
Engine54.9%	Comfort opinion (front seats):	Yes4.9	15-29 years47.8%
Handling45.4	Excellent36.0%	Dealer repairs satisfactory?	30-49 years30.0
Comfort23.5	Very good40.7	Yes52.9%	50-plus22.3
Styling23.1	Good16.7	No47.1	Would you buy another Opel Isuzu?
Performance17.3	Fair5.1	Dealer service opinion:	Yes72.9%
	Poor1.5	Excellent31.9%	No27.1

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

IT'S NEW NOW



'Fisherman' seats six, can't tip, runs on one engine

You can seat up to six fishermen in one vessel by lashing together a pair of 12-foot skiffs the way the Neuenschwanders did in Indiana. The boats are held together by a simple harness of two 2x6-inch crosspieces and one 1x8-inch plank fastened with U-bolts. The twin-hull craft is tip-proof, requires only one outboard.

Tree digger-baller-transporter

One man can dig up, ball and transport trees and shrubs, then replant them in another location—all automatically—with this power Tree Spade machine. The hydraulically operated unit, designed to be drawn behind a tractor, will handle trees with trunks up to 3 inches in diameter. Steel spades dig down to a depth of 26 inches to form a 30-inch-diameter ball, then the ball is lifted from the ground by hydraulic hoist and held in a cradle for carrying to a new site. Water feeds from built-in tanks to spray the soil and soften it for easier digging. Fingertip hydraulic levers directly behind the driver enable him to control all functions remotely. TS-30 3P is intended for use by tree farms, nurseries, landscapers. Vermeer Mfg. Co., Box F, Pella, Iowa 50219.

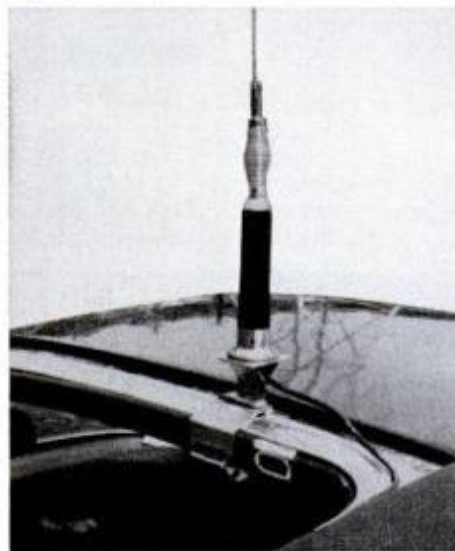


Snooperscopes for everyone

Want to see in the dark? Infrared scopes are now available for anyone (except Californians, unless authorized). Pistol-grip I.R. Eye (top) provides 1.6X magnification from 90 feet in the dark. A binocular-style Super I.R. Eye (bottom) gives a 2.5X image. The scopes have such uses as wildlife study at night and security surveillance. Pistol model is \$300; binocular, \$330. From Edmund Scientific, Barrington, N.J. 08007.

CB antenna for T-top Corvettes

Mounting a CB antenna on T-top cars can be a problem. This Vette-Tenna-T, made especially for use on T-top Corvettes, clamps to the center T-bar and in no way interferes with the fiberglass roof sections. The antenna, coated with zinc chromate for weather protection, is easily removed for low-overhead parking or to prevent theft. It is automatically grounded when properly installed. Deep South Marketing, 2828 Telephone Rd., Houston, Tex. 77023.



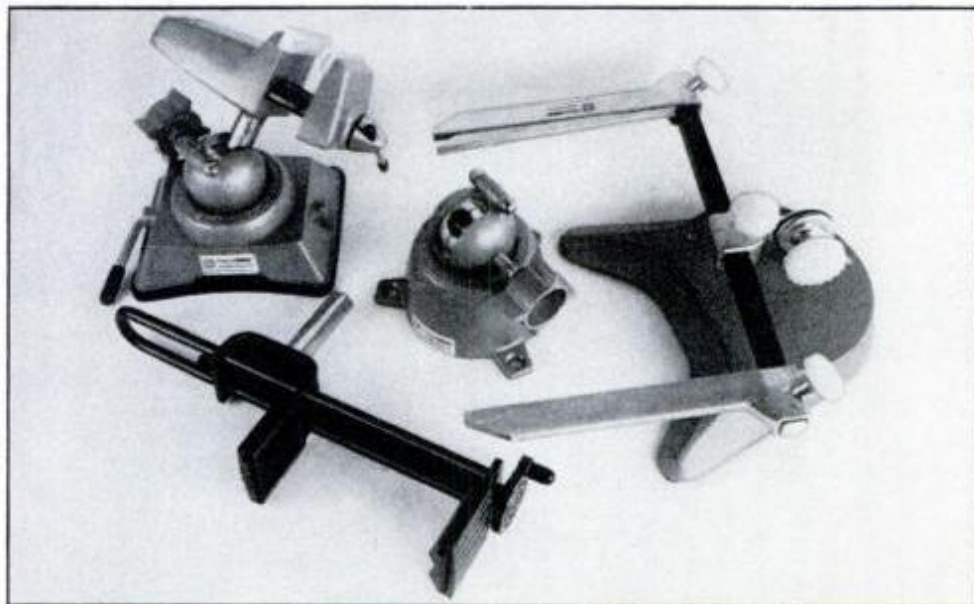
Ceilings with a 'natural' look

Wood-grained "plank" ceilings for do-it-yourselfers can be installed over dry-wall or plaster, open joists, or suspended to any height using a metal "Integrid" system. The fire-resistant panels come 4 feet long in three widths. Armstrong Cork Co., Lancaster, Pa. 17604.



New tools for your electronics workbench

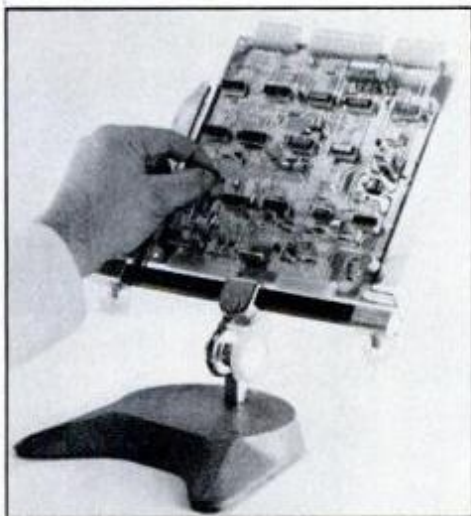
by Ivan Berger ELECTRONICS EDITOR



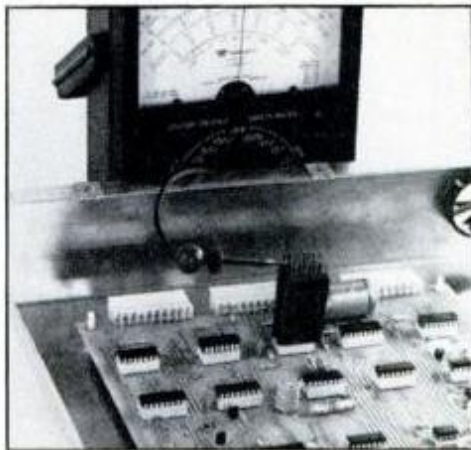
PanaVise system lets you interchange a variety of bases and holders to match the vise precisely to your job. Vacuum base shown is \$21 (plus \$10 for vise head); the bolt-on base is \$15 plus \$20 for the printed-circuit board holder; a crank-adjusting head for 6-inch objects has rubber jaws, costs \$12.



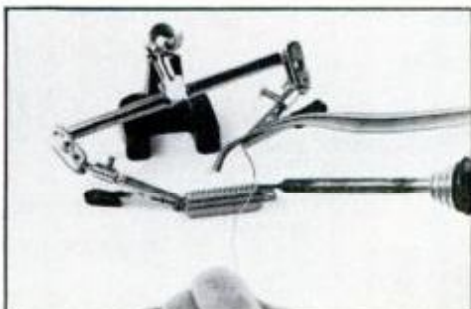
PC drill attachment turns the Wahl cordless soldering iron into a drill for component-lead holes in printed-circuit boards. The drill is priced at \$11 and irons range from \$25 to \$35.



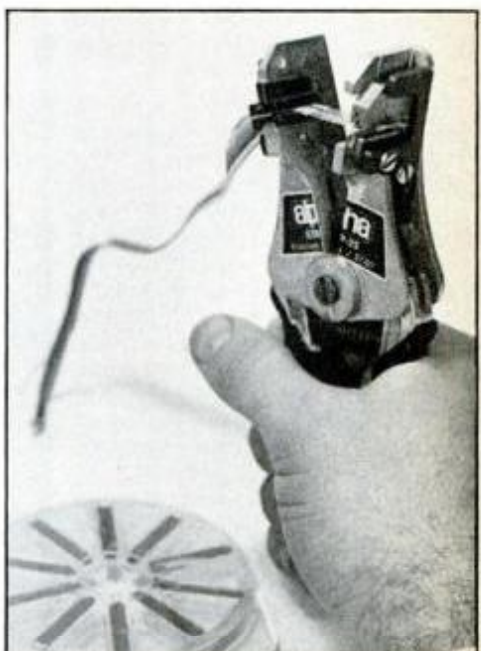
Circuit-board holder can be used with any PanaVise base, lets you place components on one side of the board (above), then flip the board over to solder the other side (top). You shine a light through the board in order to trace circuits more easily.



IC test clip (\$5 from Radio Shack) clips over leads of integrated circuits, lets you check voltages and waveforms easily at points on top of clip. EZ-Hooks on the ends of test leads clip firmly even over tiny wires and pins.



Third Hand (\$9 from Brookstone) holds plugs and wires, leaves your hands free to hold a soldering iron and solder.



Alpha wire stripper has soft plastic blades, won't nick fine wires, handles even this tricky, eight-conductor ribbon cable. As the blades wear down, they become useful only for the larger wires, but they are easily replaceable. The wire stripper, plus blades, is \$40.

How to wash your car

1

It takes more than a sponge and a bucket.

by Michael Lamm WEST COAST EDITOR

Basically, you've got three approaches to washing a car. You can: 1. Do it yourself with hose, sponge and shammy. 2. You can give it a lick at a coin-op car-wash. 3. Or you can let a commercial five-minute car-wash clean your car for you.

Simple choices, you say. Yes, but what's really the right way to shammy a car? Do you use a detergent in your wash water? Are you aware that some commercial car washes put a caustic into their wheel scrubbers? How do you come out on a 25-cent coin-op if you have to keep stuffing quarters into the meter? What's the difference between a "short-line" and a "long-line" commercial car wash? These are just a few of the questions that come up.

Wash it by hand

Hand car washing represents almost a lost art nowadays. Very few car owners even attempt it, and many who do don't know the best way. Done right, though, hand washing beats other methods—mechanical and semi-mechanical—in all ways, especially in terms of quality and gentleness to a car's finish. But if the job is done wrong, you're better off at a long-line mechanical car wash if you can find a really good one.

For a classical hand car wash, you need the following equipment: a deerskin shammy (a variation of the word *chamois*), access to a garden hose with adjustable spray nozzle, a five-gallon plastic or metal bucket, one large sponge, one plastic-mesh-encased small bug sponge, and some paper towels. A hand wringer comes in handy but isn't absolutely necessary.

A good shammy is all-important and holds the key to



1. Do-it-yourself with tender loving care—that's the best car wash you can get. Biggest investment is \$7 to \$10 for a good chamois (or shammy, as it's often spelled). Washing is done with a sponge and the shammy is used for the all-important job of drying the car. If you have no access to a garden hose, or if it's below freezing, you'll have to turn to the coin-op or commercial car wash.

2. The coin-op will give you several minutes of hot water under pressure for two bits. You will also get a protected area to work in. But if you dawdle, you'll wind up feeding the coin slot enough quarters to have gone to a commercial car wash.



2



3. Professional carwash can save you time and energy, and in winter it's a must, but make sure you pick an establishment that does a conscientious job. Avoid "short-line" washes (30 to 60 feet); they don't have enough sets of brushes, usually have no wheel scrubbers, no steam or water-pressure boost. Long-line washes (120 feet or more) have more brushes, more water for wash and rinse, and high-pressure water that's well heated. Also look for or ask for vacuuming, steam wand, whitewall scrubbers, clean brushes, as well as a final touchup toweling by one of the carwash personnel.

the entire wash job. Get one of ample size—six feet square or so. It'll cost \$7 to \$10, but if properly cleaned and dried after each use will easily last you 10 years or more. Towels, rags and synthetic shammies are no substitutes for the real thing.

You have to remember there are two crucial things about a shammy:

First, when you get a new one, you have to soak out the preservative oils before you use it. You soak it in a detergent solution, but be sure you rinse all the detergent back out. You never use household detergent or soap to hand-wash a car. These merely cut waxes and speed oxidation to dull paint. (Commercial carwashes use a special mild detergent, mostly to lubricate the surface of a car.)

Second—and this is the point most often missed—you *must* wring your shammy out virtually dry before you use it. This lets it absorb water from the surface of your car. And each time your shammy starts to get sappy, you have to wring it dry again.

To hand-wash a car correctly, follow these 10 steps:

- **Park your car in complete shade.** Direct sunlight tends to make water spots. Also, water droplets on paint act as tiny magnifying lenses and can burn blotches in your car's finish.
- **Shut all windows and doors,** once your car is shaded and cool. Then hose down the exterior thoroughly. Now fill your bucket (with warm water if it's wintertime), wet your large sponge in the bucket, and sponge the entire surface of your car. Keep dipping the sponge to keep it wet and clean. Go panel by panel, but start at the roof and work your way down. That way gravity carries the dirty water the same direction as you're sponging. Leave the rocker panels, wheels and tires for last. If you don't, your sponge and/or shammy might bring road oil and dirt up to the windows.
- **Once you've loosened all film and grime** by sponging, spray your car again to wash off the floating dirt. Once more, work your way down from the roof.
- **Spray a strong jet under all fenders** and under the chassis to get rid of mud and salt. Run your hand carefully up under fender beads to make sure you've flushed out all the mud and debris. Do the same behind bumpers and in body pockets where rust traditionally forms.
- **Using your bug sponge, remove stuck-on insects** from

your windshield, grille, hood and front bumper. Rinse with a powerful hose spray. *Note again that at no time should you use a soap, soapy cleaner or detergent when hand-washing your car.* Even those waxes that say they're detergent-proof aren't, and besides, there's no need to use soap. If your paint is dull, polish and wax it after you wash your car. That'll make subsequent washes that much easier.

- **To drain water from inside your car doors,** swing each door back and forth on its hinges. Don't let the door hit its full-open stop, but swing it briskly. You'll see water come out of the drain hole on the bottom of each door.

- **Now shammy your car.** Wet the shammy thoroughly, then wring it out as dry as possible. If you don't have a double-roller wringer, it often helps to loop your shammy around a firm stanchion or through a door handle so you can twist harder. You want to start with a shammy that's virtually dry (never with one that's totally dry).

- **Open the shammy flat,** grip it by two corners, and flop it on top of your car's roof, pulling it toward you in big swipes. The roof will now be dry where you've shammyed it. As the shammy absorbs water and gets wet, wring it out again (and again and again—it's a process you have to repeat throughout your wash job).

- **Next do all windows, inside and out.** You want to shammy your glass before your shammy picks up dirt and oil from the lower body. Use paper towels to remove any streaks that show up on window glass.

- **Finally, shammy chrome,** then hood, decklid, fenders, doors, door jambs, interior and wheelcovers, in that order. And keep wringing out your shammy. You might also wash it in your bucket once or twice during the wash, especially if there's still dirt on the car's surface. Remember, you can't wring too often or too much.

Coin-op car washes

At times, coin-operated car washes make good sense, especially for apartment dwellers and RV owners.

Basically, each 25 cents in the meter gives you two to four minutes of water from an adjustable pressure wand. You also have shade. For additional quarters, you can usually rent a vacuum nozzle and, more rarely, hot

Take your pick of the '77 mowers

Here's a look at the '77 models.
Use PM's guide to pick the mower
with the features you want.

by Mort Schultz



You have a bigger choice of power mowers to pick from than ever before. While some machines remain basically unchanged, many manufacturers are broadening their lines for '77 to offer a wider range of models at different price levels. Many are adding new features and refinements, too.

One important trend is toward more and better safety devices that work well, are easy to use and do their job of protecting you without getting in your way. On many mowers, as you grab the handle you activate a switch by rotating the handle on some models or grasping a thin secondary handle on others. If for some reason you stumble or lose your grip, the mower will automatically shut off as you let go. These common-sense devices should eliminate a major cause of mower-related injuries—runaway machines.

Here's what you'll find when you're shopping for a push mower or riding mower this year.



AMF

AMF is introducing a really new model in '77—the 1299 self-propelled rotary unit. It becomes AMF's top-of-the-line walk-behind model and fills a gap for a fully equipped mower in the \$250 price range that has already been filled by other manufacturers.

The 1200 is equipped with a 4-hp Briggs and Stratton four-cycle, manual-start engine. The machine cuts a 20-inch swath and has five different speeds for varying grass conditions, and "fast start" and "slow stop" speeds.

Other features include a dashboard-type control panel, a blade that flexes when it hits a hard object, an engine shroud that dampens noise and a choice between side or rear discharge for the clippings.

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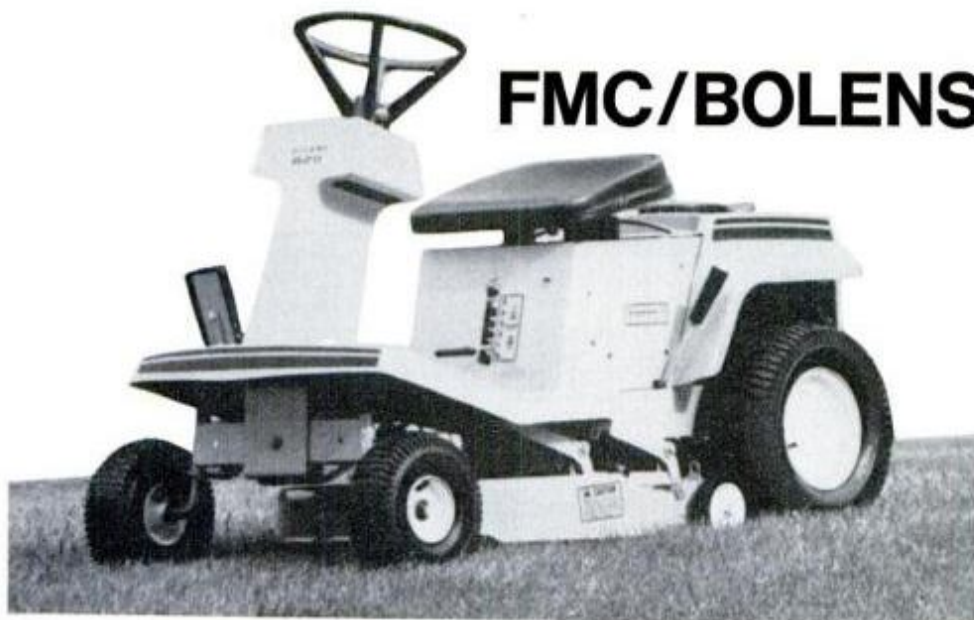


ARIENS

"While Ariens has not introduced new features with the 1977 riding mower line, there is a particular emphasis on the rear grass bagger attachment for all Emperor and 7-hp Fairway riding mowers," a company spokesman states.

The rear grass bagger has a plastic hopper which holds two stan-

dard 20-gallon garbage bags. It's mounted on a tubular frame attached to the rear of the mower. A polyethylene tube extends between the chute and hopper. Clippings drawn into the hopper are evenly distributed between the two garbage bags. Prices, not factory-established, may vary somewhat in different localities.



FMC/BOLENS

This company is emphasizing the fact that their mowers mulch the grass. Although this feature was introduced four years ago, it's still a noteworthy idea.

A multi-pitch rotary blade and a cutting chamber that creates suction lift clippings to allow cutting and recutting into a fine mulch which decomposes, adding nutrients to the soil. You won't find a discharge chute or grass bag on a FMC/Bolens mower.

Every one of the company's walk-

ing machines uses the mulching principle. This includes the 18-inch and 22-inch hand-propelled mowers (both with 3.5-hp engines), which have a retail price of \$165 and \$200, respectively. On the Model 22 we found the extra safety handle easy to use. If the mower gets away from you the handle is released and cuts off the engine.

The 828 rider has a recoil starter and is retail-priced at \$785. The 829 rider, which is the same machine with electric starting, is \$895.



JOHN DEERE

There have been a few changes made to the Deere line of riding mowers for 1977. Most are minor modifications, such as repositioning the transmission control handle. On their rear grass bagger attachment, Deere has cut a plastic window so the operator can see how full the bag is.

Deere makes three riding mower models. The 66 is equipped with a 6-hp Tecumseh engine and a 30-inch single-bladed mower. It has a suggested retail price of \$825.

The model 68 with 30-inch single-bladed mower has a Briggs and Stratton 8-hp engine and a retail price of \$950. The Model 68 with 34-inch twin-bladed mower sells for \$995.

Deere is the only company I've come across that makes an electric riding mower. It has been on the market since 1975 and has a retail price of \$895.

The Model 96 is powered by 12-volt batteries which are charged by plugging the charger cord into an a.c. household outlet. It takes 12 hours to attain full charge—five hours to attain an 80-percent charge. Fully charged, the batteries run the mower for 1½ hours—about enough time to cut an acre.

The 96 electric riding mower has a four-speed transmission (three forward speeds and one reverse), cuts a 34-inch swath and is a quiet-running machine.

GRAVELY

This new design is a walk-behind power unit but with the hefty looks, power and capacity of a tractor-driven mower. Gravely's 30-inch rotary mower attachment has redesigned fenders for faster discharging of grass and a front roller that prevents lawn scalping. The

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price of the mower itself is \$288 (FOB, Clemmons, N.C.). The power unit costs about \$1250.

Gravely's walk-behind convertible tractors (there are seven models) accept the mowing unit, sweepers, spreaders and other attachments.

These are machines for people with large areas to service. Machines made by Gravely and their competitors—John Deere, IHC and Allis-Chalmers—are among the most durable made and should last a lifetime.



HAHN

Tell you two things I liked about Hahn's three top-of-the-line self-propelled mowers (Models 833, 841 and 842). One is the safety handle that must be squeezed for the blade to operate. If the handle is released even slightly, the blade stops. The other Hahn innovation is a flexible deflector across the rear of the machine that resembles a weather-stripping seal made for door bottoms. The deflector stops any object that may be thrown to the rear by the blade.

JACOBSEN

Jacobsen will try to make a big dent in the walk-behind mower market in '77 by adding six new models. The three models classified as Twin-Blade Mulchers cut and recut clippings to eliminate raking and to add natural nutrients back into the soil.

They are equipped with what Jacobsen calls Power Burst. When you push on the auxiliary control bar, an increase in engine rpm takes place that increases blade speed, helping to prevent stalls in tall or wet grass.



Suggested retail prices are: 20-inch push model, \$220; 20-inch self-propelled model with recoil start, \$290; and 20-inch self-propelled model with key start, \$340.

Another category of Jacobsen machines is the Super Bagger. These are rear-bagging models that can scoop up three bushels of grass before the polyester bag needs emptying. Prices are: 21-inch push model, \$220; 21-inch self-propelled model with recoil start, \$300; 21-inch self-propelled model with key start, \$350.

All Jacobsen self-propelled mowers have a twist-grip safety handle. The handle is twisted to begin forward power and let go to stop.

As for Jacobsen's six riding mower models (price range: \$610 to \$850), I especially liked the Pace Command feature that does away with manual shifting. A single foot control has two pedals. Pushing down the forward pedal gives forward movement and speed control. Pressing down on the rear pedal gives reverse movement.

Jacobsen is one of the few manufacturers to offer a self-propelled rear mower. The 18-inch model sells for \$280; the 21-inch, \$300. That's really going for all market segments.



LAWN-BOY

Rear-bagging and a self-charging starter are the new features of the '77 Lawn-Boy line. The new rear-bagger attachment will convert practically all 21-inch Lawn-Boys manufactured since 1972 into a rear-bagging machine. This means that an owner has a choice of three options; rear bagging, side-bagging or, of course, not catching clippings at all.

Top-of-the-line electric-start models have a self-charging starter that automatically charges the sealed nickel-cadmium battery throughout the mowing season. An onboard alternator does away with the need for charging after each mowing.

To give you an idea of cost, the top-model Lawn-Boy is a self-propelled unit that cuts a 21-inch swath. It has the self-charging feature, solid-state ignition, variable speed controls and \$325 suggested retail.



SIMPLICITY

As far as completeness goes, Simplicity says it has the edge in self-propelled walk-behind mowers in '77. The company has introduced a 21-inch model called the Four-in-One that (1) mulches, (2) collects clip-

(Please turn to page 178)

20 new work-saving garden tools

They can help you make gardening a pleasure instead of a chore.

In gardening work from planting to weeding, you'll find the proper tools can make a world of difference in how well and how fast you do your work—not to mention how much you enjoy it. The 20 tools below and on the next two pages not only help you do the job, but are attractive as well. With them you can perform the many small chores that keep your lawn and garden in top condition. Some are all-purpose tools that can fill other needs; you may want to carry them in your car or on camping trips. Several are used by professional gardeners and are especially strong and long-lasting.



Get super-service from this weeder-rooter (above). Tines do the weeding and a straight edge cuts roots. The multi-purpose Pic 'n Planter (top right) plants bulbs, furrows and more. Rounded shape of the Hoe-Down (right) reduces drag for efficient, fun garden work. From Mark Stephens, Sherman Oaks, Calif. 91403.



Grass shears to keep your lawn well manicured. You can get them from Ashflash Corp., South Norwalk, Conn.

Weed problems? You'll be glad to know about this double-edge brush cutter. Good for trimming around objects. Ames, Parkersburg, W. Va. 26101.



For a little or a lot of work, try these pocket-size pruners by Ashflash Corp., South Norwalk, Conn.



Bet you can't break these hardy pruners. Blades are chrome-armored for harder-than-steel durability. True Friends, Teaneck, N.J., has 'em.



These garden tools can take care of your outdoor jobs and look good doing it—no small feat—but they are not ordinary tools. **1.** Here's a double-edged pruning saw for clean branch cuts. Give the branch underside a few upward cuts with the fine-toothed edge, then cut downward with the coarse teeth. **2.** The teeth of this limbing saw are in groups of four: Two cut on the push stroke and two cut on the pull stroke for zipping through branches. **3.** This five-quart English gardener's watering can has a 28-inch spout for watering hard-to-get-to plants. **4.** Here's a scoop trowel with contoured plastic handle for a comfortable grip. **5.** The three-point pivot system of this hand pruner enables you to make clean cuts with surprising ease. **6.** They still make 'em like they used to. This garden sprayer with solid copper tank and seamless solid brass pump is proof. **7.** Another trowel, but with a difference. This fine-point trowel is for delicate weeding or plant separating. The garden tools on this page are available from Brookstone, Peterborough, N.H. 03458.





Contoured garden knife is hand-honed for a lasting sharpness. True Friends, Teaneck, N.J.

Here are **border shears** for professional jobs, galvanized to resist rust. True Friends.

Limbs are actually drawn into these anvil type lopping shears for easing work. True Friends.

Easy operation of these hedge-trimming shears is assured by built-in ball bearings. True Friends, Teaneck, N.J.



This **grass shear** with add-on handle is powered by Disston's cordless Powerpack that snaps in the shear. It recharges from an electrical outlet.



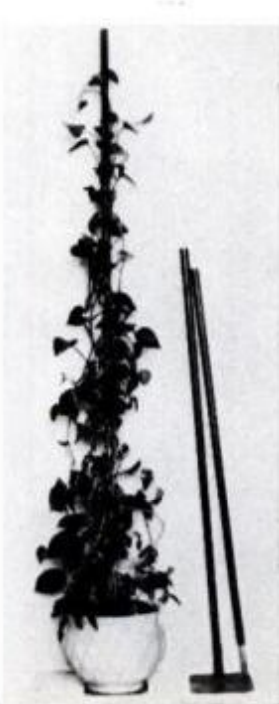
Disston's Powerpack also snaps in to get power to the cordless electric shrub trimmer (and other tools); it's back to an outlet for recharge.

GARDEN ACCESSORIES



Put garden and kitchen waste in at the top, collect good compost at the bottom. Packs flat. From Rotocrop, New Hope, Pa.

Three-piece plant support from Ribco, Los Angeles, supports small or large plants. Bottom metal part fits under the planter.



Indoor watering hose? That's right. It connects to most kitchen or bathroom faucets and extends 50 feet. Casaplanta, Van Nuys, Calif.

Double-duty walls: More than just a pretty face

Check out these walls: They can work for you in more ways than one.

by Penelope Angell ASSISTANT HOME AND SHOP EDITOR

The dazzling colors and patterns you get in wall coverings today should be encouragement enough for updating your walls. But they can be more than just attractive. Many can provide safety and utility benefits as well.

New dual-purpose products

One wall panel that's having widespread use in Europe and receiving notice here is WhyteBoard, a porcelain-on-steel material laminated to

a variety of backings to make the panels. It also comes completely framed as bulletin boards. Special markers can write or make doodles on the WhyteBoard. When erased, the writing leaves no residue on the eraser or cloth used. The hard-as-glass surface is scratchproof and comes in several pastel colors.

Another wall covering with added attraction is Formco, a waterproof Formica laminate panel that can be applied directly over old tile or other

smooth wall surfaces. It comes in a number of patterns and colors, many that resemble marble. Formco panels make a good do-it-yourself project for your bathroom because they're easy to install. They're also practically maintenance-free.

A new wall covering that you can write on with chalk is Chalk-Talk. It's a flexible material, green in color, that can be glued to the wall with contact adhesive. It comes in 30-in.-wide rolls from 4 to 40 ft.

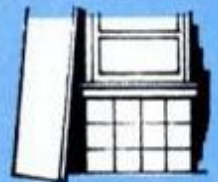
Photo: Manton Cork Corp.



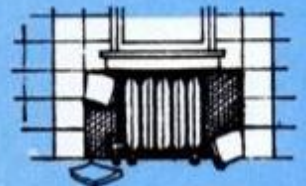
1. Cork walls

You can hang art or important messages directly on cork wall covering.

Wall cork comes in tiles and panels—self-stick and plain-backed.



Don't use self-stick cork in extremely hot, cold, damp or dry areas.



To apply, you need only a yardstick, utility knife, rolling pin or book to press (adhesive and trowel if non-stick type).



Cork absorbs sound and insulates against heat and cold.

2. WhyteBoard

WhyteBoard is a new type of writing system combining porcelain-on-steel panels and special dry markers. The writing is erased with a felt eraser or dry cloth, leaving no residue on the cloth. It's expensive to panel an entire wall in a home, but a framed board like the one shown is ideal in a child's room or kitchen for doodles or messages. From Alliance Wall, Alliance, Ohio 44601.



PM photo: Steve Fay

Special dry markers just wipe off, leaving no residue. Boards come in wall-size panels for covering entire rooms.

long and can be cut with scissors. Chalk-Talk makes a colorful surface to write or sketch on in children's rooms, kitchens or dens.

Safety can be an important consideration in the wall coverings you choose. Some new panels made of 1/2-in.-thick brick bonded to wire mesh and stitched to aluminum-covered building board are fireproof. Called Brikpanels, by Ridgerock, Dover, Ohio, they measure 32 x 15 1/4-in. They can be used over many new and existing interior and exterior walls.

A helpful fire and sound barrier is the new RC-1 Sheetrock Resilient Channel by U.S. Gypsum. The channel is made of 25-gauge galvanized steel. It is attached with screws through prepunched holes to studs or joists. The channel can be used with plasterboard walls to give extra fire and sound control, especially helpful in homes with small children.

New twist to an old favorite

Velcro is a widely used fastening device for attaching two pieces of material together. A patch or strip of the loop-type Velcro is sewn to a fabric and a piece of the hook-type Velcro is sewn to another fabric. The loops and hooks join to form a tight bond when pressed together.

Velcro can also be used on your walls. The 3/4-in. strips make a decorative pattern when not in use. Placed next to an outside door, they're a handy way to hang coats having a Velcro patch under the collar.

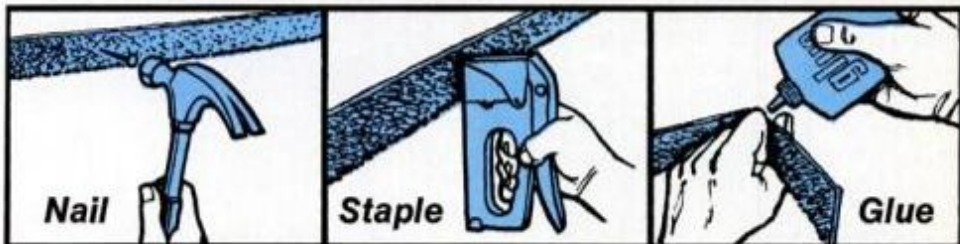
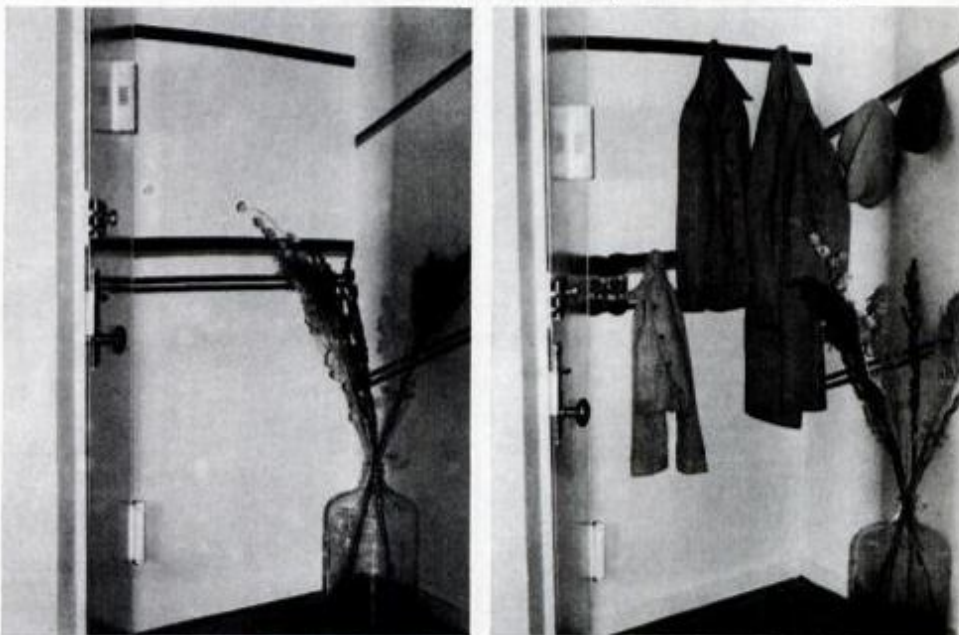
The strips come in black, white, olive, navy blue and beige. They can be purchased at marine suppliers and notions departments.

Vinyl wall coverings

The most popular home wall coverings are vinyls, largely because of their easy-care traits. They're wash-

3. Velcro

A super wall graphic of Velcro becomes a space for hanging coats and hats. Attach the hook tape to the wall and sew the loop element to clothing.



One strip has soft loops, other has strong hooks, so two fasten tightly together.



4. Perforated hardboard

Perforated hardboard can help you get organized from family room to workshop. Games and play equipment can be stored in the open for easy access (left) or you can hang shop tools (below) within reach. The panels come 1/8-in. thick or 1/4-in. thick for heavy-duty use such as hanging bicycles or garden equipment. Another plus: they can be kept clean with a damp cloth. The panels are available in several colors.



Photo: Masonite Corp.

able and many are prepested for easy hanging and dry-strippable for easy changing when you tire of the pattern.

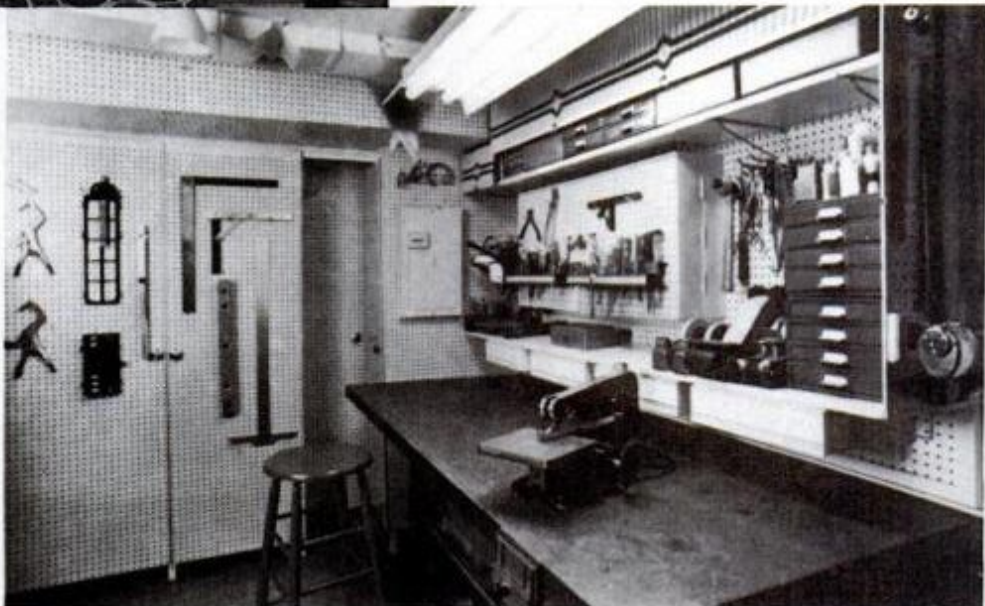
Heavily embossed vinyl coverings called "Textures Unlimited" meet federal flammability tests and are scrubbable as well as being attractive. Made by the B.F. Goodrich Co., Marietta, Ohio, they have a rough surface that gives a three-dimensional effect. Some of the surfaces look like burlap, cane, stucco, suede, leather, corrugations and sandstone.

Several vinyl wall coverings have a fabric backing, usually of cotton knit, which makes them extra durable. An example is the Malaya line by Gilford, New York, N.Y., which can also be used as upholstery. It has a deep enough texture to make a good tackboard surface, too.

Star performers

Some multipurpose wall coverings have been around a long time but continue to be widely used for their many advantages.

The newcomer to this group of old-timers is shiny Mylar. Shinier than the regular foil coverings, Mylar reflects almost as well as



a mirror. It's a good choice to lighten rooms because it reflects any available light.

A cork wall makes a great changing picture gallery. You can pin art and photos directly to it and easily remove them. With cork, your entire wall can be a bulletin board for messages and clippings. It also absorbs sound and acts as a room insulator.

Perforated hardboard like Peg-

Board can be used for storage and display in virtually every room of your home. The panels fasten directly to studs and joists, or can be fastened to a solid wall allowing room between the wall and panel for inserting hangers in the perforations.

Today's wall coverings give you safety and convenience features with beauty. It's like getting a double return on your investment. ★★★

OTHER EXTRA-PURPOSE WALLS

5. Prefinished hardboard panels

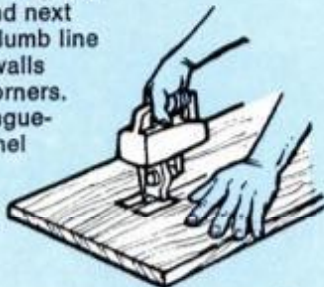
Besides being decorative, they help control sound and are fireproof.

APPLYING TONGUE-AND-GROOVE PANELS OVER PLASTER

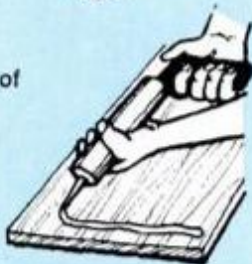
1. Lay out from the center. For best appearance, plan panels from center of wall and work out. The two end panels will probably need to be trimmed to fit, while center ones are whole.



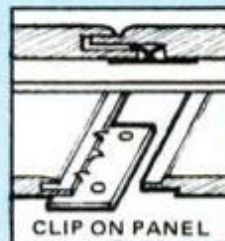
2. Cut first panel. The left panel will be attached first. Mark a plumb line from the ceiling as a guide for cutting and joining the first panel and next one. This will insure a plumb line at the joint, even if the walls are not vertical at the corners. Since the panels are tongue-and-groove, the first panel should be the width planned, plus 1/8 in. for the tongue. Nail temporary 1x2-in. leveling strips at floor where the panels rest.



3. Apply adhesive to the back of the panel and then press the panel in place so that it is flush with the corner.



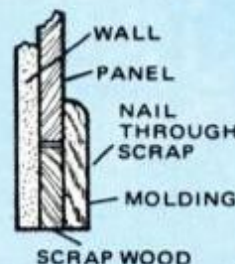
4. Attach clips with lath nails 16 in. apart. Allow a 1/32-in. expansion space between panels. To check this insert a cardboard strip between the panels after two of them have been installed. The clips should be attached quickly after you press panel to wall.



5. Attach next panel after applying adhesive and insert its tongue into the groove of the first. Press firmly together. Add other panels in the same way. The last must be cemented in place. Cut panels to fit snugly around window trim.



6. Remove starter strips, add base molding backed with scrap panel and nail to wall. Don't nail through the wall panel. Molding covers the bottom edge of the panel.



6. Ceramic tile

It's smooth to the touch and always looks clean and cool, besides being available in many colors with designs.



Highly durable and long lasting. Needs very little maintenance. Soil and water-resistant.

7. Formco panel

This is a Formica laminate with foam-core backing from Formco, Cincinnati. It comes in sheets or in tub and shower kits.



No grout lines to collect debris. Can be applied over old tile. Waterproof and easy to care for.

8. Chalk-Talk panel

Flexible, polyester laminate colored green from Conolite, Carpentersville, Ill.; applied with contact adhesive.



For writing chalk messages. 30-in.-wide rolls; 4, 8 or 40 ft. Easy to cut with scissors.

9. RC-1 Channels

Steel channels are screw-attached through prepunched holes to studs for use with plasterboard walls; from U.S. Gypsum.



Helps reduce sound transmission. Serves as a fire barrier.



Get into the act: Build a puppet theater

Everyone has a part to play
building the theater and making space puppets.

by Penelope Angell
ASSISTANT HOME AND SHOP EDITOR

PM photos: Harry Hartman



Dim the house lights and let the show begin. The curtain opens and two puppets appear. You've just entered the puppet world.

Preparing for a puppet production actually does involve creating a miniature world—building a stage where the puppets perform, making the puppets and supplying them with props and scenery.

The production can provide entertainment for your family and friends, as puppets act out stories and funny family happenings.

The puppet's world is the theater. This colorful theater has been designed to aid the puppeteers (persons who work the puppets behind the scenes). It can be folded for easy storing after use.

Materials for building the theater

The theater is made with two sheets of $\frac{3}{8}$ -in. A-A (good two sides) plywood and 1x1-in. framing on the side panels. Curtains are hung on a traverse rod and the backdrop is a window shade.

We applied fabric and star appliques to the shade for an outer space setting. You can use fabric or paint the window shade to achieve the proper setting for your production. Scenery is easily changed by changing shades.

The hardware you'll need includes three $1\frac{1}{8}$ -in.-wide piano hinges, two for the stage sides so they can be closed for storing and one for the stage door on the side. Four 4-in. barrel bolts lock the stage sides open when in use. A fifth barrel bolt can be placed inside the stage door to keep fans and friends out when the theater is backed against the wall. A knob is screwed onto the outside of the door. Wooden brackets support the performing stage and an inside ledge that is

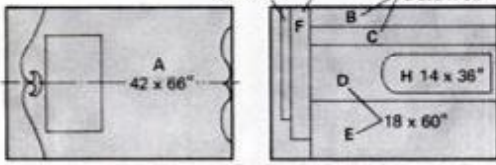
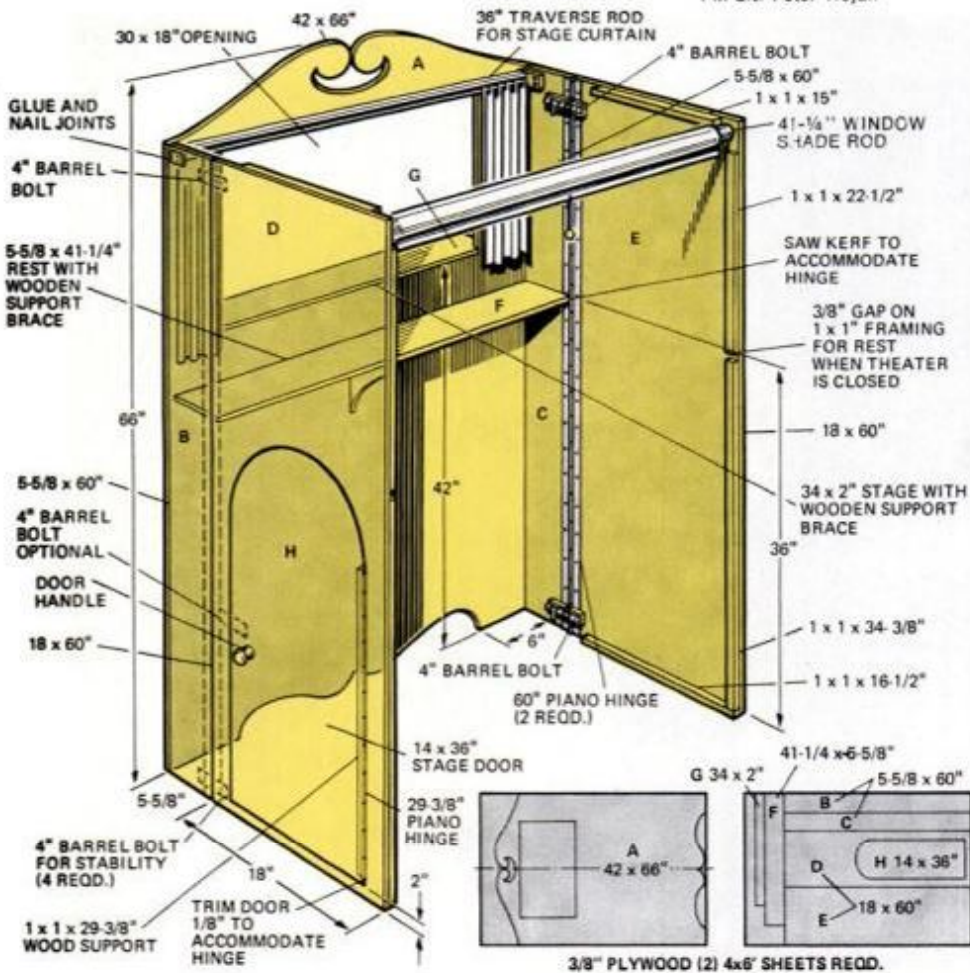
The space monster and the space woman perform, thanks to the puppeteers behind the scene. Theater comfortably holds two people, standing or sitting.



An advantage
of rod puppets over
glove puppets is that they
have freer arm movement. Rod
puppets can also have feet that
enable them to sit on stage, kick or run.

PUPPET THEATER

PM art: Pe'er Trojan



3/8" PLYWOOD (2) 4x8' SHEETS REQD.

used to store puppets and the props. Bright paint in four colors, glue and nails for construction and fabric for curtain and bottom cutout are the materials you'll need.

Constructing the theater

The basic theater consists of seven pieces of plywood as shown on the cutting diagram. The 7 and 9-year-olds pictured in the theater can work the puppets comfortably. You



The stage (above) is planed smooth. A notch is sawed into the ledge (below) for the hinge attaching the side panels.



Stage-door hinge is placed in a 1/8-in. recess sawed out of the door. A 1x1-in. wood support strip will be attached later.

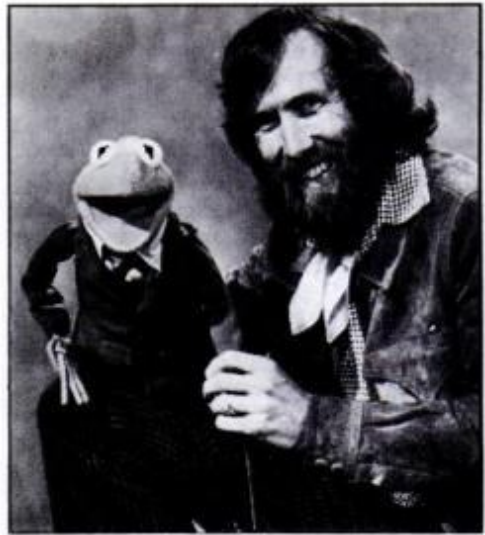


Photo: Nancy Moran

How rod puppets move

Kermit the Frog is moved by Jim Henson of Sesame Street. Kermit and his Muppet friends are rod puppets like those in our theater. The puppeteer moves the head with one hand and works the rods attached to the puppet's left and right arms with the other hand.

Two people can also work a rod puppet. One moves the head and right arm while the other works the left arm. The person who moves the head acts as the puppet's voice. Two people working together need coordination, but they allow the puppet greater movement.

When you move the puppets, exaggerate their movements. Your puppets can bow until their head touches the stage floor. They can keel over backward in a dead faint. Use your fingers, wrist and arm in the process. Practice making your puppet sneeze, cry and hiccup. Try making it wave, rub its hands or tap its head to show thought.

Vary the pitch of your voice when talking through your puppet. Try for a puppet voice—not a human one—and talk in short, concise sentences.

might want to change the theater dimensions to fit your family's needs.

You can draw the cutouts on the stage front, then saw them out with a fine blade before assembling.

Since the stage door is cut directly from the side of the stage, then reattached with a hinge, take special care to make a clean cut. Also make a 1/8-in.-deep recess along the side of the door for the hinge.

There are several extra steps to take in gluing and nailing the parts together to make the attractive theater easy to store. After you attach the theater front, small side panels and inside ledge, saw a notch in the ledge to fit the hinge for the larger side panels. When you hinge the

(Please turn to page 133)

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The Gabriel Shock Test Team.

They drive rough and tough, so you ride smooth and safe.

Four of the most respected men in auto racing have joined us at Gabriel. Their job—to help us make certain that Gabriel shock absorbers live up to every promise we make for them in performance, quality and value.

The Gabriel Shock Test Team works directly with Gabriel engineers and research personnel, testing the kinds of Gabriel shocks you buy, on the kinds of cars you drive. They test for control, handling and comfort . . . on the straightaway, on curves, during heavy braking, and on rough, bumpy surfaces.

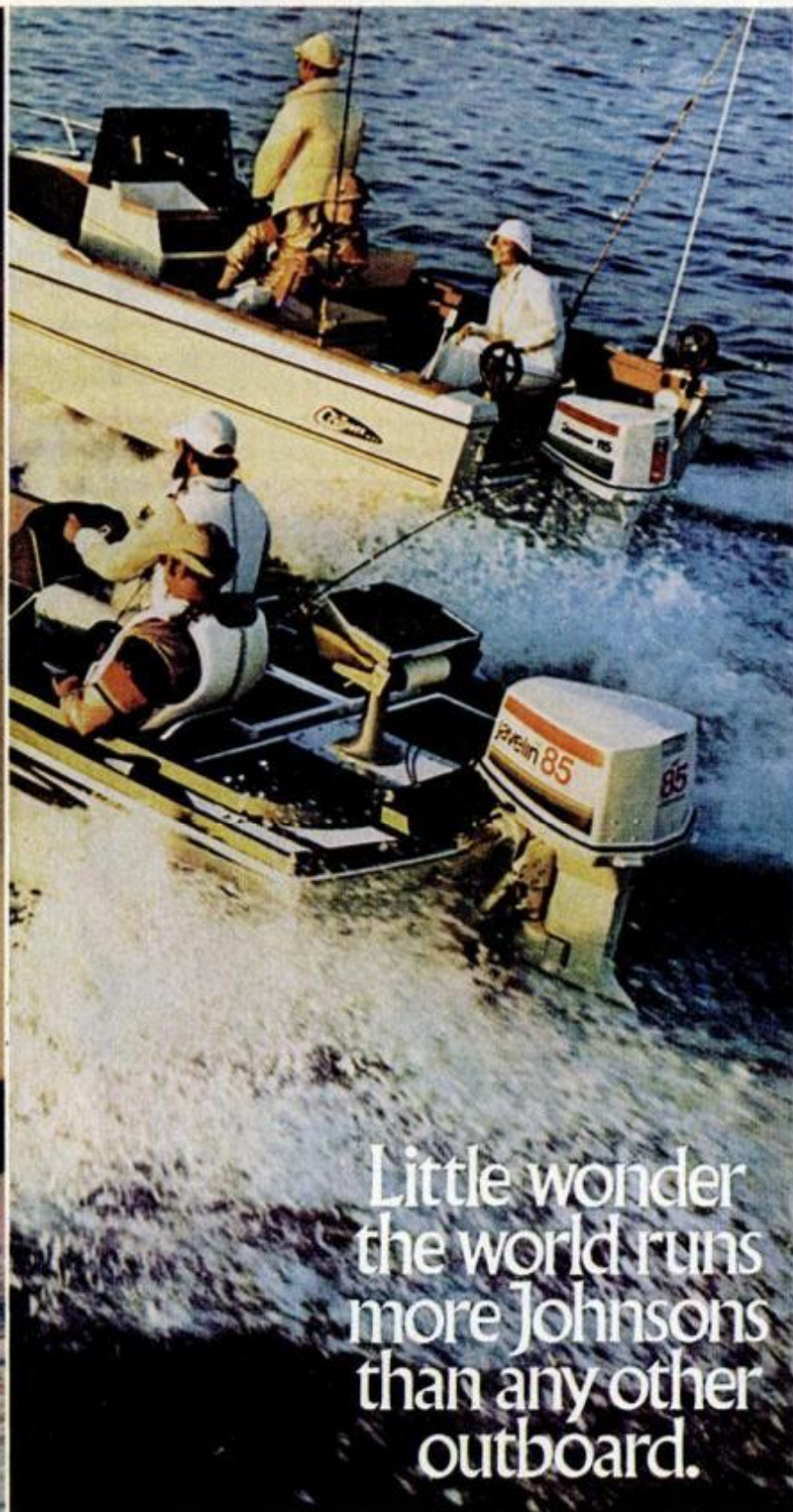
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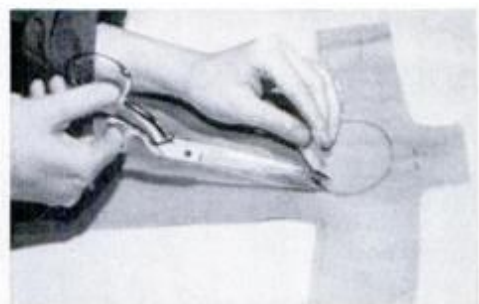
BUILD A PUPPET THEATER

(Continued from page 130)

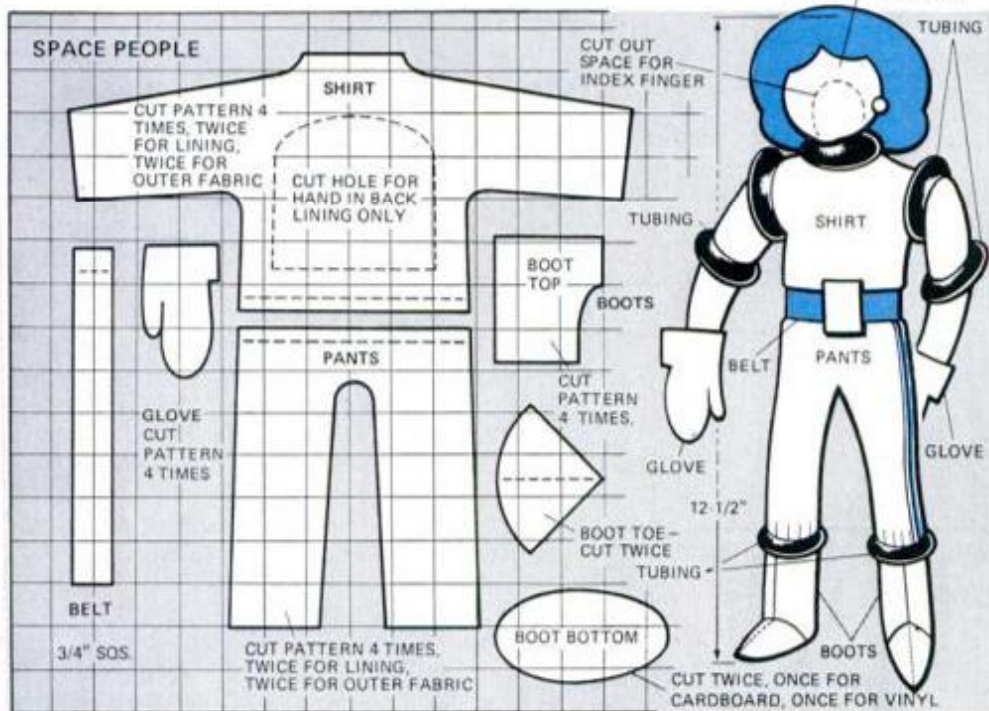
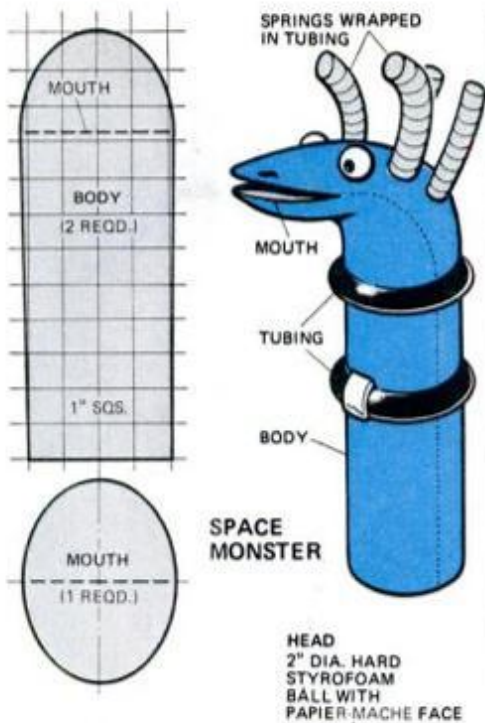
stage door to the side, add a 1x1-in. support strip to the door.

The finishing touches

It's good to paint the theater in bright colors to add to the festivity,



A slit is cut in the back of the lining for the puppeteer's hand. Then the lining pieces are stitched together.



The puppet face is a Styrofoam ball with strips of wrapping paper moistened and applied with wheat paste.

as long as the theater isn't so flamboyant it detracts from the stage action.

After you add hardware, paint scenery on the window shade and install the stage and kick curtains, the theater is ready for use. You might also want to clamp lights to the theater top to light the stage.

Making puppets

Your puppets are the life of the production. They can be glove puppets, hand puppets or rod puppets. Our space monster is a glove puppet and the space man and woman are rod puppets, which have great freedom of movement. You can make your own type of rod and glove puppets following the basic patterns here. When you're painting the

(Please turn to page 134)

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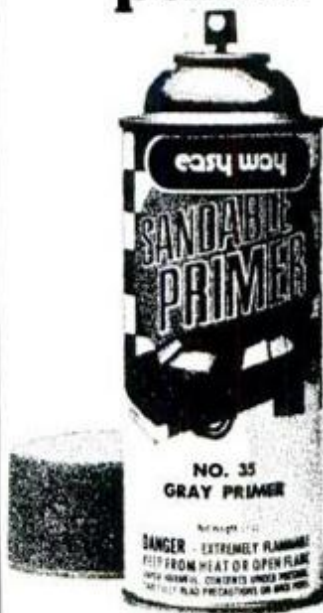
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BUILD A PUPPET THEATER

(Continued from page 133)

faces, remember that delicate details won't be seen by the audience.

Making the puppets

The head of a rod puppet is a hard Styrofoam ball with a hole cut out for your index finger. A strip of elastic is glued around the finger hole to which clothes can be sewn. The face is made of wrapping-paper strips moistened and applied with wheat paste and smoothed over



The hem of the shirt back is stitched, but the slit is left free for puppeteer's hand.

moistened tissue wadded to make facial features. When dry, the face is lightly sanded smooth and painted. Felt is glued to the head where the hair will be attached. You can make the curly hair by wrapping a strand of yarn around your finger, then running a securing thread through each curl and gluing the strand to the felt.

Bodies of the rod puppets are made with two thicknesses of material stuffed with polyester fiber fill. Old umbrella spokes make good rods; they have holes for attachment to the puppet. Stiff wire can also be used.

Small Styrofoam balls should be fitted to the rod end that rests in the palm of your hand for safety reasons and for easy manipulation.

Puppet boots and gloves are made with a stiff interlining and cardboard soles covered with black vinyl used in garbage bags. Tubing on arms and legs is fabric stuffed with fiber fill.

The space monster is a simple glove puppet made from the pattern with button eyes and antennae of small 2-in. fabric-covered springs.

After you've made your puppets and practiced with them, all you need is a story and an audience—then let the show begin. ★★★

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HOMEBUILTS AND CONVERSIONS

(Continued from page 93)

himself built one research vehicle and is working on a second. His first is a fiberglass-bodied four-wheeler over a custom tubular chassis. The one now under development is a three-wheeler.

Laski and a few other members of the nonprofit EAA hope to win grants for their work under Public Law 94-1048, the "Electric and Hybrid Vehicle Research, Development and Demonstration Act of 1976." This law was passed over President Ford's veto last year. But there's a hangup—despite authorization of some \$30 million during the law's first year (1977), no money has been appropriated as of this writing.

On a broader scale, the Electric Vehicle Council, based in New York, was formed in 1968 to advance the use of electricity in all sorts of transportation. Membership now stands at about 200, with 150 members in the United States and another 50 from 19 foreign countries.

Unlike the EAA, the EVC members are almost all commercially involved. They're making everything from golf carts to electric forklifts and suppliers of batteries, transform-

ers, chargers, switching gear and raw materials.

Japan in forefront

"Basically speaking," says Walter Laski, "we're way behind some countries as far as electric vehicles go. The Japanese have a five-year program, started in 1972, for which the government allocated \$15 to \$16 million seed money. The 15 corporations involved make automobiles, batteries and electric motors. They have a prototype with a 250-mile range, and are getting ready to produce. It's an international race now, and we've got to get into it."

Homebuilt activity isn't confined to the West Coast. Jake Ziegler, 56, a lathe operator at a General Motors plant in Indianapolis, calls his homemade electric a Volectra—Vo because he started out with a Volkswagen; Lectra because the car runs on electricity. The car uses 10 6-volt, 225-amp. batteries. Ziegler says he hasn't noticed any appreciable increase in his electric bill since he started charging the car at home.

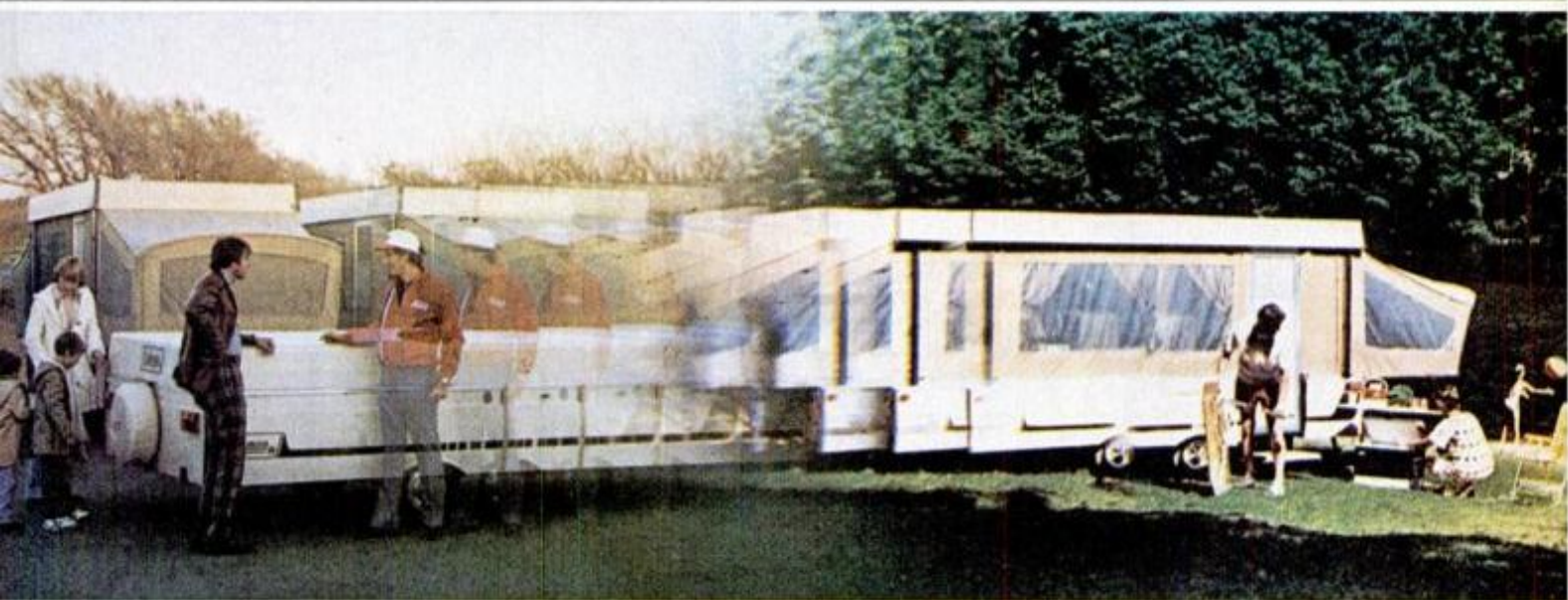
Ziegler and a neighbor, Edward W. Brinsley, made the car from bits of

this, pieces of that. Ziegler says he doesn't know how much money he has in the Volectra because friends and neighbors pitched in on the project and contributed parts. Ziegler thinks the motor came from an electric forklift. He tried three other motors before settling on the forklift. The body is made of aluminum and conduit tubing, the frame for the windshield was salvaged from a bed and the headlights are really fondue pots set on their sides. It took about a year to put the car together.

The Volectra has a four-speed transmission. It kicks off at 12 mph, climbs to 20 mph in second gear, 30 to 33 in third and peaks at 40 to 43 in fourth. One a few occasions it has attained a snappy 46 mph.

Ziegler drives the car to work—the roundtrip is 16 miles—but he doesn't take it out during winter because the batteries lose power very rapidly in cold weather.

For more information about the Electric Auto Assn., write 1674 Merrill Dr., San Jose, Calif. 95124. The Electric Vehicle Council's address is: 90 Park Ave., New York, N.Y. 10016.—M.L. and R.L.



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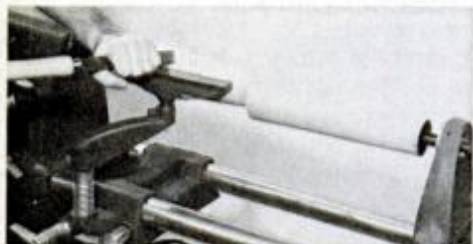
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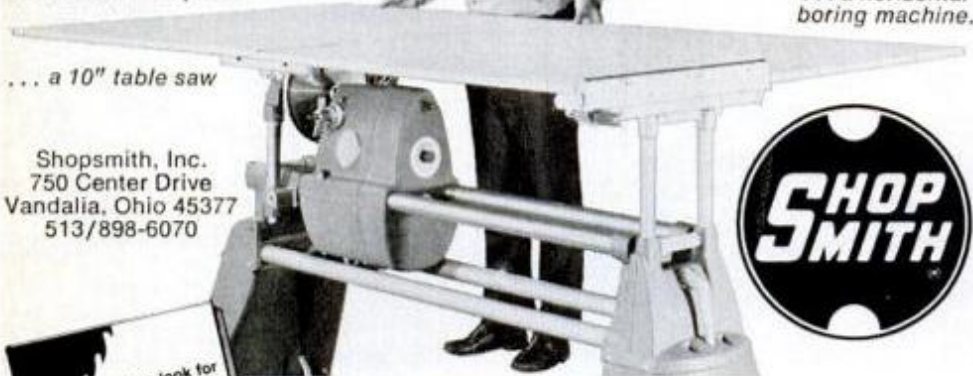
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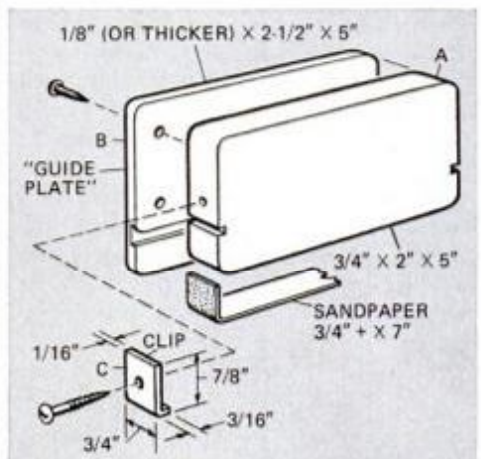
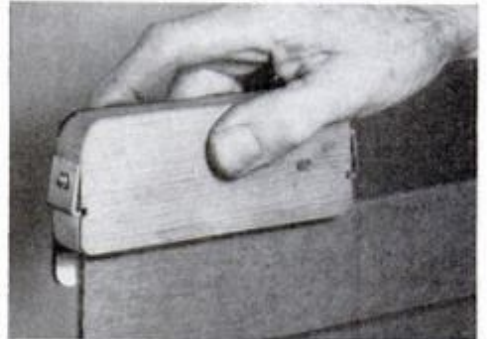
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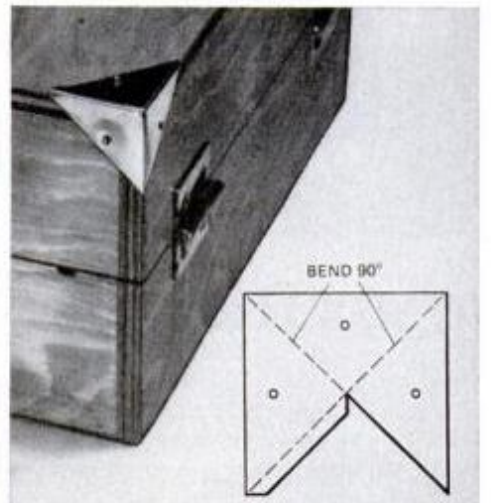
FROM READERS

Sander keeps edges square



The guide plate (B) on this sanding block preserves the edges of the piece being smoothed. It attaches to the wood block (A) with four screws. Two clips (C) anchor the sandpaper.—*Walter Burton*

Cut corners from cans



To make protective corners, cut small squares of sheet metal and draw diagonals from the corners to the center. Cut along two adjacent diagonals leaving a soldering lip on one. Bend, solder and drill holes for attaching.—*W.E. May*

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sual suburban-type dwellings have windows that look out on boxes of artificial flowers, and a recent one has a swimming pool "outside" in an underground patio. You enter Swayze's houses via stairways from small unobtrusive surface buildings. A prototype vault-home that he exhibited at the 1964 World's Fair was entered through a greenhouse.

Started with the cave man

Actually, living underground is hardly a new idea. It started with the cave man. Every age has provided remains proving man's proclivity for "digging-in" to provide himself and family with a safe, comfortable harbor from enemies and elements. And it never really phased out. Today, in North Central China 10 million people live in vast underground villages carved around sunken courtyards in the porous Loess Belt sandstone. Turkish farmers still inhabit the early Christian cave dwellings of Cappadocia, burrowed in cone-shaped formations of weathered lava. In Gaudix, Spain, 30,000 people live in apartments supplied with electricity, tile floors and all the creature comforts—carved in soft rock cliffs. There are now even *luxury* caves in France's Loire Valley where caverns, left by quarriers who cut stone for the great chateaus, have been extended, paneled, carpeted, richly furnished and sold to wealthy city dwellers who cherish their coolness in summer and natural warmth on winter weekends. On nice days, expensive nightshirts and satin sheets flap on washlines in openings along the bluffs.

The truth is that many of us have been using underground complexes right along, without noticing. For nearly half a century, millions of New Yorkers have shopped along several square blocks of underground mall beneath Radio City and dined in underground restaurants surrounding a sunken plaza featuring ice skating in winter and garden



Sunken patio is all you can see of architect Malcolm Wells' sod-covered city office.

tables in summer. Similar malls, lined with glittering shops and parking areas exist under the plaza adjoining Vienna's Opera House, at Place Ville-Marie and Place Bonaventure in Montreal and beneath Les Halles in Paris.

For 15 years, children in Artesia, N.M., have been attending an underground school—and more such schools are now being built. A big one, with a glass wall peering southward to provide classroom sunlight and solar power for heating and cooling, will open this year in Reston, Va.

Subterranean park

In Kansas City there's an underground industrial park with six square miles of floor space 40 to 75 feet beneath the surface. More than 2000 people are employed in the offices, and 80 freight cars at a time can be swallowed by two rail spurs serving tenants in the complex.

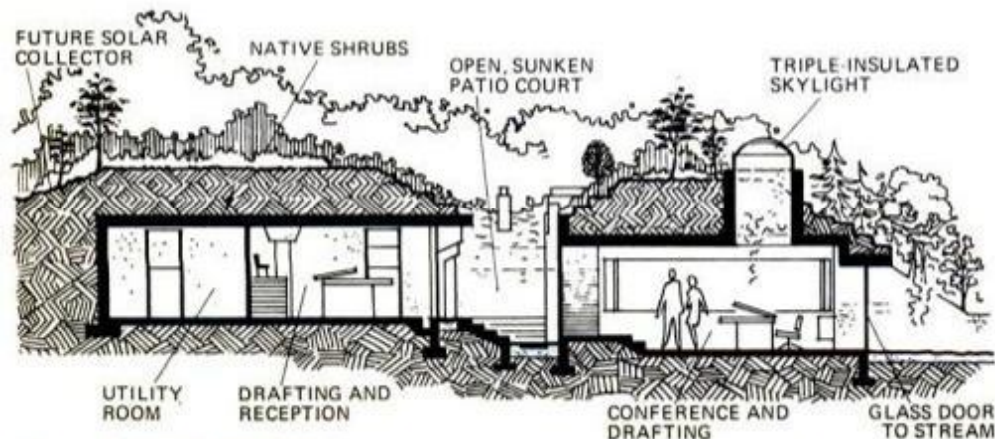
Putting warehouses, factories, parking facilities, shopping malls and even schools underground is something most people can understand (such things don't improve the scenery, so let's get them out of sight and make them weather-proof at the same time). But *living* "down there" in homes invariably raises questions from most. Here are some of the most frequently asked, with answers from leading underground architects and engineers:

1. Why live underground if you can live on the surface?

Aside from dramatic energy conservation and savings in fuel cost (see item 3), reasons are plentiful. Since weather has little effect, undergrounders are home free on exterior maintenance. The structure is termite and rotproof, Barnard points out, and is insulated from noise and air pollution; roofs don't need replacement; pipes don't freeze;

(Please turn to page 142)

Underground office of architect Malcolm Wells features sunken patio and skylight that admit sunlight and air to all rooms, plus a sliding door that opens out on a flowing stream—all in the heart of an urban area otherwise polluted by noise, traffic and high-rise buildings (see photo above). Diagram at the left shows a cross section of the office layout.



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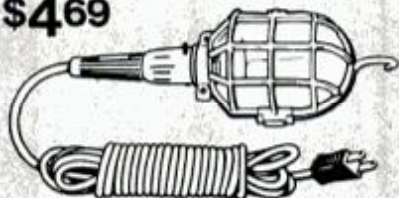
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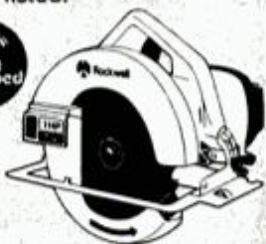
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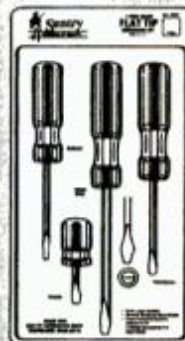
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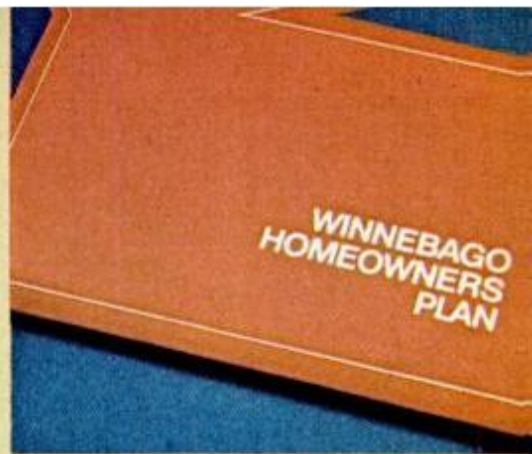
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HOW TO WASH YOUR CAR *(Continued from page 117)*

water, which is nice in winter.

The question is, by the time you've fed more than four or five quarters into the coin-op meter, are you better off going to an automated commercial car wash? After all, for almost the same price, a commercial car wash does the work for you. It's a fact, however, that you *can* apply hand-washing techniques in a coin-op situation. Thus you're theoretically able to do a better job than you'd get at a commercial car wash. Unfortunately, few users of coin-ops bring along a shammy, much less a bucket and other supplies.

Commercial car washes

As in any business, you'll find good and bad commercial car washes. Few car owners know the difference. Here's how to judge them.

Note whether it's a short-line or a long-line car wash. Short-lines (30 to 60 feet) usually contain only one or two sets of brushes, have no wheel scrubbers, no steam, no water-pressure boost, and they're often adjuncts to filling stations, sometimes stuffed into what used to be a single lube bay.

Long-line washes stretch 120 feet or more and almost always do a considerably better job. They have more brushes, use more water for wash and rinse, have pumps that boost water pressure to 600 p.s.i., often heat water to around 140° F., and give more washing time.

Also look for or ask about the following:

- **Do they use a powerful vacuum as a first step?**
- **Do they have a man on a steam wand at the entrance to their wash tunnel?** Ideally, this wand puts out a jet with 400-p.s.i. pressure at 140° F. It's used to remove impacted bugs scratchlessly, from the front of your car and, on request, to spray the undercarriage to clean away road salt and dirt in winter. You *do* have to ask for a special undercarriage spray in most car washes.
- **Are there steam-emitting movable tire scrubbers to whiten your whitewalls?** The better ones do.
- **Can you see that the big, revolving brushes are clean?** Managers who take pride in their operations use light-colored brushes so their customers can judge cleanliness.
- **Does the operation have a dryer and delinter for its towels?**

Now a few comments about commercial carwashes in general. Most have to use a special mild, sudsy detergent in their brushing operations to lubricate the brushes so they don't scratch your paint. Detergent suds also act as a wetting agent to cut through road scum and oils. If a car being brushed is too well waxed, and if no wetting agents were used, water would flow quickly off the car and leave nothing to lubricate the brush bristles.

Is the detergent harmful? The car wash people say no—it's not strong enough to remove a good, protective wax finish.

(Please turn to page 152)

CAR-CLEANING TIPS

William Trevorrow, commercial car-wash consultant and founder of Gem Auto Wash in Sacramento, Calif., lists the following tips to help keep your car looking young for years.

1. Remove tree sap, bird droppings and bugs from your car's finish immediately. Although household soaps and detergents aren't recommended for ordinary hand car-wash jobs, it might be necessary to use them to remove these things. Sap, bird droppings and bugs can permanently discolor paint. Eggs, vomit and spit can cause paint to shrink and lift.

2. If you live in areas of high salt atmosphere near the ocean or where salt is used to melt snow, wash the car often, especially underneath.

3. Never put bumper stickers on painted areas of your car. Remove such stickers with rubber-cement

thinner (office-supply stores).

4. Always try to park your car in shade on sunny days and indoors at night. Fabric car covers are no substitute for carports or garages.

5. When buying a car, remember that metallic colors fade and deteriorate more quickly than nonmetallic paints. Some metallics also grow dull with polishing when aluminum particles become exposed to air.

6. Remove road tar quickly with solvent or white gasoline. Be sure to re wax the area rubbed down.

7. Two-step polish and wax jobs beat all-in-one waxes, and hand application beats polish/wax machines or buffer rubouts if done correctly. A good paste-wax job should last (make water bead up) at least six months and makes hand-washing much easier. Chrome trim usually needs waxing more often than paint.

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HOW TO WASH YOUR CAR

(Continued from page 150)

Some new commercial car washes now recycle water—or part of it. Great, but if the water isn't properly filtered and neutralized before reuse, oils, grit and the caustics used in wheel scrubbers can get recycled right back onto your car.

One word, too, about the caustics—ordinarily harmless when used only on tires and wheels. But they can dull aluminum. So if your car has aluminum wheels, hubcaps or rocker moldings, ask that the caustic wheel-scrubbing operation be eliminated in your case.

Another warning: A few commercial car washes mix a trace of kerosene into their wash water. This gives cars with dull paint a temporary gloss. It's not at all recommended, though, because kerosene cuts wax and attracts dust. You can usually tell if a car wash uses kerosene in its water—you can smell it.

Optional extra finishes

Should you opt for the spray waxes and hot waxes offered by car-wash operations? My feeling is no, because these thin coatings, which aren't rubbed in and which cling only to the surface, last just a few days. The extra 75 cents to \$1.50 or so you pay for the spray wax every couple of weeks would be much better spent every six months on a true hand or machine-rubbed polish and wax job. A good one lasts that long and is better for your car.

What about rust-inhibiting chemical sprays offered by some commercial car washes? These usually cost about \$3 extra. Again, they don't last long, and the good they do is open to question. My opinion is that you'll do better spending the money on a good undercarriage rinse with the pressure/heat wand.

Finally, you'll be able to tell quite a lot about a car wash by its so-called "kiss-off" area. This is the big concrete apron out front where your car gets its final toweling. A good commercial car wash uses soft cotton towels that are just barely wet (dry towels tend to scratch). Points to notice: Is your car totally dry? Do the finishers change towels often? Do they wipe out-of-sight spots like the undersides of doors?

As I say, you're still best off washing your car by hand yourself. I realize that's not always possible or practical. But if you use good judgment and know what to look for, you can get almost as good a job at a long-line car wash as you can at home. Just be sure you choose one that takes pride in its work. ★★★

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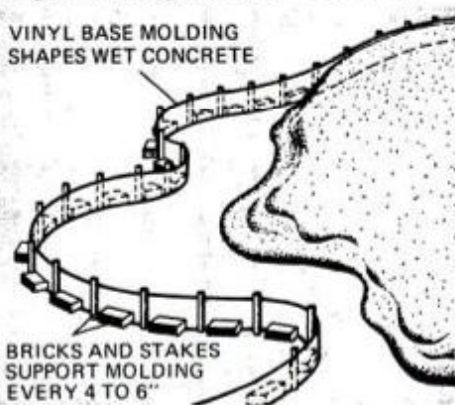
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DRIVING AT NIGHT

(Continued from page 77)

frequently to stay out of another guy's tailpipe, better make an appointment with an eye specialist.

Oncoming brights

Another dangerous aspect of night driving is that of oncoming headlight beams. We've all encountered the driver who refuses to dip his brights even though we signal him by flicking our own high beams up and down. Don't contribute to an already dangerous situation by being hard-nosed and leaving your own high beams up; two blind jackasses are more dangerous than one.

Most drivers know that looking directly at headlights is a mistake, yet many do it, mainly because it's easy—particularly when a driver is tired—to focus on headlights rather than on something else, especially when no other light is in sight.

Although it's better than looking directly into headlights, riveting your eyes on the right side of the road is almost as bad. This restricts peripheral vision to the left. Should a car suddenly veer over onto your side of the road, you might not notice it in time to take action.

Three-point scan

A good technique to fight headlight glare is the three-point scanning system. By shifting your eyes, you scan or cover an imaginary triangle, glancing first at a point somewhere near the edge of the road or near the right side of your lane. Then you shift your line of sight to a point alongside the approaching vehicle, taking care not to look directly at its headlights. To complete the triangle, glance at a point somewhere ahead of and midway between your car and the oncoming vehicle.

Don't—ever—wear shaded glasses to reduce headlight glare. Your vision through the darkened side areas of the glasses will be severely curtailed. Sunglasses can, however, help eyes adapt to darkness if you put them on in a brightly lighted room first. Some people, when exposed to very bright lights, need a half hour for their eyes to adapt to darkness.

Depth perception

Because depth perception is tricky, particularly at night, it can be difficult to estimate an oncoming vehicle's distance from you by size and spacing of its headlights. Keep in mind that headlights of sports cars and compacts will be closer together than those of a standard-sized car. The car that looks as if it's far down the road may not be.

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Another depth-perception problem is the "one-eyed" vehicle. Is it a motorcycle or a car with a missing headlight? Play safe and hug the right side of the road. (Often you can tell if a one-light vehicle is a motorcycle by the jiggling, up-and-down motion its light makes.)

Using oncoming headlights

You can make use of oncoming headlights by taking advantage of their "sidesweep" effect; i.e., the lateral spread of the beams that can reveal objects your own lights haven't yet picked up.

You can detect a car coming up the opposite slope of a hill or around the other side of a blind corner by picking up headlight reflections off telephone lines, power cables and foliage. As the opposing car gets closer, you'll notice the halo, or flare effect its headlights make.

Don't approach a blind curve or the crest of a hill with your high beams up; they'll only dazzle and possibly disorient the other driver. Also, you may not be able to detect the reflections of his headlights. It's a good idea to flick your lights up and down a couple of times to warn others that you're out and about, too.

Flicking your lights is a good way to let a driver in front know you're about to pass. Use your turn signal to further inform him. If you don't warn him, he may not notice you in his left rear-quarter area, and that could mean a crunch. It's safest always to assume "the other guy" doesn't know you're there.

When following another car at night, stay farther away from it than you would during daylight.

Driving in a fog

Fog reduces visibility and can disorient drivers so they feel they're floating through some dimensionless realm. How should you handle it? First, slow down . . . way down. Second, keep your eyes moving, even if only over a small area. Third, stay on low beams; highs will only bounce off the fog and reflect back.

You can determine an appropriate speed in fog by picking out a reflecting surface—a sign, say—and dividing its distance from you by four. One-fourth of the distance between you and the reflective surface is how far you'll be able to see something—a darkly-attired pedestrian, for example—that doesn't reflect light. Adjust your speed so that you'll be able to stop within that one-fourth distance.

Butts, booze, bennies

Apart from the obvious effects of alcohol, drugs and smoking on over-

all driving efficiency, all three also affect vision, particularly at night. Alcohol can result in tunnel vision, meaning peripheral vision is lost or severely reduced. Smoking, especially heavy smoking, can result in asthenopia, eyestrain accompanied by dimming vision. Pep pills may put you on the moon, but when you come down, the drop is steep, leading to drowsiness, and severe loss of visual perception. Combining these three with a steering wheel is suicidal and homicidal.

Wildlife

Only the most private of animals are rarely if ever encountered on roads and highways. Others, particularly deer, are a common—and potentially dangerous—sight. Spotting them in time to avoid running into or over them can be difficult. Their behavior is unpredictable, further compounding the problem. About the only thing you can do is keep your eyes moving, constantly scanning the area in front of you side to side, alert to reflections that might mean animal eyes. If impact is inevitable, better the critter than you and your passengers. In deer country, slow down; one darting deer may mean two or more right behind.

A safe car

In addition to improving your night sight and driving defensively, you can adjust the night-driving odds more in your favor by maintaining and operating a safe car. Make sure headlights are clean and properly aligned. Keep tail and side lights cleaned. Replace burned-out bulbs. Clean the inside of your windshield, especially if you're a smoker. Replace worn wiper blades and keep the windshield washer reservoir filled. Scrape ice and snow off windows before starting. Keep a clean, soft rag handy to swab away window condensation. You'd be surprised by the number of drivers who choose to ignore the most rudimentary precautions.

If your lights fail, flip on your emergency flashers or your direction lights and pull off the road as soon as you can. Never stay in a car that has no illumination; get away from the line of fire.

Please—*please*—get a flashlight for the car. Stick it in the glove box or clamp it on the steering column—or wherever—but carry one. It can save lives.

Overall, the best way to drive safely at night is to expect the unexpected. Make sure you and your car are ready to cope with whatever might come up. Remember, a guy could get hurt out there. ★★

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MR. RENT-A-WRECK

(Continued from page 85)

actually I'd sell someone a car and guarantee to buy it back at the end of the month. We'd make money like that for a while. Then we really got into it."

It was in 1965 that Schwartz changed the name of his company to Bundy Very Used Cars. "People had called us Rent-a-Very Used Car before, just kidding. Jeff Kramer, the actor, called us Rent-a-Wreck, and then people started also calling us that because we didn't care if the fenders of our cars were dented or different colors or the paint was all splotchy and the upholstery was torn. No one cared as long as the car ran all right.

"Then one day in 1973 one of our cars was stolen—a 1964 Malibu coupe. This car had been sideswiped on one side, and the door opened only from the inside. So a week later the car showed up abandoned. The police report said, 'Location of car: Hollywood Freeway. Condition: Wrecked.' But it wasn't wrecked—it was just the way it went out.

"So we had a laugh. The police were calling our cars wrecks, the customers were calling them wrecks, so we changed our name to Rent-a-Wreck, and it happened all over again—people just went crazy."

Old but safe

Today Dave Schwartz's rental fleet numbers 650 cars, 200 of them convertibles; half of those being Mustang convertibles. Rent-a-Wreck rents only older models, and no one minds that they're slightly frayed around the edges.

They have to be safe, though, and they do run well. Schwartz faces so much demand for his cars that there's a three-month waiting list for everything but one-day and one-week rentals.

Who rents wrecks? Dave says that a high percentage of his clientele consists of movie and TV people who find themselves in Los Angeles for short stints and don't want to rent or lease more conventional, conspicuous, expensive cars.

Dave likes to name his cars for the better known actors and actresses who've rented them. For example, there's the Ringo Starr 1969 Plymouth wagon, the Ali McGraw 1968 orange Mustang, the Paul Newman 1967 Cad convertible, the Don Meredith 1964 Rambler, the Sarah Miles 1966 Volkswagen sun-roof, the Anthony Hopkins 1963 Nova wagon the Gary Trudeau ("Doonesbury") Mustang fastback, and on and on.

How does Mr. Rent-a-Wreck screen his customers? "Mostly by voice reading," he says. He asks them whether they own an insured car of their own (most do), whether they have one valid credit card (his only financial check), and the rest is karma.

"I have never, never lost a car," he comments. "I even had one customer who robbed a bank with my car and then dropped that car back the same day. But I've dealt with people for so many years, selling cars . . . you know, I was stiffed a lot of times selling cars, so I've learned. Nine years in the used-car business is good training."

Dave's favorites

The least expensive cars in the Rent-a-Wreck stable go for \$47 a week with 200 free miles and 5 cents a mile thereafter. The most expensive models are Datsun 240-Zs at \$20 a day and 20 cents a mile.

The cars Mr. Rent-a-Wreck likes best are his Slant Six Valiants and Darts of 1960s vintage. Next come six-cylinder Chevy IIs before they put on airs and started calling themselves Novas. These are his most reliable, longest-lived models, and Schwartz says they'll run forever if properly cared for.

There's very little turnover in his fleet, but occasionally Schwartz does buy additional cars. He never purchases any on credit, though—he pays for them up front and owns all of them outright. People phone him constantly, offering to sell him their cars. "Now I buy only real low-mileage used cars. Just bought a 1962 Mercury Meteor with 44,000 miles. The front end was wiped out, but no frame damage, so I bought another Meteor for parts, put the two together, and I'll have about \$300 in it total."

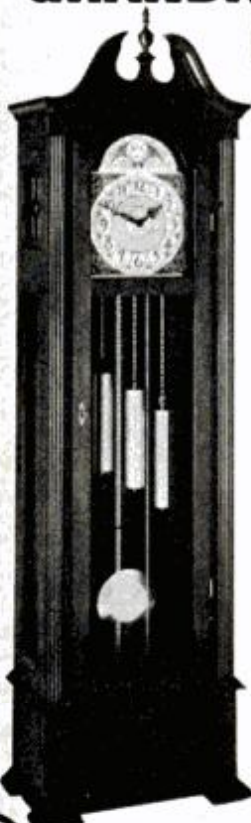
Rent-a-Wreck has a permanent staff of 11, including one bodyman, three full-time mechanics, and a 24-hour tow service. "If the fan belt goes on one of our rented VWs at four in the morning, all you have to do is call our number and the tow truck is right there. Try that sometime with a regular rental outfit."

The cars' quirks

Like the majors, Rent-a-Wreck sticks to a rigorous maintenance schedule. Each car, no matter how ratty on the outside, goes through regular inspections plus periodic brake and safety checks. Lubes plus

(Please turn to page 160)

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MR. RENT-A-WRECK

(Continued from page 158)

oil and filter changes are performed at given intervals.

When a customer picks up a car, he or she is told immediately what to watch for—the little idiosyncracies. As an example, while I was interviewing Dave Schwartz for this article, a UCLA student pedaled up on his bicycle to rent a middle-aged Ford 3/4-ton pickup. Dave told him to watch the oil level and warned him that the gearshift lever tended to overshoot third and often ended up in reverse. "You have to ease it up in gradually, and keep the stick close to you," he said. The kid loaded his bike in the back and eased out of the congested lot.

Service with a smile

What really sets Rent-a-Wreck apart from other auto-rental outfits is its ambience—the spirit of the place. It's a mess, frankly, but a happy mess. You can't take it too seriously. You drive in through the chain-link gate and ask yourself, "Is this place for real?"

The cars are mostly dented and brindled. And as if in a movie, here comes Woody Allen in a Caterpillar cap and bright yellow Adidas, and he launches right into what's wrong with the car you're about to rent. You figure it doesn't much matter whether you bring the car back with one more dent or not. It's all very casual.

Dave Schwartz lives on a 3/4-acre plot in a secluded Belaire neighborhood, 10 minutes from his rental lot. "I work hard," he admits. "I'm here all day every day, and I take advantage of every minute; don't waste a thing. It pays off."

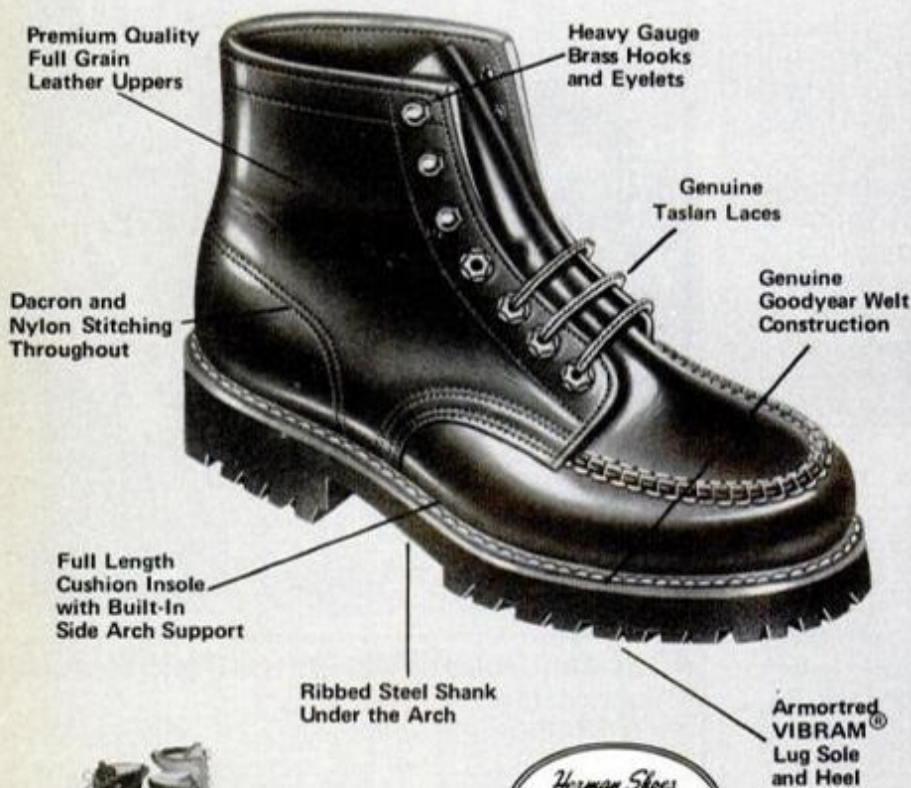
That's not to say he doesn't spend his summers in Europe or that he scrimps on his perennial trips to the East Coast.

He likes cars but isn't what you'd call a car nut. He's as likely to oooh and aaah over a punched out 1964 Riviera as over the 1968 Mercedes 250-SE convertible he bought as an investment. He's had a 1965 Porsche for years, and as a joke he keeps a Cad limo around his house.

The recent spate of publicity that's befallen Rent-a-Wreck has given rise to a number of imitators, most of them failing within the first six months. Dave gets calls from all over the country asking for franchises. He hasn't decided yet, though, whether to go into franchising or not. He realizes—and he's right—that it's very hard to franchise the spirit of a place like Bundy Rent-a-Wreck. ★★★

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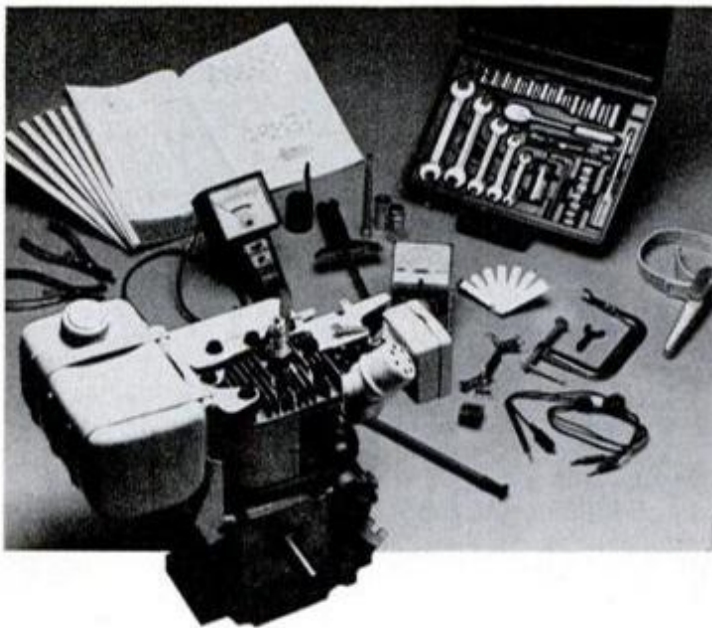
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20 WAYS THE WORLD COULD END

(Continued from page 89)

unusual speed, flooding the world before we have learned climate control.

In reverse, our industrial civilization is making our atmosphere dustier so that it reflects more sunlight away and cools the Earth slightly—thus making possible a glacial advance in a few centuries, also before we have learned climate control. At present, the two effects seem to be nearly in balance, and humankind is now making an effort to switch to nonfuel energy—geothermal, hydroelectric, nuclear and solar power. With these, we may avoid both dangers of melting ice caps and advancing glaciers.

Radioactive poisoning

Nuclear sources of energy can produce dangerous radiation, however. In particular, nuclear fission, which we are using now, not only offers a chance of core-meltings that might liberate radioactivity over a large area, but constantly produces radioactive materials that are highly dangerous and that must be kept out of the environment for thousands of years.

The spreading use of nuclear fission powerplants keeps raising the nightmare of death by radioactive fallout for millions, of large sections of the Earth turning radioactive through leakage of stored ash, of the stealing of nuclear fuel by terrorists for use as the ultimate blackmail weapon. The hope is that we will be able to switch to nuclear fusion (not yet shown to be practical), which may lessen the danger of radiation considerably, or to solar energy, which should remove the danger altogether.

On the other hand, warring nations may deliberately poison the Earth with radioactivity by using nuclear explosives in a vast and senseless confrontation that would leave no victors, few survivors and a ruined planet.

Deadly new war weapons

The advance of science in other directions may involve catastrophic dangers, too. War weapons need not be nuclear to lead to unimaginable destruction. The use of nerve gases, biological weapons and laser-beam "death rays" may, in the end, prove just as dangerous as atomic bombs.

Even the advances of peacetime have their dangers. Advances in computer technology may lower the role of humanity and make human beings almost useless. Almost any technological advance may produce

waste products that dangerously pollute the Earth. Chemical poisons fill the water and the soil. Automobile exhaust and factory smoke fill the air.

Survival of the unfittest

Pollution need not even be material, either. There can be noise pollution, light pollution, heat pollution, microwave pollution. Even the noblest efforts of medicine may be harmful. So many individuals may be allowed to live through the help of advanced medical techniques, some maintain, that the "weak" and "unfit" will flourish, filling the human gene pool with undesirable genes whose catastrophic potentialities may someday make themselves felt.

A rather unusual route to possible catastrophe, revealed only recently, involves the ozone layer. About 15 miles high in the atmosphere are small quantities of ozone, an energetic form of oxygen, that has the property of being opaque to ultraviolet light, thus preventing most of the sun's ultraviolet from reaching the Earth's surface.

Killer rays from space

It is suspected that the propellant gases used in aerosol spray cans, highly stable chlorofluorocarbons that remain in the atmosphere indefinitely, may break down ozone molecules into ordinary oxygen. If the ozone layer is destroyed in this way, great amounts of harmful ultraviolet radiation will flood the Earth. Even if man shielded himself from these rays, the probable extinction of many other species of life would so greatly alter the ecological balance of our planet that our own existence would be greatly endangered.

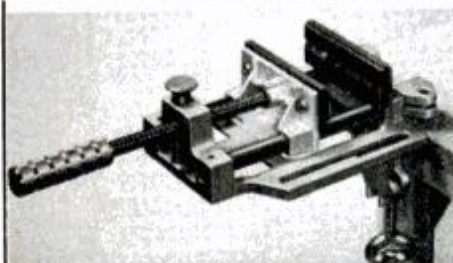
Still, humanity is aware of this possible danger now and may take steps to prevent it.

Incurable diseases

Another subtle danger arises from recent microbiological experiments involving the alteration of genes in bacteria. There is a possibility that some altered form of microorganism may be capable of causing a disease (cancer, for instance) against which the natural defenses of the body may not work. If such a microorganism escapes, it may be the Black Death all over again, or worse.

Although the chances of such an accident happening are admittedly small, the prospect is still fright-

(Please turn to page 164)



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20 WAYS THE WORLD COULD END

(Continued from page 162)

ening and the people engaged in such work have voluntarily agreed to suspend their experiments until appropriate safety measures can be put into force.

What, then, if nothing happens and humankind just continues to go on as always without any significant catastrophe at all? That, too, can be a catastrophe—perhaps the worst.

Ever since man has been on Earth, his total numbers have increased from century to century (the only exception being the Black Death century). What's more, the increase has itself been proceeding at an increasing rate. As of 1976, the total world population is at the record high figure of 4 billion and the rate of increase is at a record high of 2 percent a year, which means a doubling of the population in 35 years.

The real disaster—famine

By 2010, then, if things continue as they are, the world population will be 8 billion. It doesn't seem likely that 4 billion more mouths can be added to the present world population in only 35 years without widespread famine.

Under planetary famine conditions, the mad rush to extract food from the earth and the sea at all costs, and the drive to make use of any kind of energy, may permanently pollute and damage the Earth's ecological balance in ways a less desperate humanity would never countenance.

As the starving crowds multiply, the despairing attempt to hoard food or to steal from others will break down order and turn human beings into predators against each other. Some nations, in desperation, may not be able to resist pressing the nuclear panic button to force control over other nations. In the end, the pressures will cause the towering but rickety structure of civilization to collapse. This catastrophe we must fear most. All other possible catastrophes may or may not come. If they come, they may not do so for millions or billions of years.

But the horrifying prospect of world famine is real—and close at hand. Unless it is faced quickly and realistically, humanity could experience its greatest catastrophe within half a century. Solving the problem will call for finding new sources of food as well as some form of population control. Not everyone will agree with the latter, but it is vital the matter be given careful consideration—if man is to survive. ★★★

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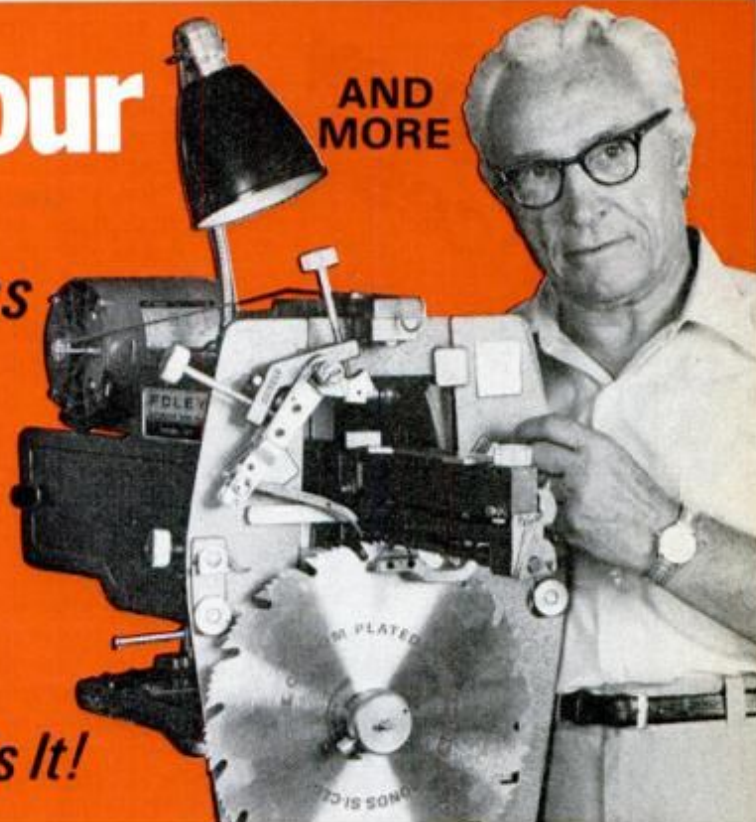
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GUIDE TO OFF-ROAD RUBBER

(Continued from page 110)

the L78-15 tire can take on 2230 pounds at 40 p.s.i.

Buying tires having a greater load range than you need is a waste. Each additional level costs about \$10 extra. Excessive plies can also make handling more difficult.

How much weight?

To determine load range, weigh your vehicle at a highway weighing station, coal or scrap yard. Weigh front and rear axles separately. Load your rig with the maximum weight it will be called on to handle, but be sure you *do not* exceed the "weight per axle" specification on the gross vehicle weight (GVW) label. Divide the amount by the number of tires on the axle (two or four). Then use a load and inflation table to determine the load range you need. Load and inflation tables may be obtained from a tire dealer or the Tire Industry Safety Council, Washington, D.C. 20004.

Suppose your light truck calls for 7.00-15 size tires, has an axle capacity of 3500 pounds and is being run fully loaded. Each tire on each axle supports 1750 pounds. The table will tell that you need a 7.00-15 load range D tire. A, B or C 7.00-15 will not accommodate the weight safely. If front and rear axle loads differ, your front tires needn't have the same load range as the rear.

Concerning tire valves: There are two types—snap-in and clamp-in. Snap-in valves have a limit of 45 p.s.i. A tire that may be inflated more than 45 p.s.i. (such as load

ranges D, E, F and G), should be equipped with clamp-in valves.

Materials

Most off-road truck tires have nylon or polyester cord bodies. Belts are of steel or glass fiber strands. Nylon cord tires are strong and resist heat, but tend to develop flat spots when idle. Polyester cord tires are strong, flat-spot-proof and resist heat but generally more expensive.

Glass fiber belts are strong, heat-resistant, but fairly stiff riding. Steel belts have the greatest resistance to impact, throw off heat and contribute to the longest tread life, but provide the stiffest ride at low speeds.

Tread design and footprint

Basically, there are two tread designs: conventional and traction. Footprint areas are narrow or wide. Footprint refers to the tire area in contact with the surface.

From tire to tire, conventional tread patterns vary, but all have a closed outer design and ribs that run parallel to the direction of rotation. These give good lateral stability and control around curves.

Traction design tires have some tread bars running parallel to the direction of rotation and some running laterally. Tread grooves are open at the shoulders, providing more traction in snow.

1. If you drive on the highway and sometimes off-road on rocks and ruts, but never in snow, sand or mud, you don't need tires with traction tread design or wide footprint area.

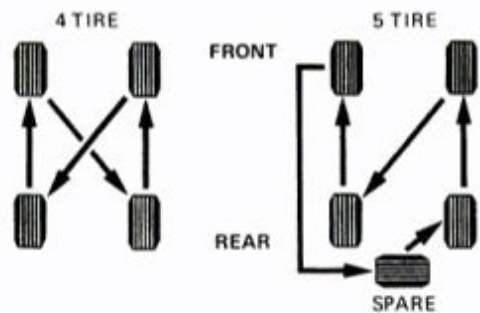
2. If you drive in snow and primarily on pavement, but sometimes on back roads, you can use traction tread design on drive wheels and conventional tread on driven wheels. For very snowy areas, you can gain more traction by using traction treads on all four wheels. Traction tread design and wide footprint provide the greatest traction in snow, but wide tires don't hold on paved roads as well as conventional tires when conditions are wet or icy.

3. If you drive a four-wheel-drive rig primarily in snow country, fit all wheels with traction tread.

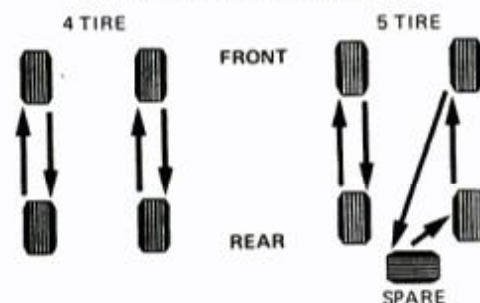
4. For sand, tires with conventional tread and wide footprint provide the most flotation. So-called "sand" tires, lightly ribbed or with no ribs, should be avoided if you also drive in rain, snow, mud or ice on or off pavement. "Sand" tires can be used safely in sand only.

5. In mud, but never snow, tires with conventional tread and wide

BIAS AND BELTED-BIAS ROTATION

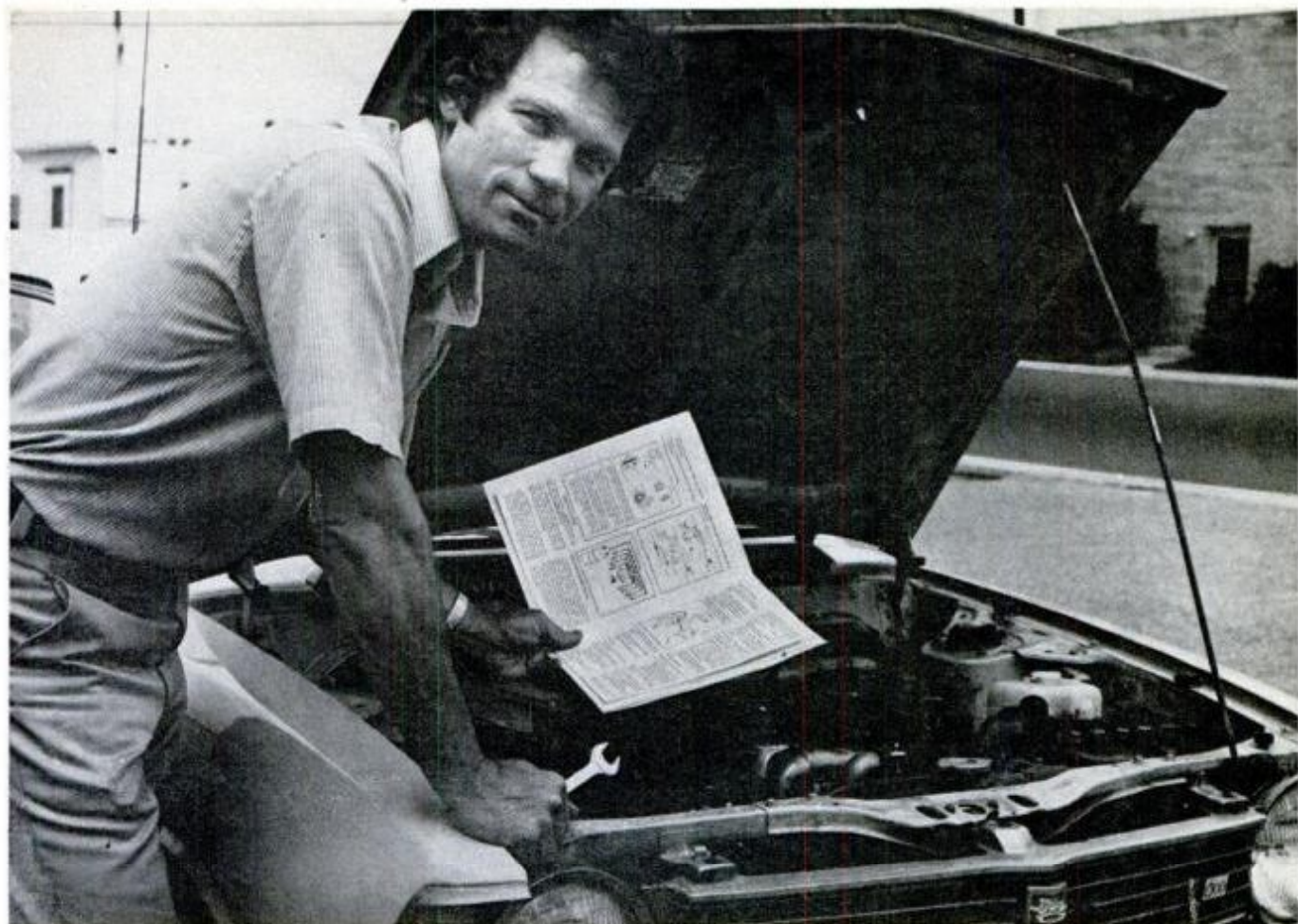


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(Please turn to page 168)



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GUIDE TO OFF-ROAD RUBBER

(Continued from page 166)

footprint provide maximum flotation.

6. For driving in snow and mud, you benefit most from tires with traction tread and wide footprint.

About wheels

Improperly mounted tires won't work, and your choice of wheels must have the exact diameter of your tires. On a narrower wheel, the beads are pulled together and the tread area crowns, increasing wear.

If the wheel is too wide, the tire's sidewall will be subjected to greater punishment and irreparable damage can occur. Exact means exact. Diameters of wheels for RVs and light trucks are often only 1/2 inch apart. If a 7.50-16 tire, for instance, is mounted on a 16.5-inch wheel, tire damage can occur.

Additional cautions

Radial tires require wheels approved by the tire maker. Unapproved wheels can lead to damage and an unsafe driving condition.

Big oversize tires are big, and may chafe in wheel wells or on the inside of fenders during sharp turns unless modifications are made. A good tire dealer can advise on this.

If possible, use one-piece wheels. Mounting tires on multipiece wheels needs special equipment and a specially trained serviceman.

Rotate tires and check inflation pressures regularly when tires are cold. Remember, proper inflation of truck tires depends on the load. Adjust tire pressures to the load you are carrying. If you don't, you will cause unnecessary tire wear.

Every tire store bearing the name of a major manufacturer should have at least one salesperson who is an expert on truck tires. Ask! If you get a blank expression or a person who doesn't seem to know, go elsewhere. Your off-road tires will provide long life, satisfaction and safety when properly selected, but they are expensive and seldom discounted. The reliable tire store will stock or order what you want, advise what you need, sell you the right-size wheels as well, if necessary, tell you if your choice will fit your RV's wheel wells, and won't try to switch you to something else if they're out of stock.

If you prefer buying by mail order, Dick Cepek, 9201 California Ave., South Gate, Calif. 90589, is an excellent source for RV, off-road, truck, dune buggy and four-wheel-drive tires and camping gear. Ask for a catalog. For the specialty tire buyer, it's a liberal education. ★★

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How to make 10 keys do the work of 27

The Sinclair Instrument wrist calculator offers the full range of arithmetic functions. It uses normal algebraic logic ('enter it as you write it'). But in addition, it offers a % key; plus the convenience functions \sqrt{x} , $1/x$, x^2 ; plus a full 5-function memory.

All this, from just 10 keys! The secret? An ingenious, simple three-position switch. It works like this.



1. The switch in its normal, central position. With the switch centered, numbers—which make up the vast majority of key-strokes—are tapped in the normal way.



2. Hold the switch to the left to use the functions to the left above the keys. . .

3. . . and hold it to the right to use the functions to the right above the keys.

The display uses 8 full-size red LED digits, and the calculator runs on readily-available hearing-aid batteries to give weeks of normal use.



Assembling the Sinclair Instrument wrist calculator

The wrist calculator kit comes to you complete and ready for assembly. All you need is a reasonable degree of skill with a fine-point soldering iron.

It takes about three hours to assemble. If anything goes wrong, Sinclair Instrument will replace any damaged components *free*: we want you to enjoy assembling the kit, and to end up with a valuable and useful calculator.

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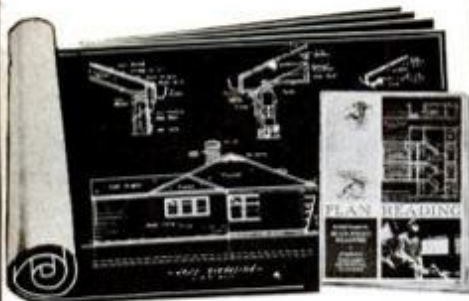
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CONCOURS

(Continued from page 84)

first primed, then gone over with a specified gray paint "tell" coat. This layer is then block-sanded to detect heretofore unseen "dips" in the primer coat. The "tell" coat is then sanded off and a new coat of primer put on, a stage that may be repeated up to five times before the painting even starts. Paint jobs of this type can set an enthusiast back as much as \$2500.

A good painter will also remove all door handles and chrome adjacent to painted surfaces so there's no chance of overspray. Some zealous Concours fans even keep a separate set of chrome trim which they take to a Concours, inserting the trim into predrilled holes just prior to judging.

So, he who spends more for paint wins a Concours? Not necessarily.

The Early Ford V8 Club and the Model A Ford Club, for example, have separate judging categories for clean *original* cars that still have their original paint and chrome. Club officials say the paint may be a little faded after 40 years, or the chrome a little worn, but the car still means a lot to someone who wants to see what it looked like way back when.

What about epoxies?

The newest things in paints are epoxies, but they are nothing for an amateur (or even an inexperienced auto paint shop) to mess with because, like fiberglass, the materials have a tendency to "set" rapidly once the resin and catalyst have been mixed. Anton steers away from epoxy on the exterior of the classics he restores, but does recommend it for the engine and chassis.

"I prefer it," he explains, "because there's nothing that will wash it off or stain it. If you have a gas or oil leak, it won't affect the paint."

Touch-up painting

If you've been street-driving your potential Concours machine, you've got rock chips. But that doesn't mean you have to repaint the whole car. If it's lacquer, it's possible to "spot in" a repair so it's almost undetectable.

First, clean the surface properly with a solvent like Stoddard's cleaner to get rid of any wax. Then dab in enough body filler to bulge outward of the tiny chip hole. Using a rubber sanding block and No. 400 to No. 600 sandpaper, lightly sand the filler down flat and then handbrush on the matching color (most cars have a color plate telling what paint num-

ber to use when you are ordering).

After the paint dries, buff it lightly with rubbing compound until it lies as flat as the rest of the paint. The reason this won't work with enamel, according to Anton, is that lacquers dissolve old lacquers and flow into the old finish while enamels tend to laminate.

Just soap and water

Any car that's street-driven is going to have tar and grease on it. Here Anton recommends Stoddard's Solvent. He usually cleans an entire panel rather than a single spot. Kerosene can be used if you already have it on hand, but Anton warns against using natural benzine or gasoline, both of which can ignite too easily.

Anyone who really cares about a car is not going to take it to a car wash.

"It's not the detergents," says Anton, "but the nylon brushes. If you've got a supergloss finish those brushes will turn it into a satin finish right away."

For genuine antique cars, Anton uses water sparingly.

"You put too much water on a wood-framed car and it'll never dry out," he cautions, "and you get dry rot just like in a boat."

To be safest, a bucket, some cold water, a mild detergent, a selection of sponges, a chamois and clean, dry Turkish towels are your best bet.

The water must be changed constantly so you won't grind dirt back into the car's finish. Baby diapers or open-mesh cloth (sometimes sold in 100-foot rolls in auto supply stores) are also recommended for drying and removing water spots.

Both Anton and Larzelere have full complements of brushes, from long, skinny ones for cleaning wire wheels, to toothbrushes for cleaning in and around engine parts. It's important to clean the brushes after each use so that you aren't rubbing in old dirt.

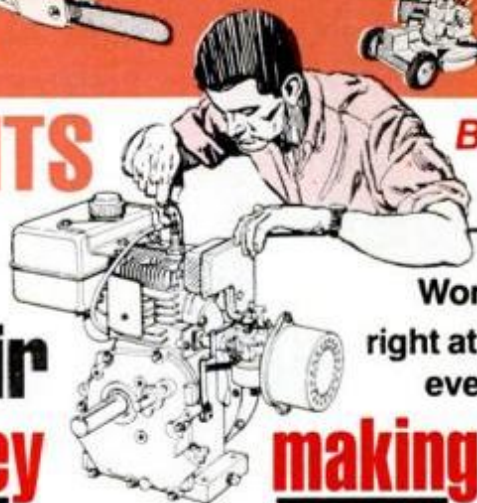
Cleaner: Another name for polish

Okay, you've washed the car thoroughly, but you're not sure it was waxed (maybe you just bought the car). The safest way from here? "Remove any wax with Stoddard's Solvent and then use Pre-Clean-O or a similar product to get down to the paint." A number of cleaning compounds are available, but Larzelere recommends DuPont No. 606 paste, which he rubs into the paint with a soft cloth. The polish or cleaner's function is to lightly "cut" into the paint, dissolving any film of wax or grime that may have ac-

(Please turn to page 172)



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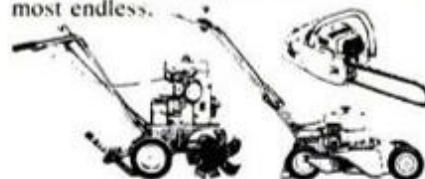
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CONCOURS

(Continued from page 170)

cumulated. As with road tar, it's best to do a panel at a time. When the cleaner has been rubbed on and polished, the next step for a Concours might be to use a glaze.

Glazes

A glaze puts luster on paint, but doesn't protect the finish like wax does. If you stopped after putting on only glaze, odds are your preparation would go for naught the first time you hit bad weather. Larzelere uses an old trick from the 1920s in applying the glaze. He applies cornstarch, right from the box, and lightly brushes it over the dried glaze to shine the surface still more.

Anton is especially partial to a silicone wax, made by Granatize Corp., that he uses to give a "super luster" to show cars just before a Concours. "It doesn't last long," he says, "but it looks great for a few hours." He uses the special wax atop the regular hard wax, which in turn is atop a glaze.

Waxes

The dedicated Concours entrant doesn't use "combination" polish-waxes; he uses the purest of each in separate steps. The favorite wax type of most Concours entrants is carnuba wax—a type of hard wax that comes from a South American plant. Commercial brands such as Blue Coral (available from GM dealers), Classic car wax, Turtlewax, or DuPont's straight wax contain either carnuba wax or waxes almost as hard.

Apply the wax to the glazed surface with a new, soft, dampened cloth folded to a 4-inch square. Again, do a panel at a time. After the wax in each section dries, hand-buff it to a luster (you can get carried away with a machine). Use short back-and-forth strokes, not circular strokes (which leave whorls and residue in the middle).

A cautionary note about the weather: If it's too hot to touch the car with the palm of your hand, it's too hot to polish or wax it. According to Anton, some polishes have an affinity for paint; if it's too hot, and polish touches a car, it will seep into the paint instead of on top of it and discolor it permanently. Either move your car to the shade or wait until late afternoon.

Applying liquids

A minor but important point is how to apply liquid wax. According to Anton and Larzelere, the best

(Please turn to page 174)

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CONCOURS

(Continued from page 172)

technique is to first pour the liquid onto a clean, dry cloth and then apply it. If you do it the other way around—apply the liquid directly to the car—it could create a residue, a sort of "high tide mark," that won't polish out for months.

Chrome

Anton, who has "prepped" thousands of new Cadillacs, uses 3M's Fill N' Glaze as a chrome polish. "It has a silicone finish and contains no abrasives," he says. He then waxes the chrome.

Aluminum is harder to polish and requires a special paste such as Semichrome, Met-All or Never-Dull. Ironically, Anton once polished an aluminum trunk rack so well that he got marked off by an overzealous judge who noted "poor chroming," not realizing he was looking at well-polished aluminum.

Concours judges do not stop at the outside of the car—they take delight in finding something amiss under the hood. A completely restored car will usually have the engine removed in order to detail out the engine compartment, but Larzelere says that's not always necessary. He leaves the engine in and merely removes everything that unbolts (rocker covers, exhaust manifolds) and details them separately.

What does "detailing" mean? It means making things look as good as they can possibly look, such as taking a grimy, pitted exhaust manifold and first sandblasting it, then painting it flat black or white with VHT enamel (a space-age paint originally developed for missile nose cones). Or it means taking each nut off a rocker-arm cover and cadmium-plating it. While chrome plating can raise the hackles of an overzealous Concours judge, nickel plating or cad plating or anodizing (for aluminum parts) not only look "more original," but cost less. They give a duller appearance at first glance than chrome, yet make things look brighter and cleaner under the hood.

All the extra touches count, too. Larzelere, for example, installs little clips to tie sparkplug wires and coolant hoses together so they aren't running "haywire" all over the engine compartment.

Rubber and tires

If you live where there's smog, the rubber on your car is probably cracking. Fortunately, many car clubs have located obsolete dealer stocks of rubber window moldings,

(Please turn to page 176)

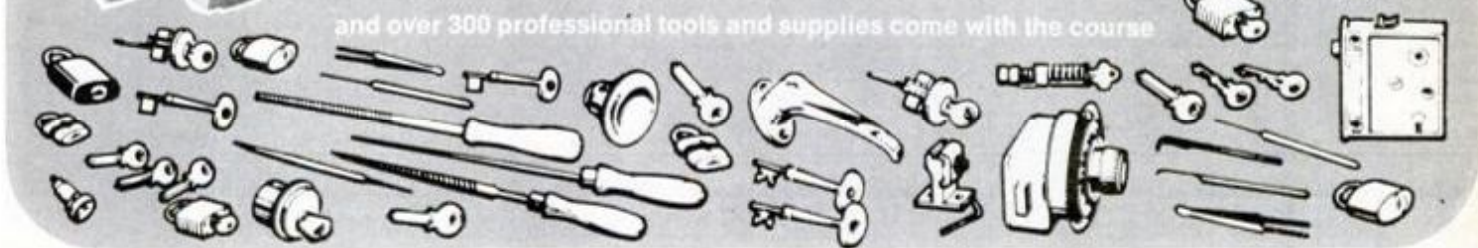
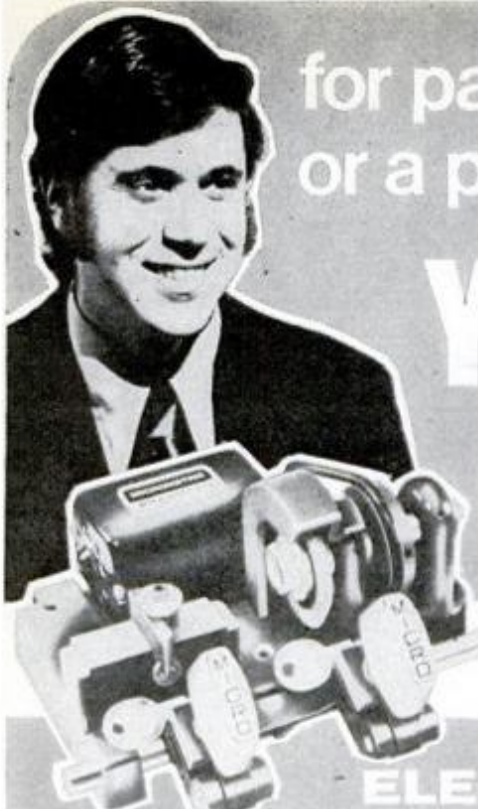
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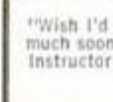
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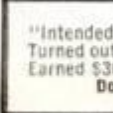
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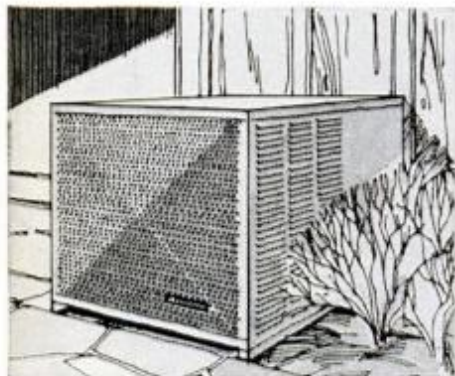
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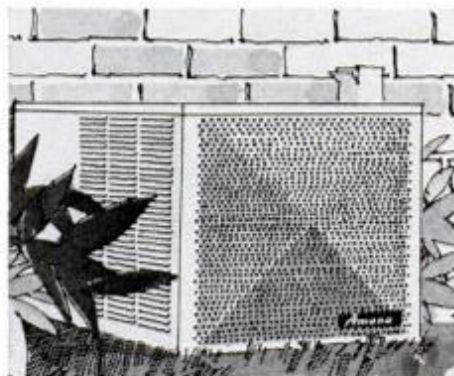
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CONCOURS

(Continued from page 174)

or even make their own new replacement sets. If all else fails, some auto-supply chains sell rubber moldings in cut-to-your-choice lengths.

Tires and existing good rubber can be restored to a shiny look with Armor-All or RVL; both come in spray-squeeze plastic bottles. Spray it on and wipe off with absorbent cloth.

Leather

If you have good leather, it can be cleaned with a mild detergent and water. Household cleaners like 409 and Fantastic help on embedded dirt spots. After the leather has been cleaned, saddle soap or Lexol can add a sheen. A favorite among "purists" is a material called Hyde Food, said to restore "life" to leather. If it is cracked, try writing the automaker or owner's club to determine the color the leather was dyed; a touch-up kit may be available.

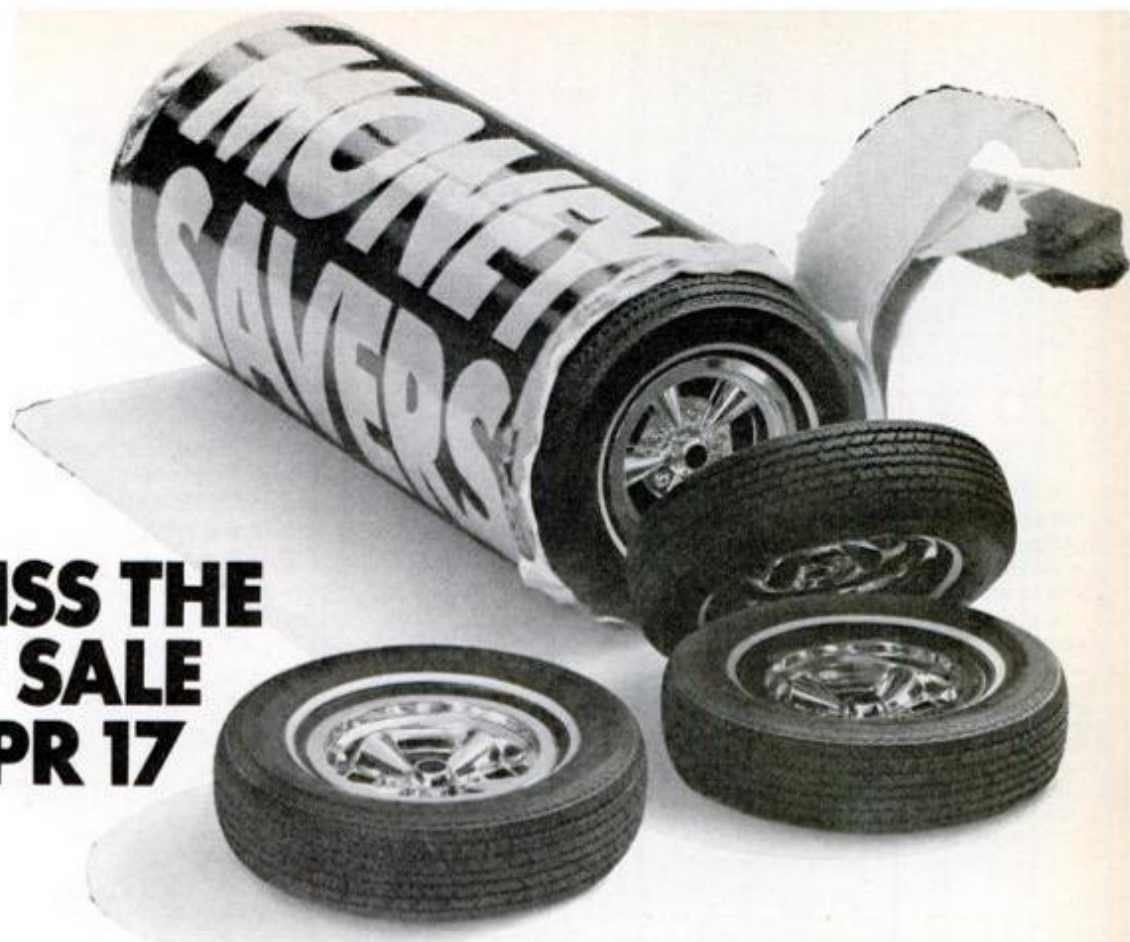
Wood refinishing, like leather, is a topic unto itself, but if you've got good wood, all the experts recommend cleaning it with a standard household spray-on furniture polish such as Pledge.

By the time the judges move around to the trunk of a car, perhaps they are getting bored. So the wise contestant, hip to their jaded sensibilities, dazzles them with the completeness of his toolkit. Most British cars right up to the '60s came with complete toolkits. Owners who have substituted new tools for the originals have committed a no-no. It is better to have a full, original toolkit—or none at all.

Many one-marque clubs (such as Corvair or Mustang) will award extra points if a car has certain emergency equipment, such as a fire extinguisher, lug wrench, flares, tow rope, or complete toolkit. While this may give a "hardware store" look to a Concours, it does encourage car owners to travel well prepared.

What if—after all your blood, sweat and tears—your four-wheeled pride-'n-joy doesn't even win a blue ribbon? Well, that's what a Concours is all about. Your job then is to find out what cars *did* win in your class and determine what their owners did to earn the extra points. You'll have to talk to other owners, maybe find out what they used to make wheels so shiny, or if they have a secret polishing glaze.

Add up these tips and apply them to *your* entry. Then perhaps in the next Concours judging or the one after that, *your* dream machine will have the judges' eye. ★★★



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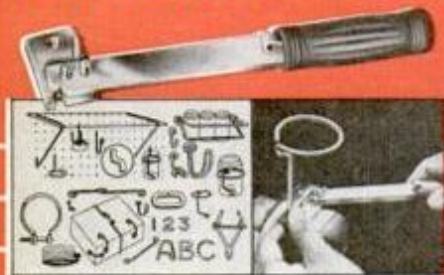
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'77 MOWERS

(Continued from page 120)

pings in a rear-bagger or (3) disperses clippings to the side. By attaching a four-bushel bag to the side chute you can also pick up leaves.

The Four-in-One is equipped with two forward speeds, a 3.5-hp Briggs and Stratton engine and either manual or electric start. The reversible grip bar is a safety feature that more and more manufacturers are using in self-propelled models. When the bar is released, drive stops.

Suggested retail price of the manual start Four-in-One is \$299.95; that of the electric start is \$349.95.

Simplicity has built new features into its line of riding mowers, which include the 8 and 10-hp Broadmoor II and the 8-hp Regent. The most significant is the application of a rear-mounted grass catcher.

The riding units have power-take-offs and can be used for tilling soil, pulling carts up to 1000 pounds, pulling vacuum collectors, and accommodating a dozer blade and snow throwers.

Suggested retail prices for Simplicity riding units are as follows: 8-hp Broadmoor, \$1390; 10-hp Broadmoor, \$1600; 8-hp Regent, \$990.



SOUTHLAND

This company features a mower that highlights an interesting development in mower design. It's a high-wheel mower, which has large-radius rear tires to reduce operator effort. This is not a self-propelled model. Southland is one of the few manufacturers of high-wheel units. Minimum retail prices range from \$150 to \$215 for different models.



SNAPPER

Snapper has put vacuum power behind its '77 High Vacuum Riding Mower. Models of 8 and 10 hp are available with a 28-in. cutting width.

Leaves, clippings, pine cones and other light litter are forced from the blades into the 30-bushel grass catcher by vacuum action without the use of an auxiliary fan or additional engine. The top of the catcher is removable so the cart can double as a tool, firewood or fertilizer hauler. A patented height adjustment system allows you to change cutting height while you're mowing.

The 8-horse mower sells for \$724, or \$994 with bag and wagon. The 10-horse rider runs about \$840 by itself and \$1090 with the vacuum-fed bag. Snapper is the brand name used by McDonough Power Equipment, Inc.



TORO

New from Toro for 1977 is a front-engine-mounted rider mower equipped with either an 8 or 10-hp, four-cycle Briggs and Stratton engine. One unique feature is a canister muffler mounted in front of the engine so heat and noise are directed away from you.

Another is the use of several automotive-type components that reduce frequency of repairs. For example, a traction clutch engages the trans-axle drive by means of a pressure plate rather than a belt idler. Steering and braking mechanisms also

(Please turn to page 180)

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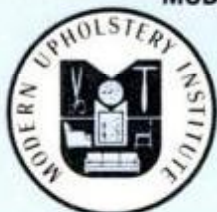
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'77 MOWERS

(Continued from page 178)

use automotive concepts. A helix screw steering rod, for instance, is said to reduce steering effort and provide better control than the usual direct-drive steering employed on riding mowers.

Toro's new rider cuts a 32-inch swath. The height of the cut is adjustable from 1.6 to 4 inches. Both models feature electric start and five forward and one reverse speed.

A rear bagger is optional at \$160. This one holds 5½ bushels of clippings and has a lever that permits the operator to dump the load without leaving his seat.

Suggested retail price for the 8-hp unit is \$1100. The 10-hp model sells for \$1250.

For more information

One way to investigate the market is to go from store to store and look at what's available. Another way is to get and study specification sheets published by the manufacturers. Here is a listing of many prominent mower makers you can write to. Address your request to the product manager.

■ AMF, Lawn and Garden Div., Box 357, Des Moines, Iowa 50302.

■ Ariens Co., 655 W. Ryan St., Brillion, Wis. 54110.

■ Black and Decker Manufacturing Co., Towson, Md. 21204.

■ John Deere and Co., Moline, Ill. 61265.

■ FMC/Bolens, 215 S. Park St., Port Washington, Wis. 53074.

■ Gravely, Gravely Lane, Clemmons, N.C. 27012.

■ Hahn, Inc., Outdoor Products Div., 1625 N. Garvin, Evansville, Ind. 47717.

■ International Harvester Co., 401 N. Michigan Ave., Chicago, Ill. 60611.

■ Jacobsen Manufacturing Co., Racine, Wis. 53403.

■ Leisure Group, Inc., 1410 W. Ganson, Jackson, Mich.

■ MTD Products, Inc., 5389 W. 130th, Cleveland, Ohio.

■ National Mower Co., 700 Raymond Ave., St. Paul, Minn. 55114

■ Simplicity Manufacturing Co., Port Washington, Wis. 53074.

■ Southland Mower Co., Inc., Selma, Ala. 36701.

■ Sunbeam Outdoor Co., Sunbeam Corp., 5400 Roosevelt Rd., Chicago, Ill.

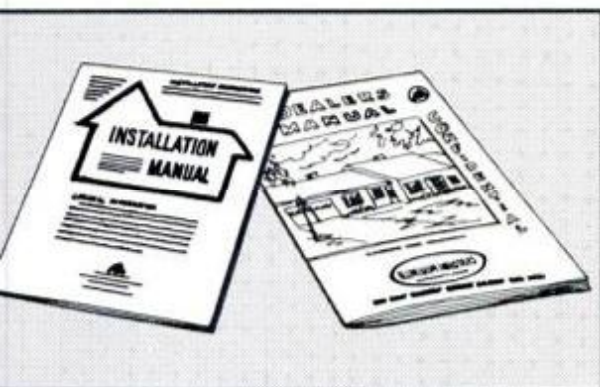
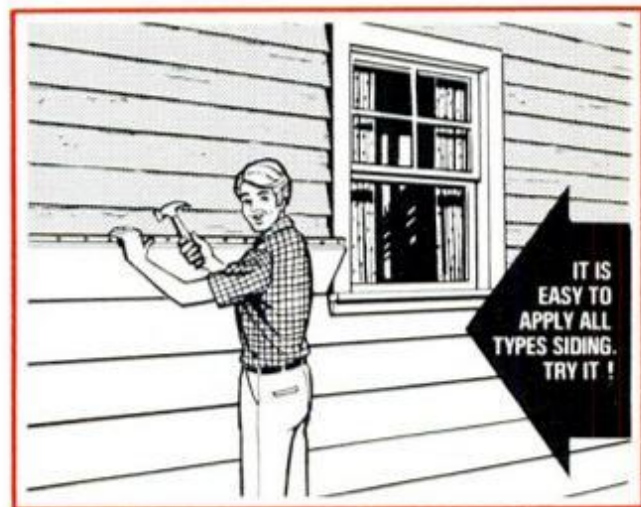
■ Toro Co., 8111 Lyndale Ave. S., Minneapolis, Minn. 55420.

■ Yazoo Manufacturing Co., Box 4207, Jackson, Miss. 39216. ★★

EARN \$1000 OR MORE PER ORDER IN YOUR SPARE TIME SELLING OUR SIDING HOME-KITS.

Our HOME-KIT is a complete covering of aluminum, steel, or vinyl siding for a home. They're available in 14 sizes and 22 colors. They're easy to apply and easy to sell because our dealer prices (your cost) allow you to buy at about 1/3rd of the national average installed price. Each new dealer must install a HOME-KIT on his own home in order to gain application experience and have something to show to his prospective customers.

Fill in the coupon on this page and send it to us. We'll promptly mail you your FREE FRANCHISE (if still available in your county) and FREE DEALERSHIP. You'll also receive FREE SAMPLES of our product and our 48 page CONFIDENTIAL DEALER'S MANUAL AND WHOLESALE PRICE LIST. The manual is extremely valuable. It explains how to apply siding, discusses each type of siding material available, and tells you how to sell it.



Your first HOME-KIT includes a complete set of professional siding applicator's tools and detailed, yet easy to follow, step-by-step, illustrated instructions... all free of additional charges. Plus, a FREE 50 lesson course on everything you'll ever have to know about selling and applying siding.

Once you decide to become an Aluminum Industries dealer, all of our merchandising, advertising and sales experience (over 30 years of it) becomes available to you... FREE!

SELL YOUR CUSTOMERS ON MONTHLY PAYMENTS.

HOME-KITS can be sold on monthly payments. No down payment is required. Details are in your free CONFIDENTIAL DEALERS MANUAL AND WHOLESALE PRICE LIST.

PLEASE... do not delay. We can only award a limited number of active franchises in any county. As soon as we receive your inquiry, we'll reserve your franchise for you until you decide whether or not to become a dealer. But act now, before your county is closed.

NOTICE

If, after applying a HOME-KIT to your home you decide that you would rather not become an Aluminum Industries dealer, you are under no obligation to do so. But we think that once you see how easy a HOME-KIT is to apply and how beautiful and maintenance free it makes your home, you will find it is quite easy and very profitable to sell HOME-KITS to your friends and neighbors.



ALUMINUM INDUSTRIES OF ARKANSAS

Dept. PM-37
300 Phillips Rd.
North Little Rock, AR 72117

APPLICATION FOR DEALERSHIP [PM-37]

WITHOUT OBLIGATION, please mail me all of the materials mentioned above including my FREE 48-page CONFIDENTIAL DEALER'S MANUAL AND WHOLESALE PRICE LIST, FRANCHISE & DEALERSHIP, AND SAMPLES. I own a home which needs to be re-sided and I understand that I must purchase a HOME-KIT for my home before I can sell them to the public. **NOTE:** No salesman will knock on your door, we distribute exclusively by mail.

My name is: _____ (please print)

I would like to be considered for a: Part-time dealership Full-time dealership

Address of property I own which needs re-siding: STREET _____

CITY _____ STATE _____ ZIP _____

This property is in _____ county.

My mailing address is: STREET _____

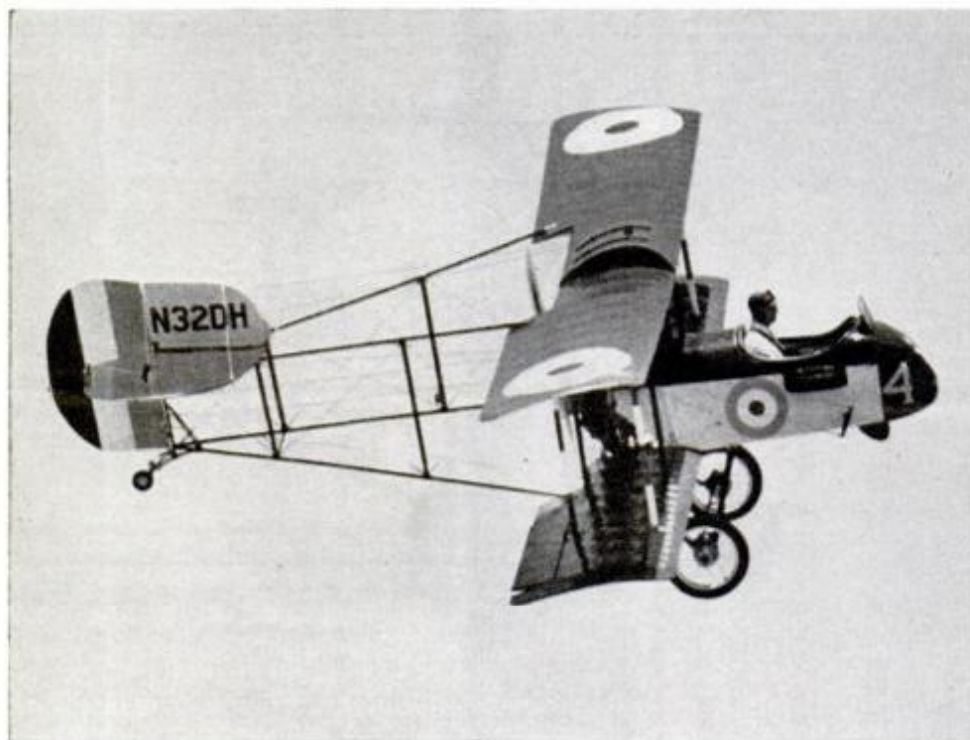
CITY _____ STATE _____ ZIP _____

My present occupation is: _____

My phone number is: _____

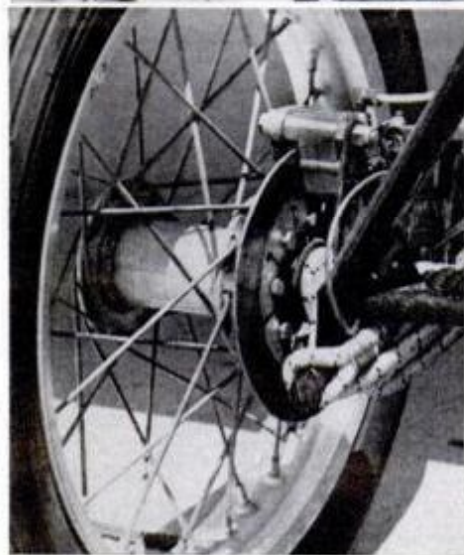
SIGNATURE _____ DATE _____

IT'S NEW NOW



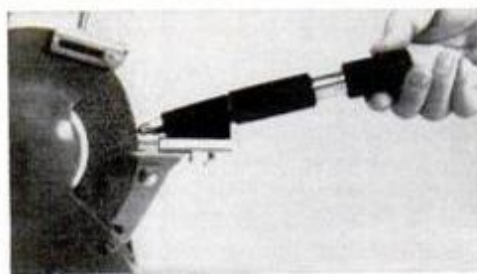
Hot new fighter plane, circa 1915

After nine years of work and \$5500, a 1/4th-size British de Havilland DH-2 fighter plane had a roll-out from Joe Mason's California garage and took to the air. The fussy engine, a 90-hp 1930 LeBond 5F, requires a preflight check that includes pulling the plugs (top right) to wipe off oil that passes the rings. But the replica will cruise along smartly at 70 mph for 210 miles on a single tankful of fuel, and the brakes (right) are strictly modern hydraulic disc type—from a kart.



Prescription ski goggles

If you need glasses to get around, they are especially useful to see where you're going on a ski slope. Uvex Racing Star Optik now has stylish goggles that accommodate prescription lenses. An adjustable strap keeps them in place, and filtered vents prevent fogging. Funoptics, Box 3883, Santa Barbara, Calif. 93105.



Quick dress for grinders

Bumps and grooves on your grinding wheel are smoothed off in a hurry with a new precision diamond-tipped grinding wheel dresser. The low-cost diamond tip is replaceable and puts a fast, accurate renewed surface on any type of bench or pedestal grinding wheel. It sells for \$9.95 from Dymex Marketing, 1956 Yonge St., Toronto, Ont., Canada M4S 1Z4.

Franklin stove, plus

New wood-burning heaters have thermostatic damper controls that maintain an even temperature on little fuel—at up to 60-percent efficiency. Shenandoah Mfg. Co., Box 839, Harrisonburg, Va. 22801.



AM radio from afar

New antenna boosters are claimed to haul in AM signals up to 3000 miles. Select-A-Tenna induction model (\$19.95) sits on set; Deluxe unit (\$117.50) pre-amplifies signal. Three models from Edmund Scientific, Barrington, N.J. 08007.

**DENMARK
GERMANY
SWEDEN
ENGLAND
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WOODWORKING

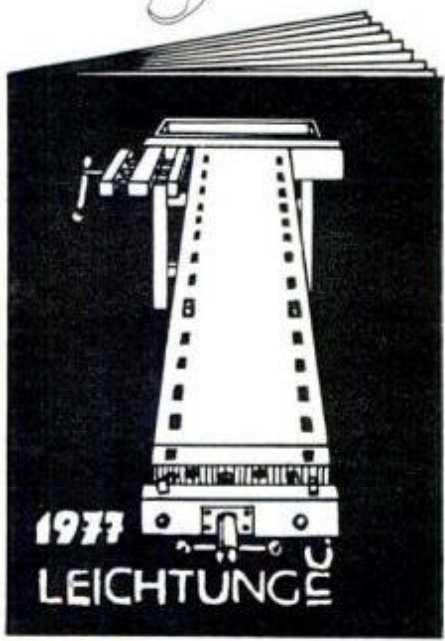
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Suite 377, Cleveland, OH 44143**

Build this easy auto circuit checker

by Rudolf F. Graf and George F. Whalen

For a quick diagnosis of car wiring problems, this compact hand-ful is just what the doctor ordered. Combining a polarity indicator with a continuity checker, it can tell you which wires carry 12 volts and which are connected to ground; it can tell you whether wires that *should* show +12 volts are accidentally grounded; and it can help you find broken wires or open circuits.

Our quick circuit checker isn't fragile or bulky like a meter and needs no outside light for you to read it. Just clip a lead to ground or to one side of the circuit you want to check, touch the probe to any other point you're checking, and a light-emitting diode (LED) flashes on—red if the probe tip is at +12 volts, green if the point is grounded or there's continuity between the probe and clip lead.

The circuit is simple, using the



Is that wire hot? Ground? Nowhere? Press the button, and an LED will tell you.

car's own 12-volt power for the red LED, and a 9-volt battery in the checker for the green one.

The red, positive-indicating LED responds to the presence of voltages greater than +6 volts between the probe and clip. It is switched on and off by transistor Q3, which allows current to pass only when it is biased by 6 volts or more.

The green LED is switched on and off by transistors Q1 and Q2 in a Darlington-pair configuration. Wired this way, they minimize the drain on the checker's battery.

You could build a simpler checker without any transistors at all, but, with transistors as switches, the LEDs come on at full brightness whenever there's good continuity or a reasonable external voltage level. Without them, the LEDs would glow feebly for low voltages and high-resistance paths, and the check-

er's readings would be harder to interpret clearly.

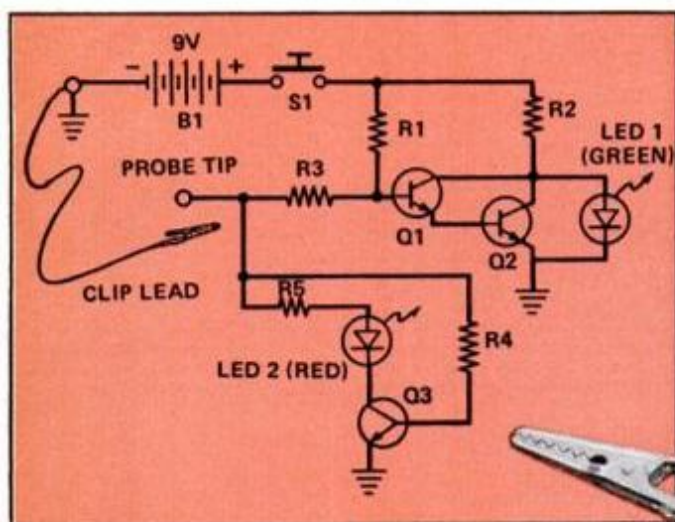
Construction

Compactness and a package that fits your hand are features of the checker's design. But, of course, you can vary the packaging.

The authors' version is packaged in a 1¼-in. dia. x 2⅞-in.-long plastic pill vial with a snap-on top. Emptied of its medication, the vial easily accommodates the 9-volt battery, LEDs, transistors, resistors and switch. The probe tip is a 1¼-in. finishing nail. (If you want an insulation-piercing probe, sharpen the tip to a fine point on a bench grinder.) Components, mounted on a scrap of perforated board, nestle snugly into the bottle. The LEDs and switch are mounted in the snap-on cap. The accompanying drawing shows the parts and how they are laid out.

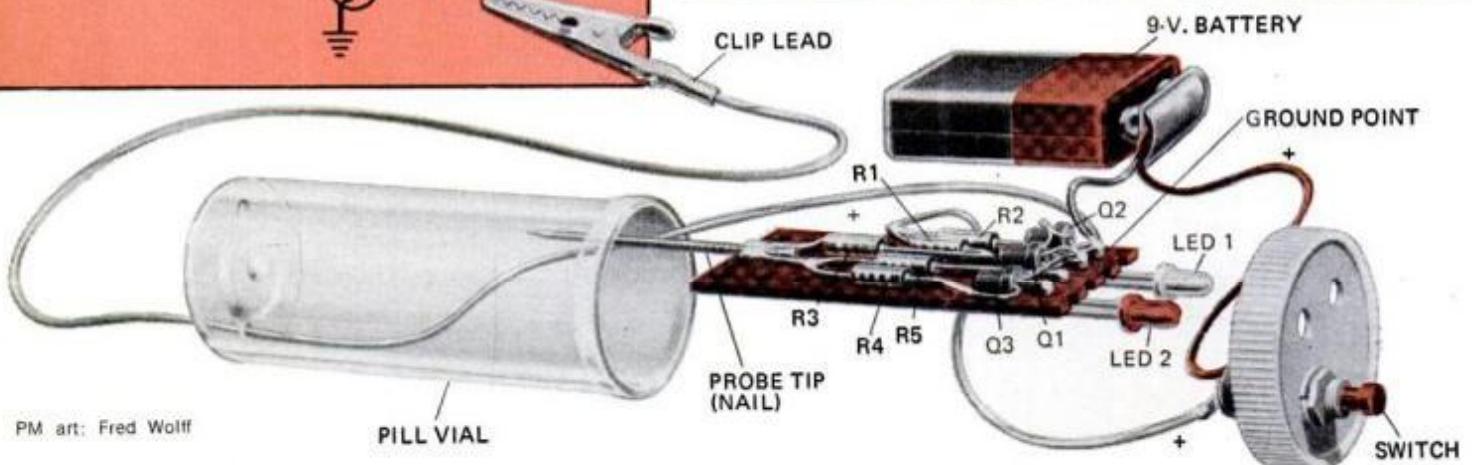
Clip the lead wire to one end of the car's circuit to be checked (ground to chassis, for example) and use the probe to touch significant points in the rest of the circuit, pressing S1 as you do so. Where there's a positive voltage, the red LED will light; where there's ground, the green LED will light. Neither will light with an open circuit.

A bit of practice will make you a whiz at checking out auto electric circuits with this natural, easy-to-use helper. ★★★



CIRCUIT CHECKER PARTS LIST

- B1**—9-v. battery (Eveready 2U6 or Mallory MN 1604)
 - LED 1**—Green light-emitting diode (Lafayette 32-06349)
 - LED 2**—Red light-emitting diode (Lafayette 32-06331)
 - Q1,Q2,Q3**—NPN transistor type 2N2926 (Radio Shack 276-2013 or HEP 726)
 - R1**—100,000-ohm, ¼-w. ± 10% resistor
 - R2,R5**—150-ohm, ¼-w. ± 10% resistor
 - R3,R4**—15,000-ohm, ¼-w. ± 10% resistor
 - S1**—Miniature s.p.s.t. normally open pushbutton switch
 - Misc.**—Plastic pill bottle (2⅞" long x 1¼" dia.), perfboard (2½" x ⅞"), ground wire with alligator clip, battery snap terminals, wire solder.
- (Note: ½-w resistors may also be used.)



PM art: Fred Wolff

PILL VIAL

PROBE TIP (NAIL)

SWITCH

PM OWNERS REPORT: OPEL 18UZU

(Continued from page 113)

comfortable seating. The Opel is very well instrumented, with instruments backed up by warning lights. One of the reasons we purchase the Opel was the apparent quality of workmanship. We have not been disappointed."

What about general complaints? The greatest percentage of Opel Isuzu owners said "none" when we asked them to list their complaints—18.9 percent found no faults at all.

Of those who did, 13.8 cited rattles and rumbles, particularly in the trunk. Poor dealer service, too little rear legroom, and an annoying ventilation system were other (but minor) gripes. On the vent system, the fact that the blower won't turn off, turned off 5.5 percent of our respondents. "On a cold morning," wrote one owner, "there's no way to keep the ventilators from blowing icy air in your face until the engine warms up."

We asked owners what they'd like to see changed, and received these responses.

"Radio speaker up front as well as in the rear," suggested a Fresno teacher. Several owners mentioned that because of the tiny space behind the dashboard for a radio, they had to buy Opel's—no aftermarket radio would fit. The Opel AM/FM costs \$179 and comes, they complained, with only one speaker.

"I'd like to see more legroom for back-seat riders," opined an Oregon diesel mechanic, adding, "but most small sedans and wagons

A hatchback would give space for bulkier cargo and might eliminate the noisy-trunk rumbles.

Engine noise, while not severe, seems to be caused by the EGR and a vacuum diaphragm in the air cleaner; also mechanical instead of hydraulic valve-lash control.

The trunk lid is thin, so there's apparently some drumming; also too little sound-deadening via carpeting, and so on.

Some owners found parts hard to get, though, with long waits for minor items.

have the same problem." Others said they'd like the Opel Isuzu in hatchback form.

Other suggested improvements included, "... a light in the trunk, ashtrays for the rear seat, return of the Opel GT, front-wheel drive for better snow traction, four doors and a station wagon, quieter engine, softer ride, redesign the grille so it's less toothy looking. . . ."

Buick-Opel dealers came off very well in our survey, with 76.1 percent of owners rating dealer sales policies good to excellent. Michigan secretary: "I've had six cars since I began driving and have never been treated this well. I felt like I was buying a new Rolls-Royce!"

The dealer service department also came off well, but only 61.1 percent called service good to excellent. And 45 percent had mechanical troubles of some sort, carburetor maladies heading the list. Dieseling and stumbling were the more common carburetor ills.

To sum up, a Georgia computer operator, who writes, "This Opel by Isuzu is a sporty economy car. I've had no problems at all with it in 4000 miles but appreciate the availability of parts and service at Buick dealers across the country. I'm over 6-2 and rate the front seat very good, with a little more room needed in the rear. This is my second Opel, and I find its driveability much improved over the older German one—also feels like a much larger car. What makes me especially happy is that I can drive 60 mph with the air conditioner running and still average 26 mpg." ★★

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When the first cassette recorders came out, everyone marveled at how small they were. Now there's a flood of far tinier recorders using tapes resembling Lilliputian versions of the original cassette. They're so light (just over half a pound) you can tote them anywhere to preserve all those out-of-the-moment ideas.

But more than size separates the new systems from the old, standard-size cassettes: Because their tiny heads move at a slower speed, they're not suited for taping music unless you only care about the lyrics, not the sound quality. And unlike standard cassettes, interchangeable between tape units of all makers, the new cassettes come in four different, totally incompatible forms.

The new minis and micros are,

quite frankly, intended just for taping speech. They were originally designed for businessmen who wanted portable dictation units. They're equally handy for students, travelers who want to keep an oral "diary" on tape, friends who swap recorded "letters" or anybody else who needs a recorder that's never too big to take along. Even the smallest standard-cassette recorders will be bigger and bulkier than the biggest of these.

Tapes for the palm-size recorders will be harder to find than those for regular cassettes. And having four different types of tiny tapes on sale, under several brands, makes finding the right one even harder. Knowing which is which also matters if you're going to swap or share tapes with a friend.



Regular cassette dwarfs the tiny new ones. But none of the four new types shown can be used in the same recorders.

Alas, manufacturers don't tell you which tapes match which machines, and most salesman don't know. But the salesman will know how long the tape runs. That's the giveaway:

If the tape runs 15 minutes on each side, it's part of the "mini-cassette" family shared by Norelco, Unitrex, B&B Rhapsody, Radio Shack and Certron tapes. If it records on one side only, for 30 minutes, it's a DeJur Amsco tape, used only on DeJur's Stenorette 2050.

Spotting micro-cassettes

If the matchbook-size cassette records 30 minutes per side, it's probably one of the Olympus "micro-cassette" family which includes recorders by Olympus, Panasonic, Lanier, Sony and Courterport. The one exception is the Sanyko Seiki cassette, which only fits the Sanyko MTC-10.

All the small recorders except the Norelco-compatible group have capstan drive: The tape is pressed against a revolving capstan by a rubber roller and pulled across the tape recorder's heads, just as in bigger machines. Capstan drive means more constant speed and better sound quality, but it costs more.

"Mini-cassette" tapes are driven by the takeup spindle. The motor turns at fairly constant speed, but as tape builds up on the takeup hub, more tape gets pulled across the heads for each revolution of the hub and spindle. And as tape speed varies, so does sound quality.

When you purchase such a unit, make sure it's operating at the correct speed. Record a sentence on one recorder, then play the tape back on another. If the sound is okay, then so are both recorders. But if the tape sounds speeded up or slowed down, try another recorder to see which one is off.

All the tiny machines are designed for one-hand operation, but you'll

(Please turn to page 188)

Those tiny new cassette systems—they're not all alike

by Cindy Morgan



Who shrank the tape cassette? Thirteen recorder makers did to bring you recorders so small you can always take one with you wherever you go.

Wow!

The RCA Music Service is having a

5¢ SALE

Take any 6 tapes or records for only 5¢ — plus postage and handling — when you agree to buy just 4 more hits at regular Music Service prices and take up to three full years to do it.



Save on Your Choice of 8-Track Tapes or Records or Cassettes
Start Saving Now! Take any six 8-Track Tapes or Records or Cassettes for just 5¢ with trial membership. (Sorry, no mixing.) Indicate your choices on the coupon, enclose your nickel, and mail it today!

Colorful Magazine! Free Choice! Every four weeks illustrated MEDLEY brings news of over 400 selections and features a "Selection of the Month" in your favorite music category. And, five times a year, you receive sale issues featuring a "Bonus Selection" and alternates at great savings. In all, you will have 18 purchase opportunities in the course of a year. No need to buy a selection every time. You merely agree to buy 4 more hits in the next three years at regular prices — usually \$6.98 for records, \$7.98 for tapes. Choose from top labels like RCA, Capitol, Warner Bros., Reprise, A&M, Atlantic, Atco . . . over 60 more!

Automatic Shipments! To get the regular "Selection of the Month" or the special sale "Bonus Selection," do nothing; it will be sent automatically. If you want other selections, or none, advise us on the card always provided and return it by the date specified. You always have at least 10 days to decide. But, if you ever have less than 10 days to make your decision, you may return your automatic selection at our expense for full credit.

Cancel whenever you wish after completing your membership agreement by notifying us in writing. If you remain a member, choose 1-selection FREE for every 2 you buy at regular Music Service prices! (Postage and handling charge added to each shipment.)

Free 10-Day Trial! If not satisfied, return your 6 hits after 10 days for prompt refund. Mail coupon today.



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THOSE TINY NEW CASSETTES

(Continued from page 186)

find your hand fits some better than others. Most are designed for dictation, so their controls will be easy to reach when the microphone is held up to your lips—but if you're going to record others a lot, see how the controls feel when you're pointing the mike away from yourself.

The capstan units, as a group,

(Please turn to page 190)



Four tiny-tape "families" of recorders and tapes include: Grunding Stenorette (top); mini-cassette family (above, left) including Unirex, Dictaphone, Courterport and Norelco; Sanyo Seiki (above, right); and micro-cassette family including Sony, Olympus Pearl-corder, Courterport and Panasonic. Tapes are only compatible within families.



Maxi-size Elcaset has pop-in convenience of standard cassette and fidelity equal to most open-reel types. But system is expensive.



If shrinking the cassette lowers its sound quality, a bigger cassette should sound better, right? Right.

So TEAC, Sony and Matsushita (Panasonic) developed the Elcaset. Slightly smaller than a paperback book, Elcaset combines the standard cassette's pop-in convenience with the sound quality of an open-reel deck.

That better sound comes from wider, quarter-inch tape (cassette tape is about 1/7-inch wide) and higher tape speed (3¾ instead of 1½ inches per second). And the tape is pulled out of the cassette shell when it's running so that the recorder—not the plastic shell—guides it across the tape heads more precisely.

Elcaset also features extra control tracks for slide or movie synchronization, electronic indexing to quickly find a favorite passage, or any other use you like. And indicators molded into the Elcaset shell tell the recorder what type of tape is inside.

The catch? Cost: Elcaset decks will cost \$600 to \$1599; 60-minute tapes will be \$7 to \$10 each.

Henry Morgan says: "GOOD APPLIANCE REPAIRMEN ARE SCARCER THAN DOCTORS WHO MAKE HOUSE CALLS."

Did you know that there are over a billion appliances in use in the United States today? And three repairmen. At least that's the way it seems when one of mine goes on the blink. With more than two dozen electrical gadgets in my house going snap, crackle and pop, I finally got tired of trying to locate a guy with enough ambition to take my money and I decided to learn how to make the repairs myself.

When a well-aged comic like me decides to go back to school, you can bet the family jewels it won't be back at P.S. 93. I'm going to learn at home, or not at all. So I sent away for NRI's home study course in Appliance Repair . . . and I took the course.

With a mechanical aptitude slightly below that of King Kong, I needed a course that started at the beginning and didn't move ahead too fast. Well, NRI did just that. They started with electricity—what it is and what it does—and went from there. You proceed at your own rate of speed. Whip through it if you want to, or take your time. What counts is the fact that you learn, in a way that it sticks with you.

You learn two things: how to repair appliances—from washers, coffee makers, cooking appliances and refrigerators to room air conditioners, and more . . . and how to get started in your own appliance business. That can mean money for you either way. If NRI can turn old ten thumbs Morgan into a reasonable facsimile of a repairman, think what they could do for you!

NRI's no fly-by-night outfit. They've been training men for more than sixty years . . . and they've had over a million students. It's the oldest and largest home study school in the field of electronics and electricity, so they know it better than anyone else around.

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With the tester and a few basic tools you probably have already, you're ready to service most electrical appliances. After a few months, you'll be fixing your own appliances like I do, and then you can start earning spare time money fixing them for your friends and neighbors. Before you know it, you can have your own full-time business and be independent.

Take my advice and clip the coupon. Even if you don't know which end of a screwdriver is the handle, they can give you real professional training that'll help you break into the appliance repair field. It's one of the few things I've ever sent for that was even better than they said it would be . . . so why not invest a postage stamp to see if it's right for you. The NRI catalog is free and there's no obligation. No one will knock at your door or bug you at home. NRI doesn't use salesman. They don't need them.

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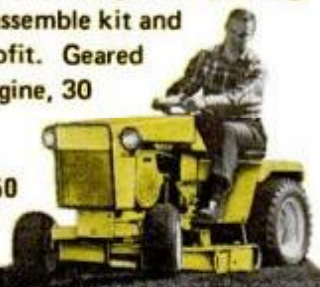
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THOSE TINY NEW CASSETTES

(Continued from page 188)

picked up distant sounds better than the non-capstan ones. So for speeches and school lectures, the capstan units might be your best bets.

The Norelco 185 (\$135) is light and easy to hold, and its controls are handy—but none of them is marked, which could be important if you'll use it infrequently enough to forget which is which. Even in my small hands, the Unitrex Memory Recorder (\$60) and Sony M-101 (\$101) were very easy to work.

Extra features

The DeJur Stenorette (\$225), biggest of the lot, takes a stronger hand to operate, but it has some extras to justify its bulk. The tape position counter is built into the tape cassette rather than the recorder, which makes locating things on the tape easier. And you can record a beep at any point on the tape, either to alert a typist to spot where changes are to be made, or to remind yourself to pay more attention to a particular tape passage.

So you don't get carried away talking to a unit that's run out of tape, several mini-cassette units, such as Norelco's 185 (\$135) and Dictaphone's Dictamite 10 (\$165) have an audible end-of-tape signal; so does Lanier's Microcassette 60 (\$215), a micro-cassette (Olympus-type) unit. The Dictaphone and DeJur also signal when there's no tape in the machine.

The more expensive the unit, the more controls it has. All models have fast rewind, but none of the mini-cassette (Norelco system) recorders have fast forward except the Hermes Compur Dict (\$130). A "review" feature that makes it easier to hear what you've just taped is standard on all micro-cassette (Olympus system) units and the Sankyo, but not on Grundig or mini-cassette units.

If you ever want to transcribe your tapes, you'll need at least an earphone (available for all but the Norelco 185) and a foot-pedal start-stop switch (available for all but the micro-cassette units, though one could be built to work with the a.c. adaptor socket on all of these except the Lanier).

Desktop units

If you do a lot of transcribing, you might want a desktop unit designed for that. Norelco, Dictaphone and Unitrex make transcribers for Norelco-type mini-cassettes. If you have a Lanier transcriber for conventional cassettes, you can get a \$150 micro adapter. ★★★

IT'S NEW
NOW



Remote-controlled will-o'-the-wisp

This mini-helicopter built for the British Army and known as the Wisp is designed to carry out surveillance missions behind enemy lines. The rugged little chopper, exhibited at a recent Farnborough Air Show, is remote-controlled from ground stations and will perform its military chores without need for pilot or crew.

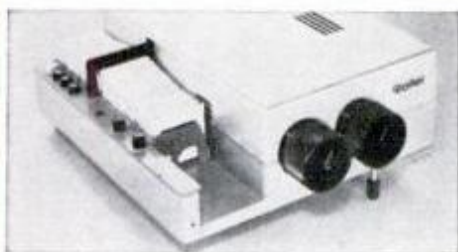
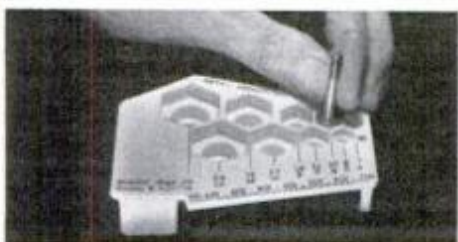


Image dissolve projector

This new slide projector with twin lenses has a built-in light dissolve, with adjustable fade-out-to-fade-in from a half to six seconds. Manual override is possible, too. It's the 35-mm Rollei P3800. About \$800 at Rollei retail dealers.



Metric nut gauge

Nine sizes of metric bolts, inserted into molded forms of a new plastic gauge, can be checked quickly for diameter, length and nut size. The Size-a-Bolt gauge is \$2 postpaid from Stock Sales, Box 606, Mineola, N.Y. 11501.



Split-action electronic timer

Start-stop and split-action timing to within 1/100th of a second is possible with a new Heuer Microsplit LCD stopwatch. It also has a timeout feature and promises accurate readings up to 59 minutes, 59.99 seconds. The device operates on two small replaceable batteries. Cost: \$85 at sport shops.

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Power from the sea: Fact or fancy?

A British humorist takes a wry look at some of the far-out schemes that have been proposed—plus a serious look at a few that just might work.

by J. A. Maxtone Graham

Thirty years ago we were told we were on the threshold of the nuclear age—that it would be only a short time before this newly harnessed miraculous form of energy would become our principal source of power. Domestic electricity would be so cheap it wouldn't even pay to meter it.

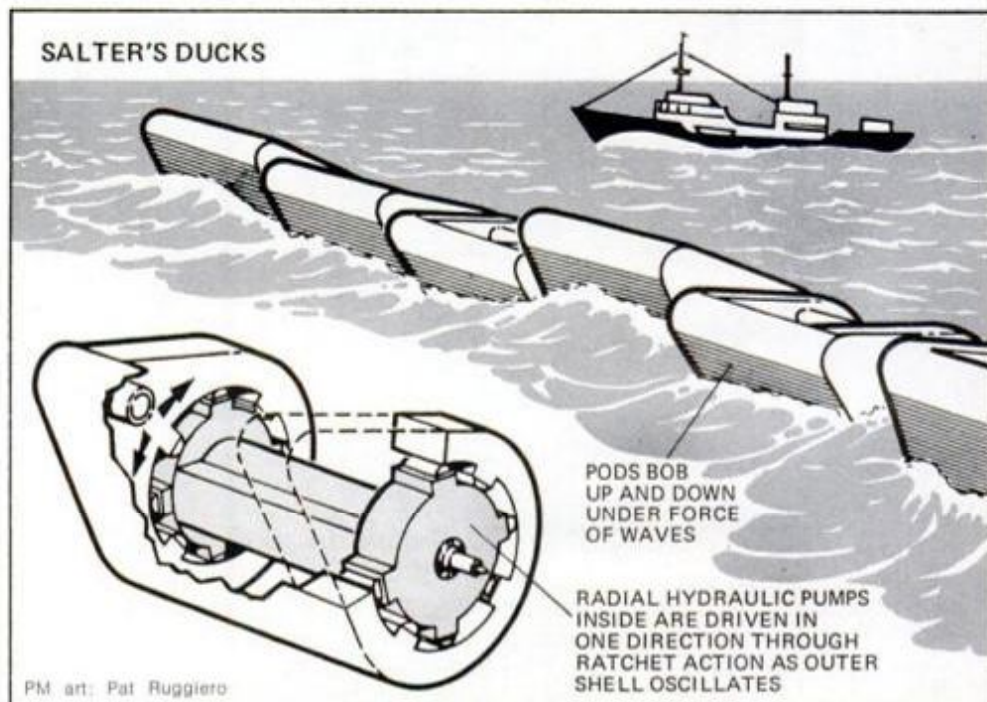
As with so many such rosy optimistic forecasts, this one has yet to come true. Even if nuclear power does eventually see widespread use—and some scientists now doubt this—there are no signs that it will be cheap. All we can do is hope that a practical energy substitute can be found by the time—not too distant—when the world's fossil fuels are exhausted.

Fortunately, man is by habit an indolent slob who would rather get nature to do the hard work for him, thus freeing him to engage in creative and cultural pursuits like drinking beer or shooting pool. This alone should provide a strong incentive to solve the energy crisis, though it has so far run into snags. Down through the centuries man has toyed with alternate energy sources with varying degrees of success, or lack of. It is strange, however, that one of the world's greatest single natural forces—ocean power—has remained virtually untouched.

Seems easy, but . . .

The seas with their colossal currents, tides and waves could, if harnessed, easily supply all our energy needs forever. At first sight, it would seem ridiculously easy. Tides, for instance, gallop into thousands of bays and estuaries twice a day, building up heads of water as high as 53 feet in the Bay of Fundy in Nova Scotia. Yet little has been done to harness tides.

Then there are the great natural currents, like the Gulf Stream that persistently sweeps vast quantities of water throughout the northern hemisphere. Traveling at four knots and containing 50 times more volume of moving water than all the rivers in the world, it sounds like an im-



PM art: Pat Ruggiero

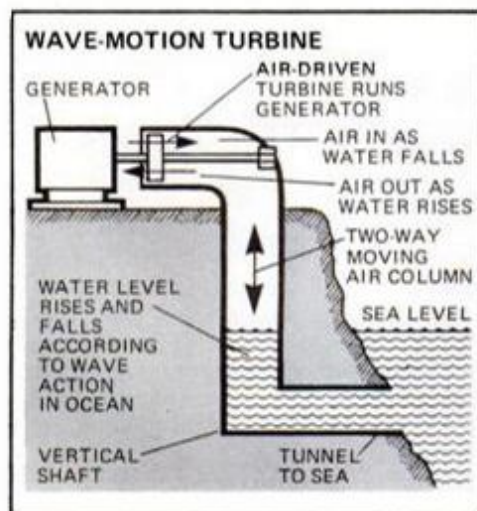
pressive source of power—until you are told that its entire energy potential is equivalent to that of a dam with a head of water 10 inches high.

Undeterred by this dismal fact, at least one inventor has suggested a way to tap the Gulf Stream. His idea: You moor a ship in the current with a continuously moving chain suspended below it. Tiny parachutes attached to the chain pull it through the water in the direction of the stream, turning a generator on board the ship. The parachutes collapse on the return part of the trip against the stream, then refill again, keeping the chain moving constantly. This, in theory at least, was to light all of Florida and other places where the Gulf Stream passes by. Needless to say, the plan never saw the light of day, let alone any light at night.

Weirdest scheme

The weirdest of all ocean power schemes—achieved fortunately only on paper—involved the virtual elimination of the entire Mediterranean Sea. In 1928 a German engineer, Herman Sörgel, revealed his "Atlantropa" plan to a startled and

Salter's Ducks, named after Scottish inventor Stephen Salter, are teardrop-shaped pods that bob up and down in ocean waves—like nodding ducks. As the pods oscillate, they turn radial pumps inside through a one-way ratchet arrangement. Pumps drive power-producing generators. The idea is under serious study in Britain.



This "simple" scheme called for driving a vertical shaft 80 feet or so down near the edge of a cliff, then boring a horizontal connecting tunnel out to the sea. The rise and fall of waves in the ocean were supposed to produce a similar up-and-down motion in column of water inside the vertical shaft. Air pushed up and drawn down by the movement of the water in turn spun a turbine wheel at the top, driving a generator. Elaborate affair was actually tried in France in 1910 and produced 1 kilowatt of power.

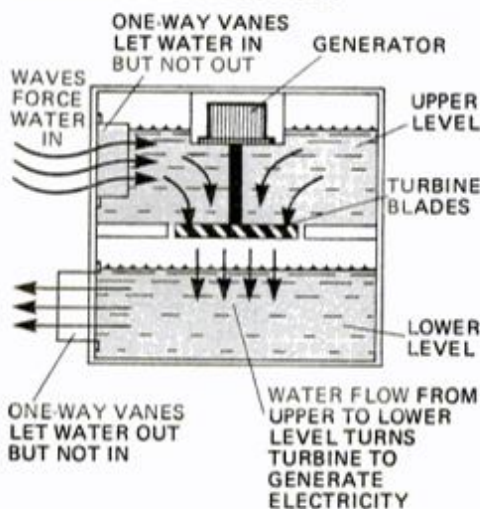
incredulous public. The Mediterranean, he pointed out, loses enormous quantities of water every year through evaporation, only a little of which is replaced by rain and rivers. The bulk of the loss is made up by currents flowing in from the Atlantic Ocean through the Straits of Gibraltar and from the Black Sea through the Dardanelles.

Sörgel's little idea was to dam up the Dardanelles and the Straits of Gibraltar, then just sit back and wait for the Mediterranean to evaporate. At an annual loss of about 40 inches, the sea would drop 33 feet in 10 years or 330 feet in a century (you must admit the man thought for the future). As the level fell, tremendous heads of water would build up at the two dams, driving huge hydroelectric generators to power all of southern Europe, northern Africa and the Middle East—nothing small about that!

Would really work

The frightening thing about Sörgel's grandiose scheme is that it is totally feasible. There are just a few minor technicalities to consider. A dam big enough to span the Straits of Gibraltar would have to be 18 miles long, up to 1000 feet deep and 1500 feet wide at its base—a somewhat considerable construction job. Damming up the Mediterranean would close some of the world's busiest, most famous seaports, disrupt the trade and economies of nations bordering on the sea, discourage tourism and very possibly change the ecology of the whole area—just for starters.

THE RUSSELL RECTIFIER



Russell Rectifier, so named because it changes one form of energy into another, uses force of waves to push water into a two-level tank. As water flows by gravity from upper level into lower one, it spins a turbine that drives a generator. Clever system of one-way vanes lets water in but not out at top, out but not in at bottom.

The reduced weight of water over the volcanic Mediterranean sea floor would probably lead to violent eruptions and earthquakes. All those lovely Greek islands would stop being islands, and the Adriatic would be no more. Everywhere else in the world the sea level would rise by three feet, causing massive flooding in some regions. And, worst of all, England would no longer control the Straits of Gibraltar. Well, you can't have everything.

The Egyptian caper

Another Mediterranean scheme that holds considerably more promise is one currently under serious study in Egypt. It involves the use of the so-called Qattara Depression, a huge, marshy, below-sea-level bowl lying in the desert between Alexandria and the Libyan border. The plan is to open a channel—by nuclear blasting, no less—between the Depression and the Mediterranean. Water rushing into the Depression from the sea would drive power-generating turbines estimated to have a potential peak output of 2400 megawatts (by comparison, the great Aswan High Dam on the Nile has a maximum output of 1100 megawatts, less than half the projected Qattara capacity).

What happens when the Depression fills up? This is the really neat part—it never does. So deep and vast is the Depression—roughly the size of the state of New Jersey—that it would take 10 years just to fill it to a point still below sea level. At that time, evaporation—Sörgel's old friend—would take over and the loss of collected water would exactly balance out the inflow of new water from the sea. Ingenious.

Some not so clever

Not so clever are some other proposals that have come down the pike. One is a wave-power machine, and it's hard to think of anything that better exemplifies the principle of cracking a nut with a sledgehammer. To use it, you have to live in a house near a rocky cliff—and, incidentally, have an ocean under it. You excavate a vertical shaft 80 feet or so down, then dig a horizontal connecting tunnel out to the sea (being careful not to get drowned in the process).

The idea is that the pounding waves that rise and fall outside the cliff produce similar up and down wave motions in the column of water inside the vertical shaft. These fluctuations alternately draw in and push out air through a turbine wheel at the top of the shaft. The wheel

(Please turn to page 194)

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POWER FROM THE SEA

(Continued from page 193)

spins a generator, producing electricity.

One brilliant thing about the contraption is that the generating wheel is fitted with spring-loaded flaps—one set opening one way, the other set opening the opposite way. The result is that the wheel turns in the same direction no matter which way the air is flowing. Very crafty.

One prototype model was actually built and operated in France about 1910. It produced one triumphant kilowatt. The accompanying drawing will make the scheme supremely clear. I guess.

Centuries ago, man saw the potential of tide power, and tide mills have been used for at least 1000 years. There were many on the East Coast during the last century, and there's still one working in England, used to grind corn. There are drawbacks, however, to tide mills—tide

heights vary enormously, and half the high tides occur at times when no one wants to use them much, like 2:00 o'clock in the morning.

The largest tide mills were probably those installed between the piers of Old London Bridge before it was demolished in 1824. They had giant 20-foot-diameter wheels and pumped water out of the river. But calculations today indicate a ¼-hp electric motor could do more work in 24 hours than the interrupted efforts of the average tide mill.

Thinking, not doing

There is a lot of modern thinking about tide power, but the problem is that it mainly stops right there—at thinking, not doing. Plans to dam England's River Severn have been on and off almost as often as that old favorite, the Chunnel linking France and England under the Channel. It seemed almost certain to go ahead in, let me see, 1918, 1921, 1933, 1943 and 1945. Then the

prospect of atomic power stations gave the government a marvelous excuse to drop it. We are due for revival No. 6 any day now.

While the English are rightly regarded as champions in the field of procrastination, it must be said that the United States and Canada are vying for a close second place. The Bay of Fundy, where the world's largest tides are, lies between Maine and Nova Scotia and would thus seem superbly situated for providing power for both countries.

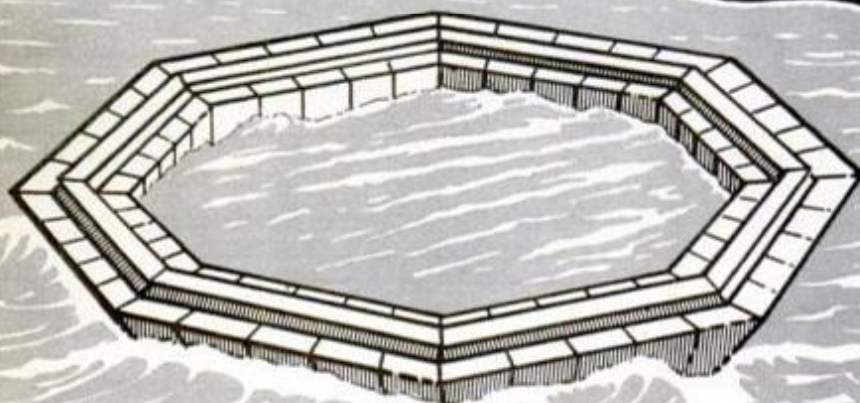
Between 1924 and 1933, a Boston engineer, Dexter P. Cooper, applied four times for permission to build plants for harnessing the Fundy tides. Three times he was turned down, then suddenly was happily surprised to find himself promised \$7 million in federal funds to build a pilot plant. A town for 5000 workers was built on the site and heavy equipment moved in. Things looked hopeful. Then in 1936 the U. S. Government called off the project, citing its heavy expense, and the 5000 men went back home. Today there is nothing left but a few small dams linking a couple of islands. Poor Mr. Cooper.

No Fundy in sight

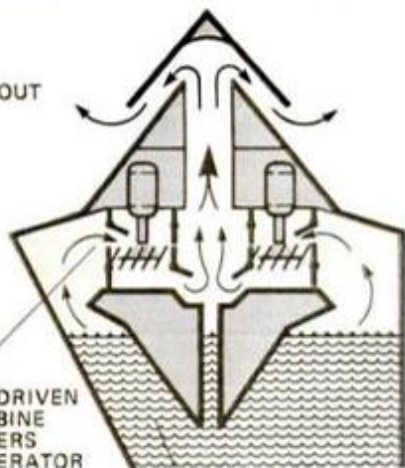
More commissions and committees produced studies, opinions and reports in the United States and Canada in 1941, 1945, 1948, 1954, 1959 and 1964—but still nothing has come of the Fundy plan.

Today, unless the Russians are

AIR PRESSURE RING BUOY

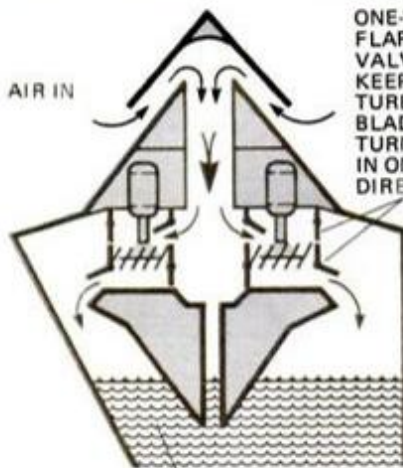


AIR OUT



UPWARD MOTION OF WAVES FORCES AIR OUT

AIR IN



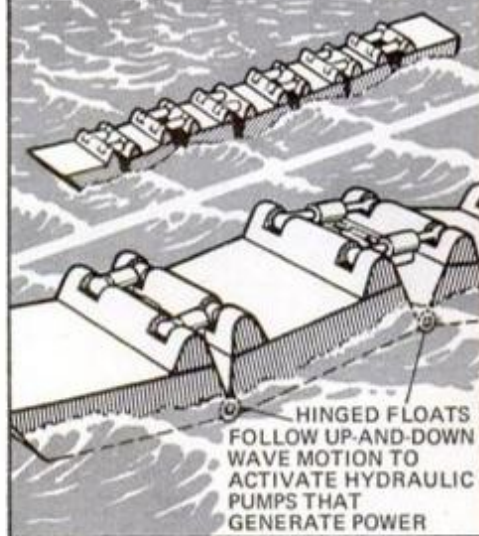
DOWNWARD MOTION OF WAVES DRAWS AIR IN

ONE-WAY FLAPPER VALVES KEEP TURBINE BLADES TURNING IN ONE DIRECTION

Hollow ring buoy uses up-and-down motion of waves to force air in and out through vent slots at the top. Flow of air drives a turbine connected to a generator

to produce electrical power. One-way flapper valves keep air flowing through turbine in the same direction regardless of which way it moves through the buoy.

WAVE-RIDING RAFTS



HINGED FLOATS FOLLOW UP-AND-DOWN WAVE MOTION TO ACTIVATE HYDRAULIC PUMPS THAT GENERATE POWER

Wave-riding rafts, hinged together in strings, undulate as water surface rises and falls. As the floats flex at the hinge points, they alternately compress and extend hydraulic rams connected between them. The rams pump fluid under high pressure, spinning turbines that in turn drive power-producing generators.

up to something we don't know about, the world's only effective commercial use of ocean power occurs at the mouth of the Rance River in France. In 1966 a dam was built across the estuary incorporating 24 turbogenerators with highly sophisticated computer-controlled variable-pitch blades that work in either direction. Incoming tides generate some electricity; outgoing tides generate more.

The turbines can even be used as pumps to bring in and store extra water when the power demand is low, such as in the middle of the night. Then the water is released in the morning to heat Frenchmen's breakfasts. Power output is 500 megawatts—enough to service a city of half a million. And despite the seemingly high initial construction cost of \$100 million in 1966, the Rance installation has easily paid for itself and now shows a handsome profit—a lesson other governments could well benefit from.

Exotic thermal power

One exotic ocean-power scheme doesn't rely on physical energy at all, but on water temperature. So-called thermal generators use the temperature differential between relatively warm surface water and near-freezing deep water to alternately vaporize and condense a working fluid, something like the heat-exchange cycle in a heat pump or airconditioner. The moving fluid drives turbines that in turn drive generators to produce electric power (see *Amazing New Power from Ocean Depths*, page 93, Nov. '75).

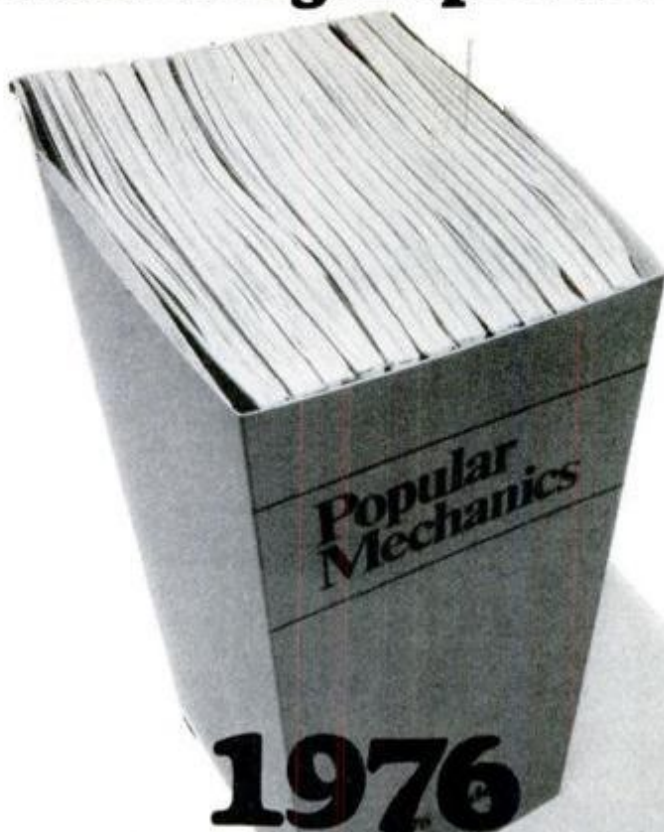
While the system is eminently workable in theory, it does call for giant floating power stations as much as 250 feet in diameter with water-collecting pipes extending 1500 deep. A United States federal agency is currently examining the economic practicality of such devices.

Harnessing waves

Wave power is also coming under serious study, although the idea is by no means new. As far back as 1892 a fellow named Albert Stahl in San Francisco proposed no fewer than 16 methods of harnessing waves. One of his machines is my, and anybody's, favorite: You have a pair of steel tracks running down the beach to the water and on these rides a little trolley. Waves smack the trolley, driving it up the beach. As it rolls back down, it pulls a rope that spins a generator of unspecified nature. Even Stahl himself foresaw the weakness of this device: "Some little difficulty would

(Please turn to page 196)

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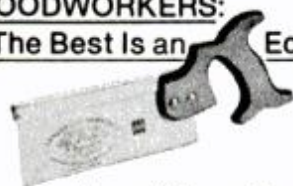
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POWER FROM THE SEA

(Continued from page 195)

probably be experienced on account of sand filling in along the track, which would probably finally result in throwing the apparatus off the track," he readily admitted. Too bad.

More practical wave-power systems are, however, in the works. Four proposals are under study by the British Government.

In Japan it was found that floating breakwaters worked more efficiently if they were filled with air with slots at the top for the air to flow in and out. The resistance of the air acts as force to flatten waves inside the breakwater. Now an enterprising English chap has borrowed the idea and installed air-driven turbo-generators inside a hollow, ring-shaped floating buoy. The rush of air in and out of the slotted buoy spins the turbines to generate electricity. A clever arrangement of one-way flapper valves keeps the turbines turning in the same direction as the air alternately reverses its flow.

The Russell Rectifier

Then there's the Russell Rectifier, named after another British inventor, C. Russell. This affair is basically a two-level tank with a turbine-driven generator mounted between the upper and lower compartments. Waves push water into the upper compartment where it drains down into the lower one, turning the turbine in the process. Simple.

A variation of this idea is being worked on at the Scripps Institution of Oceanography in La Jolla, Calif. The device consists of a huge floating reservoir with a long vertical pipe hanging down below it. Every time it dips down between waves water is forced up the pipe and into the reservoir. The water is prevented from falling back by a nonreturn flapper valve. After a succession of waves, the reservoir is filled, then the water is released through a turbine that drives a generator. Sounds a bit quaint, but scientists at the Institution believe it holds promise.

Another scheme calls for a series of wave-riding floats hinged together in a string. The floats rise and fall with the waves, alternately compressing and extending hydraulic rams connected between them. The rams act as pumps, forcing fluid under high pressure to drive generators. Not bad, either.

Salter's Ducks

But my pet is something called Salter's Ducks, developed in Scot-

land by Stephen Salter, a professor of physics at the University of Edinburgh. One day Salter was struck down with flu and took to bed. Mrs. Salter, not particularly sympathetic, urged her husband to do something useful during his illness—like solving the energy crisis. Her specifications were very clear: Whatever it was had to be clean, safe, last forever—and work in a Scottish winter.

That last requirement knocked solar energy on the head right at the start. Convinced that wavepower could be tapped, Salter doodled out a design for a float that would respond to wave motion, converting that physical energy into electrical power. The best configuration, later tried out in a test tank at the university, proved to be a teardrop-shaped pod with a "beak" that bobbed up and down like a nodding duck.

To his delight, Salter found that a scale model of his Duck, working in a wave tank, could extract a staggering 90 percent of the water-generated energy. Full-scale versions would be the size of a house, made of reinforced concrete. They could be strung together in rows, some bobbing up as others bobbed down. Inside each pod giant radial-type hydraulic pumps would be rotated, through a ratchet arrangement, by the oscillating motion of the bobbing shell. The pumps in turn would drive power-producing generators. There could be as many as 100 pumps in each Duck with a dozen separate generating systems each with an output of 400 kilowatts.

Could power all Britain

Salter determined that waves, depending on their size, typically have an energy potential of 80 to as much as 1000 kilowatts per meter of wave frontage. A quick calculation indicated that a mere 300-mile chain of bobbing Ducks could supply all the electricity now used in Britain.

While Salter's Ducks have yet to be built, they are getting close attention now in England, with the support of a cement firm eager to build all those beautiful mammoth concrete pods. Do the Ducks meet Mrs. Salter's specifications? Well . . .

Clean? Nothing's cleaner than water. Safe? Yes, provided they're kept away from shipping lanes. Actually, they'd serve as breakwaters, calming rough seas to make boating safer and protect harbors.

Will they work in a Scottish winter? Anyone who's crossed to the Isle of Harris in December would have no doubts. Last forever? Salter has a ready answer: "The first ferro-cement boat was built in 1855. It's still in perfect order." ★ ★ ★

FIRSTHAND REPORT

by Bill Hartford
AUTO EDITOR



Driving Mazda's new piston-packin' GLC

A front-engine/rear-drive car whose appeal is in its simplicity.

Mazda engineers in Japan joke that GLC means Goes Like Crazy, but the letters—whether or not they ever had any significance—have come to mean Great Little Car to Mazda enthusiasts here. There is no recognizable combination of letters for “simple and stylish hatchback.” That’s what it is and what it was meant to be. No need to apologize for good, clean honest design, or for no gimmicks.

I had the opportunity to see and

Photos by the author



GLC hatchback is piston-powered by a 1300-cc, ohc Four.



drive the GLC at the Miyoshi proving grounds of Toyo Kogyo, Ltd., the Mazda maker, on Japan's main island of Honshu. The GLC I drove was a deluxe model so it had some comfort, convenience and appearance features not on standard models.

First impressions

GLC styling is unlike anything ever done before by Mazda: It's clean and easy to look at! The front end is especially well done and will easily distinguish the GLC from the Chevette, the car it will most likely be compared to. Both are conventional, front-engine/rear-wheel-drive cars, with similar overall dimensions (GLC wheelbase is 91.1 inches), but the GLC clearly has that touch of class in styling that the Chevette lacks.

The rear styling, too, is neat. The wide hatch opens with a remote release in the car, swings up high

(rear glass is heated and has a wiper/washer system), the liftover is low and the spare is under the floor. In the rear, the split folding seatbacks, once experienced, could lead a million owners of old hatchbacks to attack their one-piece seatbacks with power saws! With seats folded, the floor is flat and no suspension components intrude.

What keeps the rear suspension out of the cargo area is its compact geometry. The live rear axle is carried on a pair of trailing arms. Two upper torque rods and a Panhard rod are used, with coil springs ahead of the rear axle and shocks behind. The fuel tank is outside the passenger cabin under the spare.

Up front are independent struts, coil springs and anti-roll bar. Steering is recirculating ball and the turning circle an impressively tight 28.8 feet. Power front disc brakes are used on the front wheels, drums in the rear. Tires are 13-inch four-ply with 155SR13 steel-belted radials optional.

You slide behind the wheel through

(Please turn to page 198)



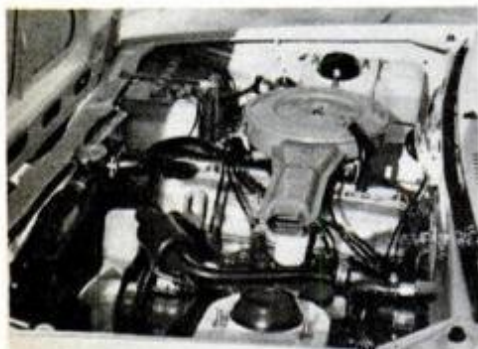
Split rear seatback increases versatility of the hatchback. Interior is neat and car is well finished throughout.

DRIVING MAZDA'S NEW GLC

(Continued from page 197)

a wide door opening. The reclining bucket seats are nicely shaped; a good driving position is easily found, even for tall drivers, and visibility all around is excellent. The passenger side bucket slides forward automatically for easy back-seat entry.

There's a sporty touch in the



Fuel consumption is 38 mpg combined city/highway. Weight: just under 2000 lbs.

treatment of the instruments and steering wheel, and there are adequate catch-all places, even one molded in the dash for toll change. Trip odometer is standard as are twin stalks with lights and wiper/wash controls.

Getting up to speed

Standard gearbox is a four-speed, with five-speed manual and three-speed automatic as options. The four-cylinder, ohc engine displaces 1272 cc and is rated at 52 hp at 5000 rpm. Regular fuel must be lead-free since a catalyst is used. Carburetion is two-barrel down-draft.

At Miyoshi I ran the car up to 60 mph in roughly 16 seconds and then held it at an indicated top speed of 86 mph for several laps. Interior noise is quite moderate for a subcompact. On the handling course the car had usual understeer and no quirks. On repeated runs on a wicked Belgian block pavement the car refused to skitter, at least not enough to go off on its own.

Do-it-yourselfer's car

It's no secret that Mazda doesn't have a U.S. dealer organization that can rival that of Toyota, Datsun, VW or even Honda. That's why they kept the GLC simple—a help to the d-i-y-er. It's easy to maintain, and service intervals (like oil changes at 6250 miles) minimize Saturday mechanic chores. At \$3200 (\$3000 for standard version) it's a bottom-buck buggy, but despite the price the GLC could make it on the strength of its basic good looks and refreshing simplicity alone. ★★

SPEED AND THE SINGLE ROTOR

I did a double take . . . on a stand in the test bed was a tiny, hip-pocket powerplant. It was half the size of the two-rotor engines that were undergoing various tests. "The single-rotor project is still confidential."

said Kenichi Yamamoto, the brains behind Mazda's rotary-engine design, and he led us out of the laboratory and into the rotary-engine assembly area of the Toyo Kogyo plant.



Yamamoto

Yamamoto remained singularly tight-lipped about the forbidden subject, but didn't hide his enthusiasm over the progress made in the fuel economy of the two-rotor production engines since the fuel crisis of 1973.

Bright future for rotaries

Yamamoto is a true believer in the rotary. He even predicted increased competition for Mazda, with a resurgence in developmental activity on the rotary at other automakers—including General Motors—as soon as limitations on emissions are specified once and for all, and as soon as the competitive fuel economy of the rotary is appreciated.

Meanwhile, Mazda remains the only automaker who has a going business making and selling rotary-engine-powered vehicles. Mazda will sell 700,000 cars and trucks in 88 countries this year—the year total production of rotary-engine cars hits one million, just 10 years after the first Mazda rotary.

Yamamoto, manager of the Ro-

tary Engine Development Div. and a director of the company, has overseen three distinct stages of rotary-engine development. The first challenge, after signing licensing agreements in 1961 with Audi-NSU for rights to manufacture the Wankel powerplant, was to build a practical working engine. Second was reducing exhaust emissions, and third was improving fuel economy. Development programs continue on such concepts as stratified charge (called ROSCO for Rotating Stratified Combustion), but the current gleam in Yamamoto's



RX-3 coupe racing version spins out over 250 hp with 9500-rpm redline.

eye, and what he will surely look back on as a fourth stage in his work, is performance.

Racing rotaries

In Japan, an unbeatable two-rotor RX-3 coupe runs in the two-liter touring-car class. It spins out more than 250 hp. That's with a minute displacement of 2 x 573 cc or 1146 cc! It's a base RX-3 engine but with a special, peripheral-type intake-port design perfected in Yamamoto's always-humming laboratory. It isn't running circles around the competition here for a simple reason: Rotary-engine displacement is handicapped by a factor of two. That 1146 cc is considered 2292 cc and can't compete in the under two-liter classes. That rule may change this season, however, since consideration is being given to a 1.5 to 1 factor.

Enter the RX-3 SP

Mazda's racy street car for '77 is the RX-3 SP coupe. It's a 2 x 573, but it's a U.S.-legal setup that's rated at "only" 95 hp. Still, it'll net you an honest 110 mph top speed, and Yamamoto isn't apologizing for the fact that this little double-rotor hummer could get you in big trouble with Smokies. Well, maybe a future single-rotor version would peak out at half that speed—that's double nickels to all you law-abiding good buddies.—B.H.



Two-rotor Mazda engine is assembled at Toyo Kogyo's Hiroshima factory.

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HONDA'S NEW CB-750A

(Continued from page 16F)

Four engine. This bike makes it easy. You swing out of the parking lot after only a few seconds of instruction, head down Vermont Ave. toward the Ascot Speedway in south Los Angeles, and suddenly the traffic seems to be falling behind. Only then do you realize that you are doing 50 and it feels like 25.

The 750 Four with its four-into-one tuned exhaust is not so much quiet as soft-spoken. Like a six-foot-four guy calling for a drink at the local bar. He doesn't have to raise his voice to be heard.

It's a standout

People stare at the Honda 750A. At least other motorcycle people do. You'll see them looking at it while



Top speed of Hondamatic is about 100 mph, slightly less than that of five-speed.

you wait for stop lights. It stands out, probably because of the wider tank overhanging the round hydraulic torque converter that sits in where the engine case normally flows back to enclose the standard transmission.

The Hondamatic 750A is fun to ride. At 550 pounds it is still easy to handle. It electric-starts in an instant . . . but, just in case, there is a stored kick starter under the seat of the electric model. Engineers claim that although initial tests with prototypes indicated lower mileage, the automatic transmission production models now get *better* mileage than the standard-shift jobs.

There was no evidence of another potential complaint, that of the necessity for the trans to warm up before you could ride away. It didn't seem a logical complaint at that, since all that would be necessary would be to get the fluid in the torque converter circulating.

Jim Swartzlander, head of American Honda's Product Testing and Development section, says, "We think we have built a *fine* motorcycle." That it is, but you have to ride it to find out. If you don't like the luxury of automatic operation, you can always consider the almost-identical bike with five forward speeds, the CB-750F. ★★★

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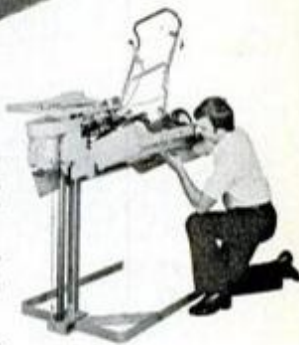
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Sawdust collector kit

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FROM READERS

Hanger for sleeveless clothes



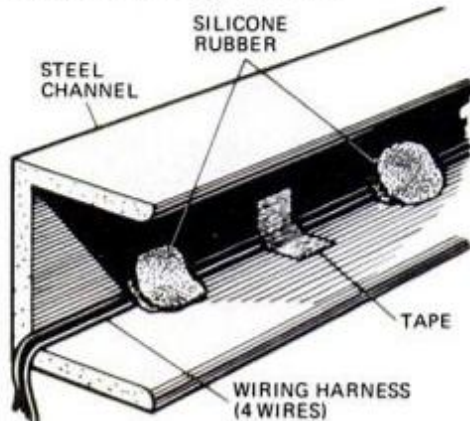
Keep tank tops and other sleeveless clothes from falling off hangers. Bend the ends of the hanger upward with pliers.—Harold Neibert

Needles from can keys



Food-can keys with an "eye" in the end make sturdy needles for sewing burlap and canvas. Heat key handle red hot, then straighten it and grind to a point.—Walter Burton

Secure a wiring harness



When the holding clamps of a wiring harness rust and begin to chafe the wires, remove them and secure the wires with rubber silicone. Masking tape holds the wires in place until the rubber cures.—Larry Cox

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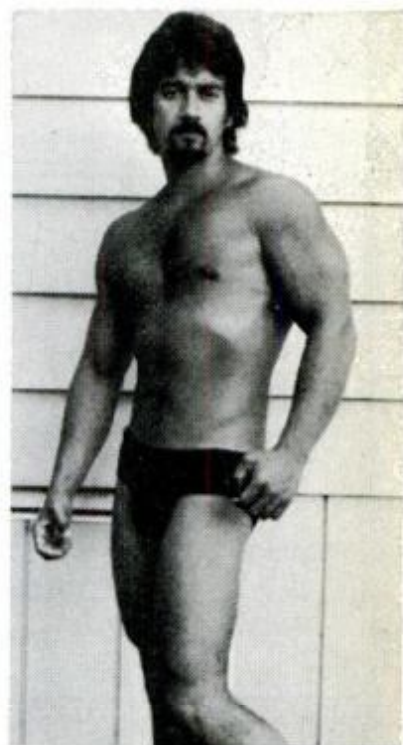
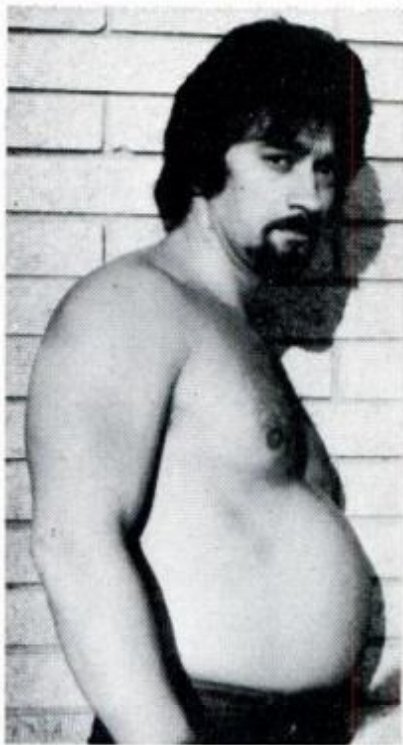
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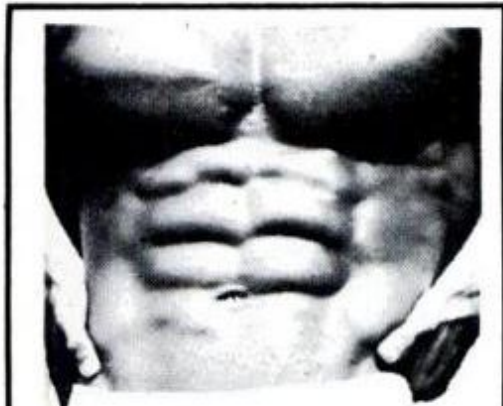
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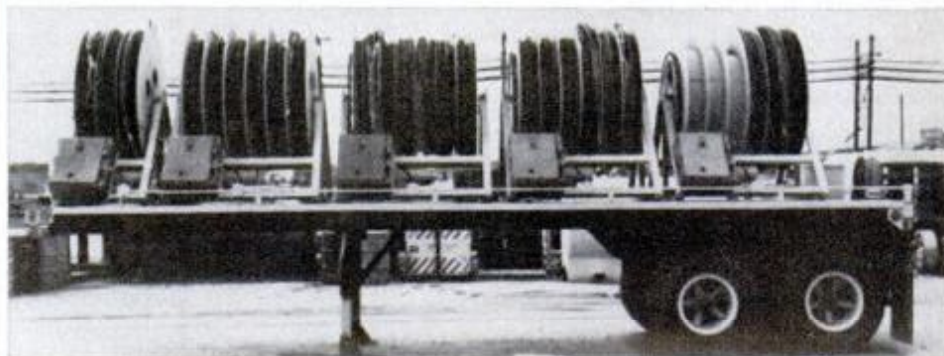


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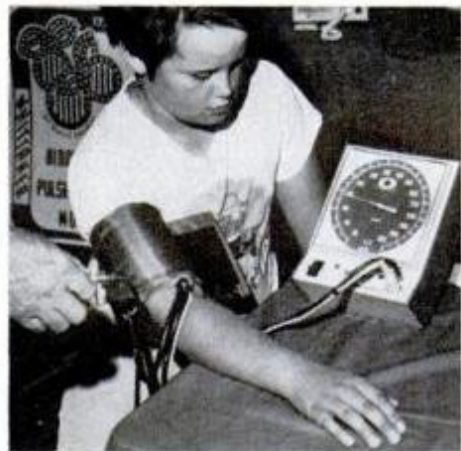
Blood pressure on a dial

If you can read a speedometer, you can read blood pressure on the new S/D 500 Whittaker sphygmomanometer. When light flashes, reading is systolic; when it stops, it's diastolic. The noise and vibration-proof unit costs \$445. Whittaker, 335 Bear Hill Rd., Waltham, Mass. 02154.



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Tokyo bus drivers running between airport and hotels have 20/20 hindsight nowadays. Instead of mirrors, a closed-circuit TV camera mounted on the rear of the bus and a mini-monitor bracketed to the dashboard switch on when reverse gear is engaged, giving the driver a quick picture of what he may be backing into in crowded streets. Set can be turned on manually in any gear if the driver wants to know what's going on behind him. Mitsubishi Electric.



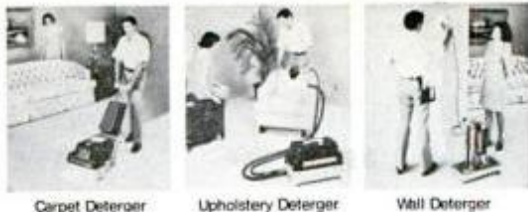
Swingers on an 'Atom-Splitter'

New version of the playground swing has a circular top rail so up to five kids face inward, swinging toward each other. Atom-Splitter swing is 30 feet across, 11 feet high. Game Time, 6874 Washington Ave. S., Eden Prairie, Minn. 55343.



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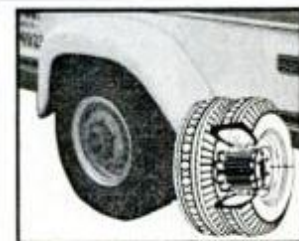
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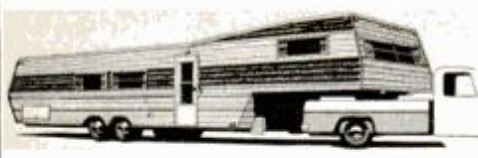
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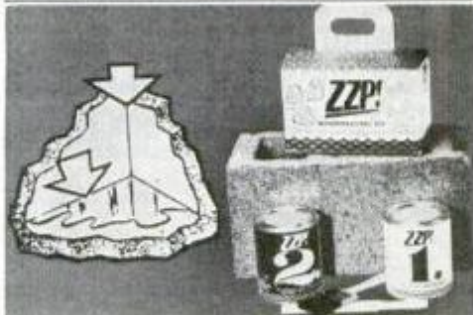
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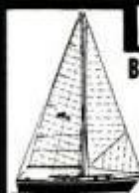


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