

How to Keep From Getting Killed in the Fog

POPULAR MECHANICS

SEPT. 1970
50 CENTS

How to
Phone
Vietnam
—Free

PM 'Helps' Chevy
Test the VEGA



First Report on '71 FORDS and MERCURYS Including the Pint-Sized PINTO

**28 Pages of Ideas
To Make Your Home
More Livable**

- Making a Room Out of a Porch
- Building a Bar in the Basement
- Hiding Trash Cans
- Installing Plastic Pipe
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- Building Storage Into Walls

New Radio-Controlled Mower

'Sensible' Station Wagons

How to Sight-In Your Rifle

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SEPTEMBER 1970

1

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Fiberglas 6&3 insulation could save over \$3,000 toward your mortgage

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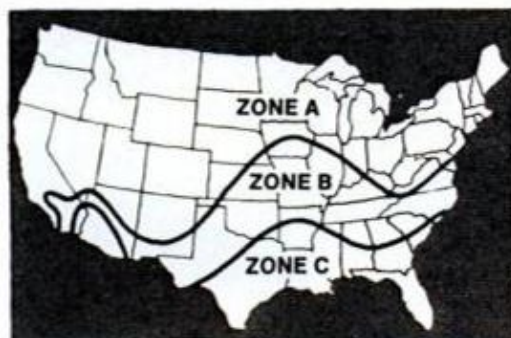
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*T. M. Reg. O-C. F.

Calculate possible savings in your area—add heating and cooling savings for total.



HEATING ZONES**			
Floor Area, Sq. Ft.	Zone A	Zone B	Zone C
1000	\$1,650.	\$1,150.	\$475.
1500	\$2,225.	\$1,575.	\$625.
2000	\$2,700.	\$1,925.	\$775.



COOLING ZONES**			
Floor Area, Sq. Ft.	Zone A	Zone B	Zone C
1000	\$200.	\$425.	\$650.
1500	\$275.	\$550.	\$825.
2000	\$325.	\$650.	\$950.

**Estimated savings: Ranch house on slab, 15% glass area, over 25-year term of mortgage. Heating costs, 10¢ per therm, cooling costs 0.02¢ per KWH. 6" & 3" versus FHA minimum property standards.

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PLYCRON 2 PLUS 2

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†Average of all tests run simultaneously by independent test fleet during last 12 months.

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Cover Photo by Michael Lamm, West Coast Auto Editor

*PM helps Chevy test the Vega on shakedown cruise from desert lowlands to the high Rockies***NEXT MONTH IN POPULAR MECHANICS**

More '71 Cars in Color! Another chapter in PM's continuing coverage of Detroit.
 What's Watt in Choosing a Hi-Fi. How much output do you really need?
 Will You Lose Your Right to Fly? Are private pilots being forced out of the air?
 New Snowmobiles and New Outboards: Two roundups on the '71 models.
 A Jeep Dune Buggy? Rugged, 4-wheel-drive Jeep dressed up in slick, sports-car body.

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SEPTEMBER 1970

Planter or playroom, Nicholson makes it easy.

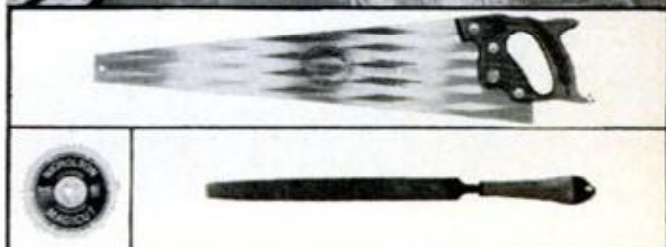
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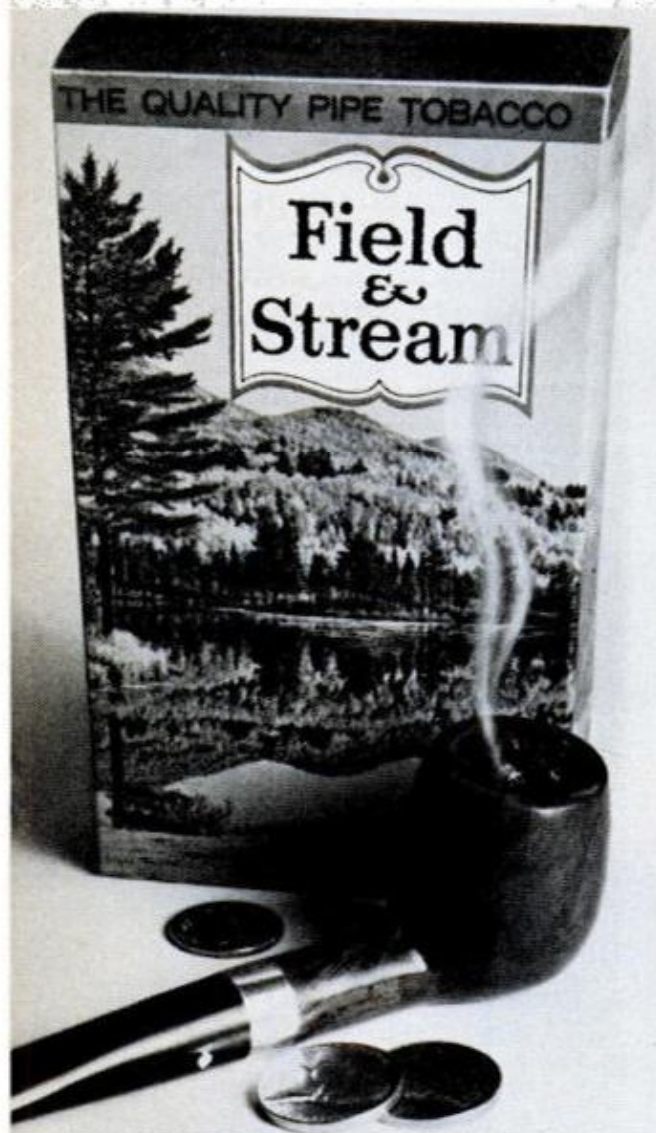
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says that Field &
Stream's aroma reminds
her of a great autumn
day in the woods...



**start
saving up
the dowry.**

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LETTERS TO THE EDITOR

Cheers and tears

Man, what an exciting story that was, entitled *The Face in the Mustang Window* (page 88, July PM).

I couldn't put it down, and could hardly wait to get to the end of the story. I found myself holding my own breath as I read about Fireman Larry Norton holding his breath to effect the rescue.

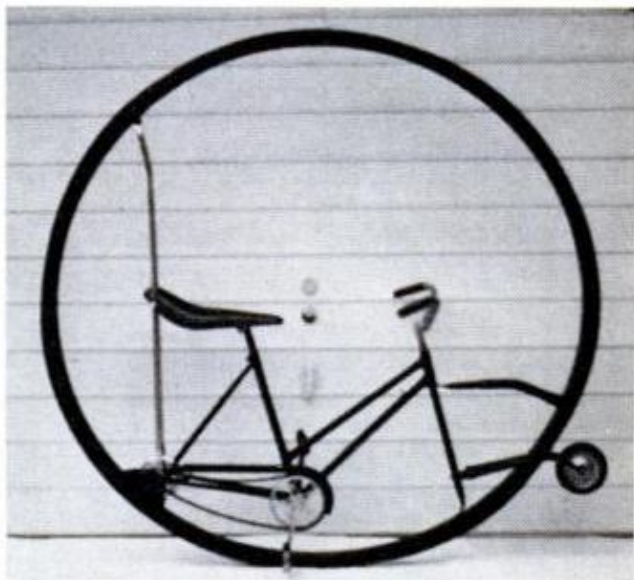
Let's have more, more, more!
OAKBROOK, ILL. JOHN R. VANDERVELDE

Yeah, but pretty soon you'll get all of our rivers filled up with Mustangs.

I cried for 10 minutes. It's the best I've read yet, but please don't write stories like this and make me cry. I'm ashamed that I cry so easy, so I will not sign my name. But I like your magazine.
ROMULUS, MICH.

Holds the patent

Regarding the Michigan *One-Wheel Cycle* (page 104, April PM), I am the inventor and hold the patent (No. 3,380,755) on the one-wheel cycle.



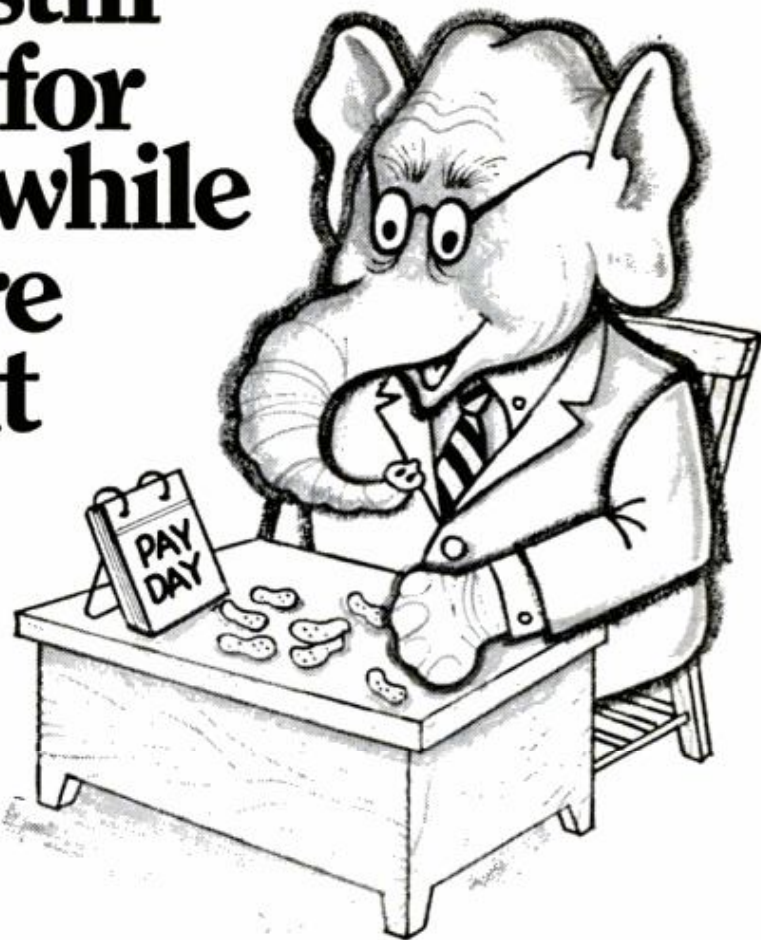
The model shown in this photo was finished late in June.
LONG BEACH, CALIF. J. M. POUND

Overcautious overload?

If all the items mentioned in *What You Need in a Roadside Emergency Kit* (page 120, July PM) were carried by the author, he would need several of them just to take
(Please turn to page 8)

POPULAR MECHANICS

Are you still working for peanuts while others are making it big?



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WEAVER SCOPES

The trophy takers.



LETTERS

(Continued from page 6)

care of problems incurred from overloading. Why doesn't he simply tow a spare-parts car along behind him?

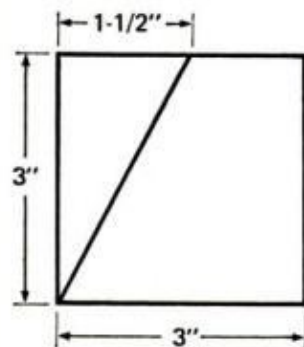
WINCHESTER, MASS. DAVID E. WALTERS

Immeasurably puzzling

I want to thank you for driving me nuts by not giving the complete dimensions of *A Puzzle to Stump You* (page 160, May PM).

WATERBURY, CONN. HANK RONCARTI

After working for hours, I looked at the answer. It seems as though some information has been left out of your puzzle.



You failed to dimension, or include in the text, that the split side (marked $1\frac{1}{2}$ " on the drawing enclosed) needs to be half the square side (marked 3"). I can assure you that many readers are puzzled by this puzzle.

DALLAS, TEX. DON PERKINS

Yes, you are right, and, yes, they are puzzled.

Stiletto builder

Using only the directions and plans in *Building the Stiletto* (page 166, Jan. '67 PM), our son, Michael—who was then 15—went to work in the winter and fin-



ished the boat by the first of July.

The picture will tell you more than a million words. That's Michael in the boat; he is quite proud of his achievement and so are his father and I.

BALTIMORE, MD. MRS. STEPHEN FISCHER

You should be. He did a great job.

As we were about to say

Congratulations on a wonderful and enjoyable magazine. I look forward every month to the new issue, and I always find

(Please turn to page 10)

POPULAR MECHANICS

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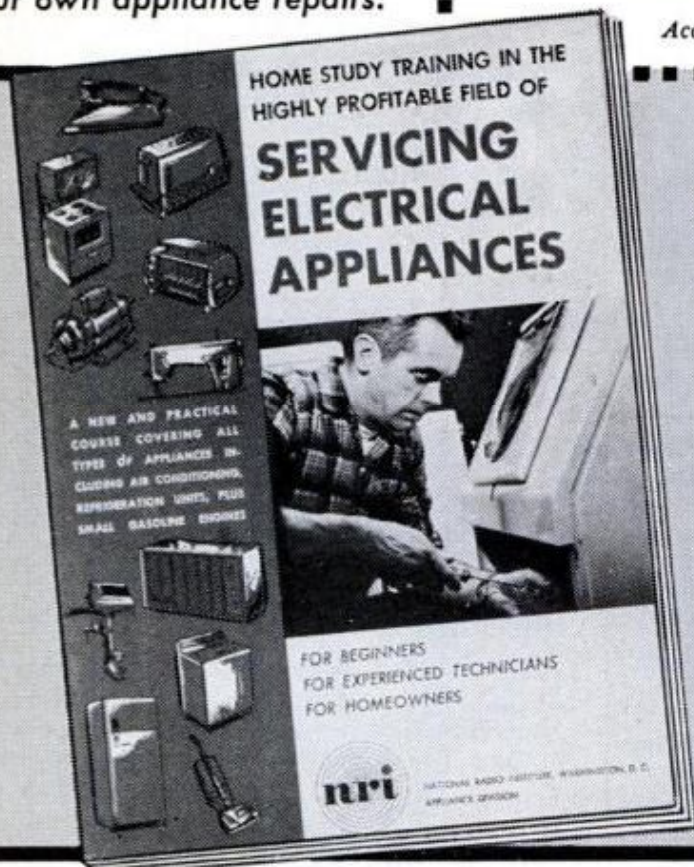
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LETTERS

(Continued from page 8)

an informative article that pertains to my interests or to the interests of my friends.

I'm particularly interested in automobile repair. Because I'm the owner of a new automobile (as, I'm sure, are thousands of your readers), I feel there is a need for a good, thorough article on the theory and repair of present engines that have emission-control and other antipollution devices.

OAK PARK, ILL.

MARIO A. PETRONE

Funny you should mention it. Servicing emission-control devices is the subject of next month's Saturday Mechanic.

Some balloon!

Using a vacuum cleaner to inflate lots of balloons quickly is a good idea (*Solving Home Problems*, page 156, June PM), provided you do not use an explosive gas. About 20 years ago a man near here used an explosive gas to fill a balloon and a spark from the vacuum cleaner caused an explosion. It caused him to be deaf, blew the shingles off his house, blew the front door through the back door and demolished his car.

FREMONT, N.C.

C. E. DAVIS

Birds and bees

In *Solving Home Problems* (page 156, June PM), you show an easy-to-make hummingbird feeder. I was told that sugar is bad for birds—so try using honey.

LA MIRADA, CALIF.

RICHARD SUMMERS

Wrong country

In *Cranking Transforms Trailer* (page 123, June PM), you state that Lugano is in Italy. Lugano is in the Italian-speaking state of Ticino, Switzerland.

WHITE PLAINS, N.Y.

MRS. G. HOFER

Likes new binding

Your changes in the binding and layout are very welcome. For years I have pulled staples and separated the pages I wanted to keep. I file them in letter file boxes that are just the size of the magazine page. The new binding has been a great help.

MEMPHIS, TENN.

HENRY W. PEABODY

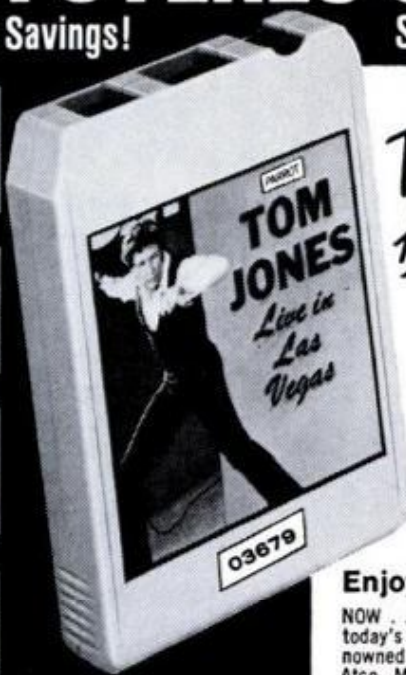
Glad you like it—and have you noticed that the magazine lies open much better when you're using it in your workshop? With the June issue, we quit using staples to bind the magazine and went to the hot-melt glue process in order to make PM handier for readers to use. ★★★

POPULAR MECHANICS



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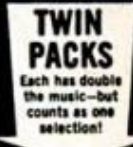


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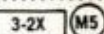
I am most interested in the following type of music: (check one only)

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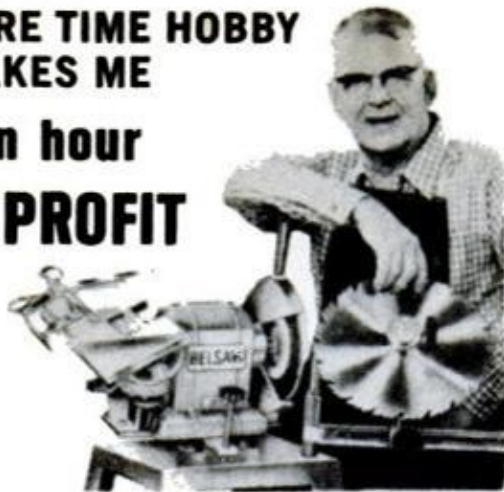
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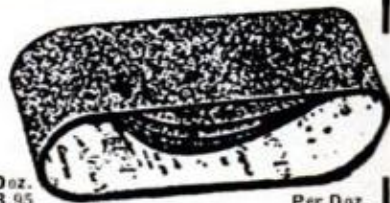


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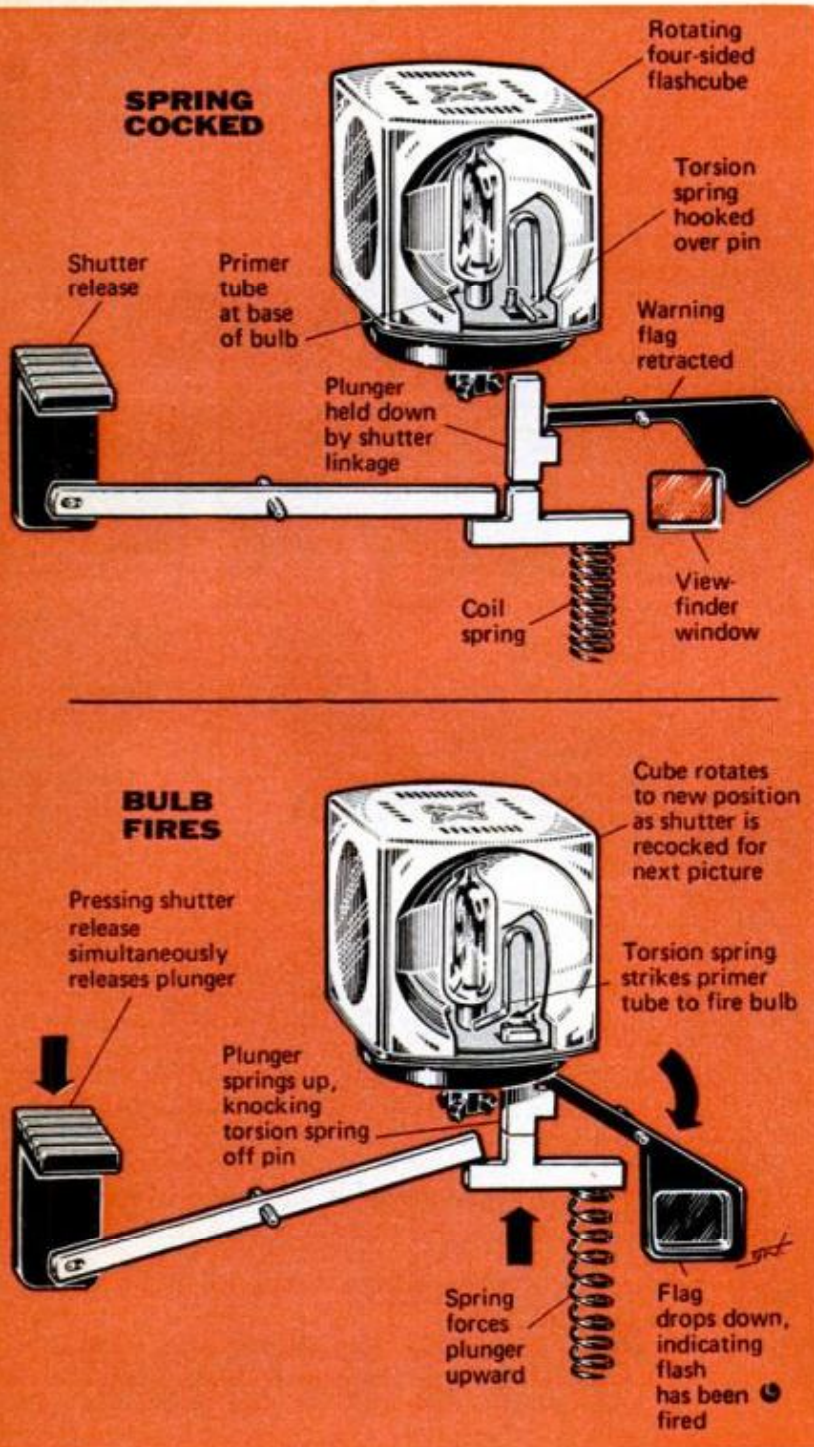
for strength.) And Firestone has a special way of reinforcing the side walls and bonding the tread to the body. Extra steps for us but extra security for you.

Firestone's Sup-R-Belt will give you important extra margins of security and mileage. Prices vary according to size, but they cost far less than you'd expect. (Sup-R-Belts are also available with raised white letters.)

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YOU DON'T have to worry whether your flash will fire with this revolutionary new flashcube-camera combination. The bulbs are fired mechanically by impact instead of electrically by batteries. This eliminates the chance of a rundown battery or corroded electrical contacts—frequent causes of flash failure—and gives you a sure shot every time.

The system was previewed last month in PM in a special advance report (see "The Flashcube That Fires Itself," Aug. '70, p. 68). Now the flashcubes are on the market, along with five new Kodak Instamatic cameras engineered to take them. Two major flashbulb makers—Sylvania and GE—are both producing the four-shot, battery-less lamps under the same trade name—Magicubes.

How the system works is shown at left. Alongside each bulb is a tiny torsion spring held by a pin. When you press the shutter release, a plunger is driven up through a slot in the cube, knocking the spring arm off the pin. The spring strikes a percussive primer in the base of the bulb, producing a spark that fires the flash.

The five new Instamatic cameras range in price from \$20.95 for the simple fixed-focus X-15 shown above to \$144.50 for an automatic model with power drive and exposure control. All take 126-size instant-load film cartridges. As an added feature, a red warning flag drops down in the viewfinder as each bulb is fired and stays down after the last is used, indicating a new cube is needed.—Sheldon M. Gallager

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"What started as a hobby, now pays me \$10 an hour"

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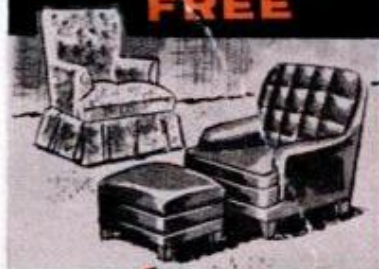
When you read the papers you see there's a strike here, a lockout there. Detroit lays off 150,000 men. A plant is shut down and moved out of state. A new automated machine eliminates 5,000 jobs. They talk about dislocated workers and try to do something about it. What pays the bills if you get caught up in one of these situations? When you know upholstery, life gets very simple and lots of fun. It's simple because where there are people, there are upholstery jobs and lots of them. It's fun because life is fun when the bills are paid and there's money in the bank, even enough to buy those things you've always wanted for yourself.

MUI IS APPROVED BY THE CALIFORNIA SUPER-INTENDENT OF PUBLIC INSTRUCTION AND IS AUTHORIZED TO ISSUE A DIPLOMA IN UPHOLSTERY.

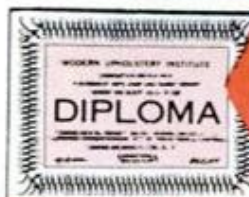
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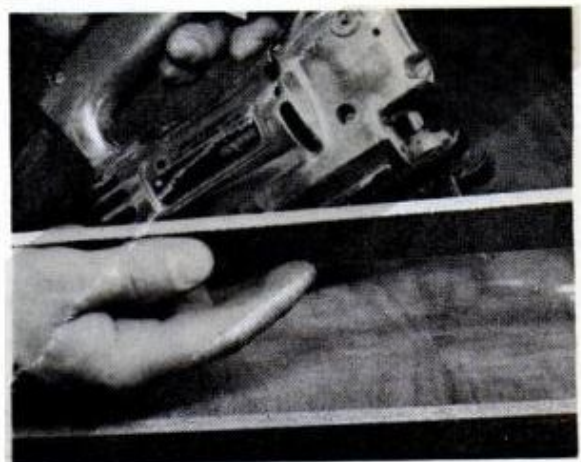
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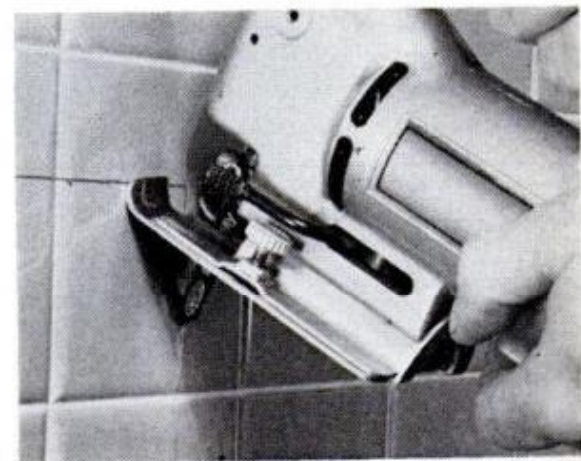
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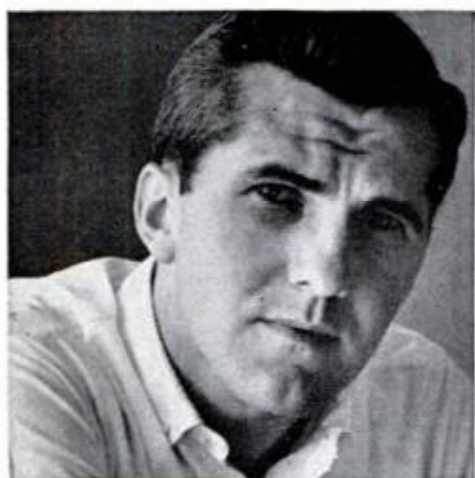


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SCIENCE worldwide

by JOHN F. PEARSON

The person who drinks to forget may be doing a better job of it than he thinks. That's one conclusion that can be drawn from the results of research on white mice by the University of Florida's Dr. Gerhard Freund. He reports that mice, given "cocktails" with their food over a period of months, showed deterioration of brain function and loss of memory—damage that appeared permanent. The mouse brain, according to Dr. Freund, is similar to man's and "the basic biochemistry is the same." He says his studies tend to cast doubt on the notion that it's malnutrition that causes brain damage in alcoholics. His mice showed damage whether well fed or not.

NASA is helping to collect facts for the 1970 U.S. census by carrying out high-altitude aircraft flights over 26 cities—Denver, Salt Lake City, Atlanta and New Orleans, among others. Purpose of the missions is to gather standardized data on urban areas so that land usage can be correlated with statistical data gathered in the census.

A continuous record of the ocean bottom in a 3500-mile-long strip from Cape Hatteras, N.C., to Cap Blanc, Mauretania, in northwest Africa, is being made by the Discoverer, a survey ship operated by the Environmental Science Services Administration. Electronic instruments on the Discoverer record the shape of the ocean bottom and subbottom, including rock layers several miles below the ocean floor, and their magnetic and gravity fields. Scientists think that evidence gathered during the two-month trip will cast new light on the theory that the continents once were joined.

Is the Earth losing its oxygen supply? No, say Department of Commerce scientists after completing a three-year study and comparing the results against tests made as long ago as 1910. Despite the heavy burning of oil and coal, there has been no discernible change in the atmosphere's oxygen content. The scientists report that air at sea level contains 20.946 percent of oxygen by volume. Earlier measurements made since 1910 range from 20.945 to 20.952. Projecting their research results, the Department of Commerce investigators say that even when all recoverable fossil fuels have been consumed, the concentration of atmospheric oxygen will still be about 20.8 percent by volume. The direct effect of this slightly lowered concentration on human breathing would be negligible.

If you're a lepidoptera fancier, you'll be happy to know that color photos of all the 10,000 species of moths found in the United States, Canada and Greenland will appear in a 14-volume work now in preparation. Called *The Moths of America North of Mexico*, the reference set will be published in England over the next 12 years. The driving force behind the monumental venture comes from a South Carolina physician, Richard B. Dominick, a life-long collector of moth and butterfly specimens.

"Polywater" is still a puzzle. First produced by Russian scientists in 1962, the substance is regarded as a new and peculiar form of water by some scientists. Others think its unusual characteristics may be due to the presence of inorganic contaminants. Polywater's controversial status remained unchanged after an international symposium recently held at Lehigh University, Bethlehem, Pa. Of interest to American scientists was a report by a Russian researcher that the liquid he has been working with has a boiling point of 482°F. In addition, it has a molecular weight 10 times that of ordinary water, a high viscosity and a very low freezing point.

A new world's record for "dry" dives is claimed by two young English researchers, who recently spent 10 hours at a simulated depth of 1500 feet. Scientists say the achievement indicates man has yet to reach the physiological limits of deep diving. ★★★

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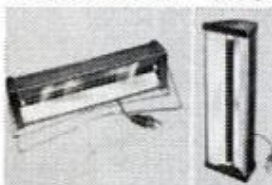
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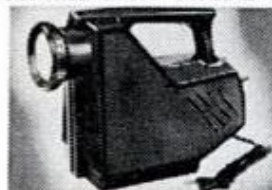


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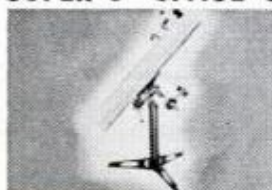
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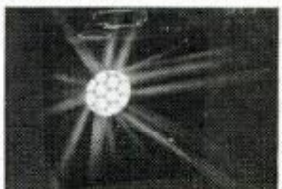


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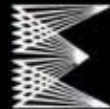
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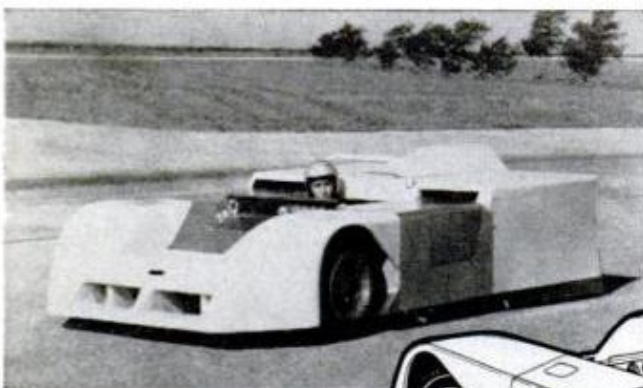
Drivin' with Dan

What's different about the '70 Can-Am cars? Do wide wheels make an appreciable change in performance? Are the bigger engines okay for small-car use? Dan Gurney answers these and other automotive questions

Q. I was happy to see you walk away with the first two races in the Can-Am series, but was also anticipating tougher competition in the series with the entry of Jim Hall's Chaparral 2J at Watkins Glen. What really happened to it?—Neil Sonenberg, Douglaston, N.Y.

A. The 2J with Jackie Stewart driving got off to a good start in the race, turning several really hot laps. The vacuum fans were disabled early in the race when asphalt chunks breaking off the track surface jammed the belt-drive system from the fan motor. Without the atmospheric down force acting on the car to "glue" it to the road, the brakes were overtaxed and the car had to retire.

Q. Since wings were banned from the 1970 Can-Am cars, what kind of driving "feel" difference do you notice?—Kelly McCurnin, Long Beach, Calif.



CHAPARRAL 2J is held against the road by atmospheric pressure when partial vacuum is created under the car. An auxiliary motor drives the two fans in the aft end which evacuate the air. Rugged Lexan "skirts" extend down from the car body almost to the road, thus providing enough of a seal for the system to work. The skirts are articulated to allow some freedom of movement since they do on occasion come in contact with the road

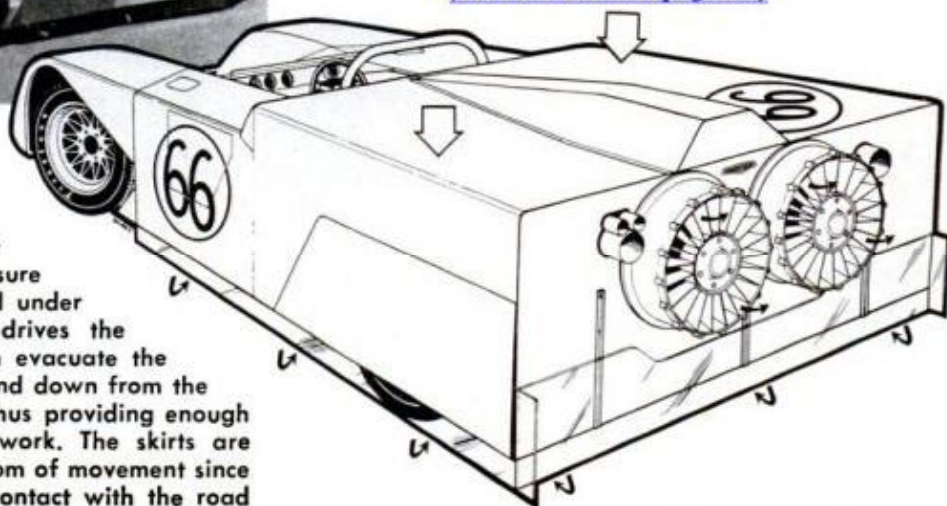
A. Actually wings are still allowed, but they can no longer be mounted directly on the suspension. There's a limit as to their height and they must attach to the chassis or body. This means heavier springs are needed, the car's ride is stiffer and the front-to-rear balance of the car is harder to achieve throughout the speed range.

Q. Is appearance the only reason for the wide wheels so many people buy or is there any appreciable performance difference?—Greg Hogan, Milwaukee.

A. Wide wheels have evolved out of racing right along with wider tires and more rubber on the ground. Many passenger cars suffer adverse effects from wider wheels along with bigger tires. Usually wider wheels and tires are heavier, possibly rougher riding and sometimes not as good in wet weather.

Q. Did you notice any significant changes in Grand Prix racing when you returned this year after a two-year absence?—Randy Erickson, Cleveland.

A. Yes. I was two years older and rustier. The cars are not much faster in top speed, but are quicker around corners and brake *(Please turn to page 26)*



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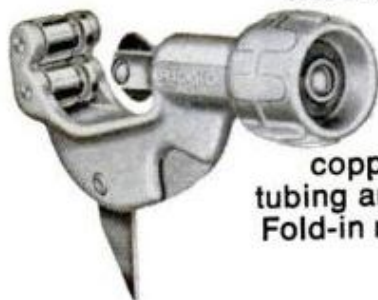
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DRIVIN' WITH DAN

(Continued from page 24)

harder. There are still standouts, but the so-called second echelon is much closer to the fastest people, and there are many more of them. It is tough competition.

Q. I am making a study of whether or not there is any problem in handling small automobiles equipped with engines more powerful than the standard engine normally installed in them. What's your opinion?—Ervin D. Sacks, Philadelphia.

A. How do you plan to carry out this study? Drivers have a lot to do with problems in car handling. I believe a more powerful engine need have no detrimental effect on the car's handling. As a rule, however, higher speeds require better handling, brakes and so on.

Q. How much do smog-reducing devices reduce performance in ordinary automobiles?—Paul Olson, Newark, N. J.

A. I don't know the exact percentage reduction in economy and performance (very slight), but the various devices enable the engine to meet minimum requirements for air pollution. They work; they're not all hokum. Don't disconnect the plumbing!

Q. I just bought a 3 $\frac{1}{2}$ -hp mini-bike. What are the advantages of taking off the governor?—Howard Truckman, West Hempstead, N.Y.

A. It should let you reach higher speeds; it should also enable you to wear it out sooner. It might be more fun. You can probably smoke off your neighbor or his mini-bike if he still has a governor on his.

Q. What is the difference between the Triumph Spitfire Mk II and the Mk III?—John Engstrom, Corning, N.Y.

A. Obviously, in addition to having one more mark, the Mk III, introduced to replace the Mk II in 1967, has many differences that do not, however, affect the basic appearance of the car. The Mk III has a different cylinder head, various trim and badge changes, higher bumpers and a soft top that folds back into the rear well as opposed to the old type that had to be removed and stowed in the luggage boot. The Mk III, has had

(Please turn to page 30)

"With my budget when the engine packs it in so do I."



Tom Davey's in racing for the fun of it. He's not a pro with a spare engine and a big fancy pit crew. He pays his own way. And he knows that a cham-

pionship he's been chasing all year can go up in smoke — right out the tailpipe.

That's why he uses Gulfpride® Formula G. Formula G's low ash content helps keep plugs and rings clean. And it won't turn to foam or break down when the old mill is turning over 30% faster than it was designed to.

Which is more than Tom can say for other racing oils he could name. Because he's come face to face with bearings that were the victims of oil breakdowns.

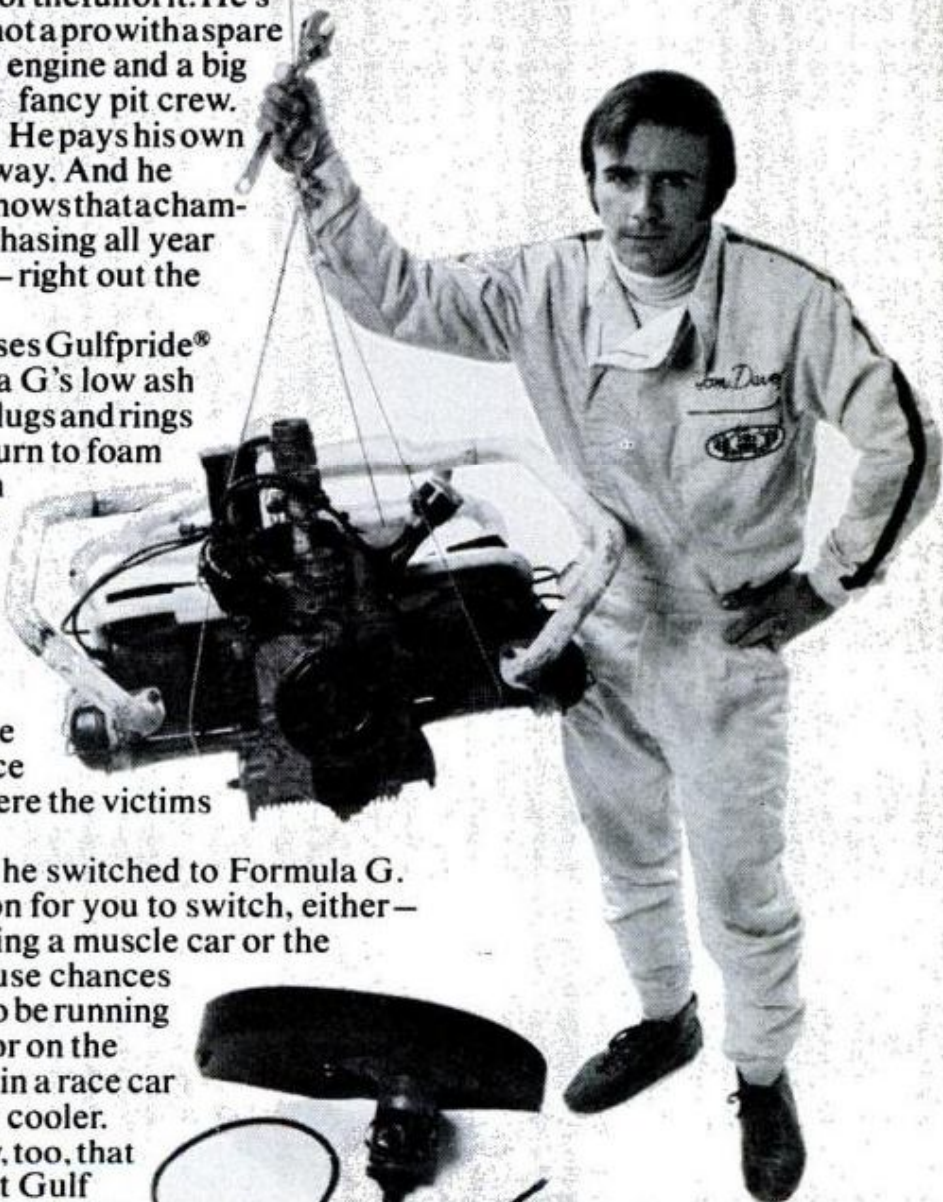
And that's why he switched to Formula G.

Not a bad reason for you to switch, either — whether you're driving a muscle car or the family wagon. Because chances are your oil is going to be running hotter around town or on the highway than the oil in a race car equipped with an oil cooler.

It's nice to know, too, that we sell Formula G at Gulf stations. Because not only is it a racing oil, but it also meets all passenger car manufacturers' new car warranty standards.

Tom knows. Which is why he uses Formula G in the car he drives to the track, as well as the car he drives on the track.

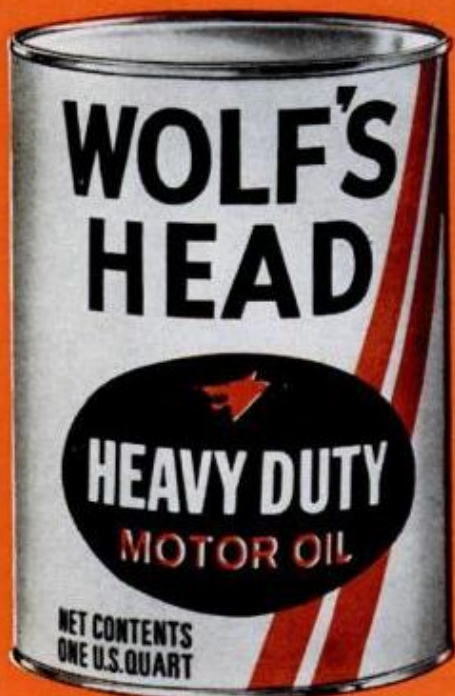
He knows that if he blows the engine in one, he loses the race. But if he blows it in the other, he rides the bus.



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warranty requirements.

DRIVIN' WITH DAN

(Continued from page 26)

annual changes since its introduction, among them the change to high-back seats and more effective emission-control plumbing.

Q. How come Wally Dallenbach is sponsored by a soda company? You can't use soda in a radiator.—Wally Simpson, Waldwick, N.J.

A. You can surely run it in the driver and pit crew! It's just a good way to get the "Sprite" name before the public. AAR's Olsonite Eagle Indy cars are sponsored by the world's largest manufacturer of toilet seats, Olsonite. Mr. Olson's companies make many other products also. How's that?

Q. When did you start your racing career and how did you get into racing?—Linn Bishop, Tulsa, Okla.

A. Nov. 1955, at Torrey Pines, Calif. It took me about 3½ years to get my first big breaks with other people's cars. In the meantime I raced my own little Triumph and Porsche and did a lot of practicing and begging and politicking.

Q. In the SCCA Trans-Am car, is there a regular roll bar or a complete roll cage, as is found in the NASCAR stockers?—Joe Norris, Wisconsin Rapids, Wis.

A. A roll cage similar to NASCAR is in our Plymouth Barracudas, but I don't think the rules require that much. The cage is much stronger and safer, of course.

Q. I recently read that a race driver should have a "mean edge." What do you mean by that?—Sam Matsuda, West Jenkins, Minn.

A. After going through all the training, all the preparation, testing and adjusting, sooner or later you must race. When that moment comes, you are in effect isolated in the car and you have to be aggressive, maybe vicious, but at least, violent. It all gets pretty basic and animalistic at those moments. ★★★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 74).

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I'd like to give this to my fellow men...

while I am still able to help!

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

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

By Victor B. Mason

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

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

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

I Have All The Money I Need

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

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

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

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

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CALVERT CITY, KY.—Mobile detection units are being employed by the State Air Pollution Control Commission to survey air pollution, test and evaluate pollution's effects, conduct on-the-spot studies and provide mobile lab facilities for specialists. The sophisticated monitoring tools, housed in two vans and several supporting trailers, include hydrocarbon analyzers, anemometers, colorimeters and infrared analyzers. One unit is stationed outside Calvert City. The other van and trailers, along with six rooftop facilities, establish monitoring bases in key domestic and industrial locations. Armed with "fume brooms," Kentucky can constantly check the external combustion of industries, powerplants, home heating and incineration.

BOSTON, MASS.—A special "scrubber" device will be used in an experimental plant to recover sulphur dioxide pollutant from powerplant smoke and convert it into resalable commercial chemicals. If approved by the state, the "scrubber" will be installed early next year at Boston Edison's Mystic power station where it is expected to convert 90 percent of the irritating pollutant into 50 tons of raw sulphur and sulphuric acid daily. Cost of the project will be shared by local utilities and the National Air Pollution Control Administration. Sulphur dioxide accounts for about 17 percent of all air pollutants by weight, second only to motor-vehicle emissions.

SACRAMENTO, CALIF.—Steam-operated buses will be used to curb pollution in smog-stifled cities of California, under a federal grant from the Department of Transportation. International Research and Technology Corp. and the Lear Corp. are among the firms contracted for development work. Two San Francisco Bay Area transit fleets will donate buses and operating personnel for initial testing, scheduled for next year. The state legislature has stipulated that the buses be powered by External Combustion Engines (ECE).

MISHAWAKA, IND.—Wheelabrator Corp. announces it will market a system for collecting liquid contaminant particulate matter from the air in heavy industrial areas. Ultra-Dyne, developed in conjunction with Johns-Manville Corp., uses high-velocity air to impact particles onto glass-fiber filters, where they are captured. First commercial trials disclosed a 98 percent efficiency at air velocity of 500 feet per minute. Ultra-Dyne removes not only particles, but the odor associated with oil, grease and tar processes.

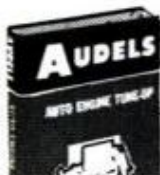
DO YOU KNOW about some action being taken to fight pollution that we don't know about? In your community? On the job? Tell us about it. Write Environment Editor, Popular Mechanics, 224 W. 57th St., New York, N.Y. 10019.

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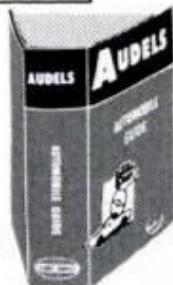
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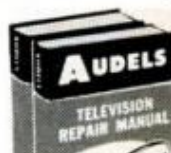
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LISTENING POST

BY ROBERT LUND

POP-OUT ENGINES COMING SOON? One of the "discomforts" of plowing head-on into another car or an unyielding object is having the engine land in your lap. Better you should try to field a shell out of a hot howitzer one-handed. But you may not have to worry about the engine cannonballing onto your knees much longer. The auto companies are working on an idea to prevent it from penetrating the passenger compartment. There are test cars around now in which the engine has been installed with breakaway mountings. In a severe collision, the motor pops out and drops on the pavement instead of hurtling rearward into the front seat.

The National Highway Safety Bureau is pushing the industry to adopt the idea immediately. The auto companies are asking for time to run additional tests and check their calculations. But pop-out engines are a fair bet for '73 or '74.

NEW LOOK FOR JEEP? American Motors is said to be working on it now that the car's in the AMC catalog. The new version will be less boxy and more contemporary in appearance than its predecessors. But AMC won't try to change the image. The mechanical hero of World War II will continue to be a utility vehicle first, a pleasure car second.

SMALL CARS AT NOT-SO-SMALL PRICES. If you decide to go for one of the new small cars in the next few months, don't expect to buy it for the skinny price quoted in the ads. Not if you want early delivery. There's always a waiting list of free spenders when the new cars come out. It usually takes six weeks to two months to satisfy 'em. The auto companies make the most of the market while it lasts and turn out more expensive cars at the beginning of a model run than at any other time. First cars off the line are usually loaded with options and the extras will be especially important to automakers on the mini machines. GM and Ford figure to take a beating on Vega and Pinto on the basic vehicle, but they expect to make money on optional equipment. They'll turn out enough plain numbers to provide dealers with sample copies. But until the bloom wears off, the emphasis will be on high-ticket cars, not the economy specials pictured in the ads.

DUAL LAMPS ARE ON THE WAY OUT. While you're looking at the new ones, notice the number of cars with single headlights and where they're positioned. Pontiac, Vega, Pinto and Mustang, for example. You'll see more of this over the next few years. At the same time, there's a movement to engineer headlights out of the grille, by stacking them above it or tucking them in fenders. The idea is to position lights—recessed, if possible—so they're less susceptible to damage in a front-end accident.

IF AND WHEN THE VENT WINDOW COMES BACK, it may be about a third the size of the old vent and on a sliding track in the lower corner of the side glass. You'll be able to open and close it with two fingers. Ford's working on it. Another novelty Ford is looking at is an elliptically-shaped (egg on its side) steering wheel with notched sections for the driver's hands.

THE NEW-CAR WARRANTY GETS WORKED OVER every year at this time—just as the new cars. But where the cars are improved, the warranty becomes more complicated and incomprehensible. The footnotes, the qualifiers and disqualifiers, the fudging and the fine type become more bewildering and unintelligible model year after model year. The auto companies realize the new-car guarantee is written in gobbledygook and if you ask what they're doing to demystify it, they beg off with the explanation, "We're studying it." They may have run the string on that stall, because there's a movement

(Please turn to page 38)



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DETROIT LISTENING POST

(Continued from page 36)

afoot to get the government to force all manufacturers to write their guarantees in everyday English.

But if there's still time for the auto firms to act on their own, Listening Post suggests they get a copy of the fall-winter catalog put out by Sears and check the guarantee printed on page 767. It happens to be for a dishwasher, but Sears uses the same guarantee, same language, for a long list of products. It runs exactly 74 words, including the name of the item guaranteed, how long the guarantee is good for, what it covers, what the buyer must do to collect, what Sears will do and who is responsible for paying off on a legitimate complaint.

All that in 74 words! If a mail-order house dealing in a couple million products can put it that succinctly, why can't auto manufacturers lay it on the line in a few hundred words?

REMOTE PRESTARTERS. When is Detroit going to develop a time-controlled, remote-controlled starter so you can turn on your car's engine at a predetermined time and activate the heater in the winter or the airconditioner in the summer? The idea's been around for years and Cadillac once considered putting it in a production car. Some wheels around town have such a device on their personal cars as a toy. There have been a couple of drawbacks to the prestarters developed up to now. With the car running, a thief could hop in and drive it away. Second, there has to be an automatic shutoff if the driver doesn't get to the car in a certain length of time; otherwise the engine could be damaged if it were allowed to run indefinitely.

A PM reader in Marion, Ky., Willard Mott, says he's solved both problems. Mott has prestarters on both his cars. He's used one on his '67 Pontiac something over 500 times, another about 200 times on his '70 Olds. Mott, who built the units in his garage, admits the hardware is pretty cumbersome and primitive because the components came right off the shelf at the local hardware store. But he says the gear could be slimmed down to a compact package if the parts were tailored for the purpose.

A LOT OF WORTHWHILE IDEAS for cars still come out of garages, basements and the research departments of supplier companies who sell to the auto firms. Not many of 'em make it. The economics are (Please turn to page 40)

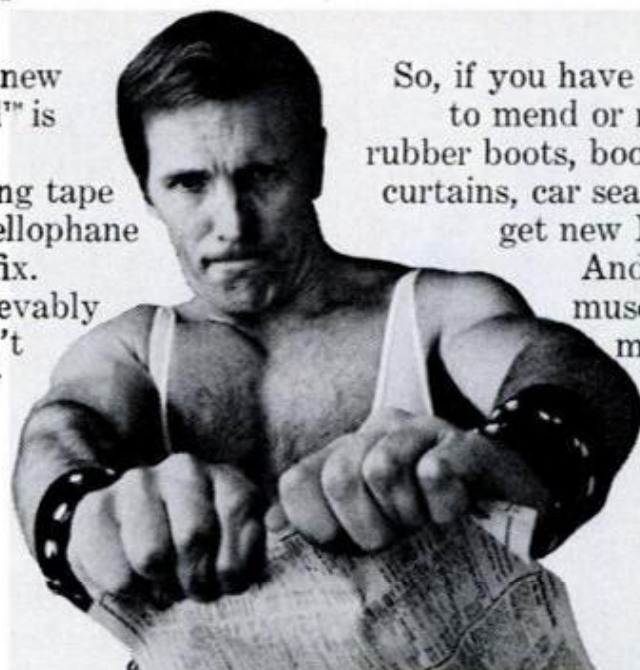
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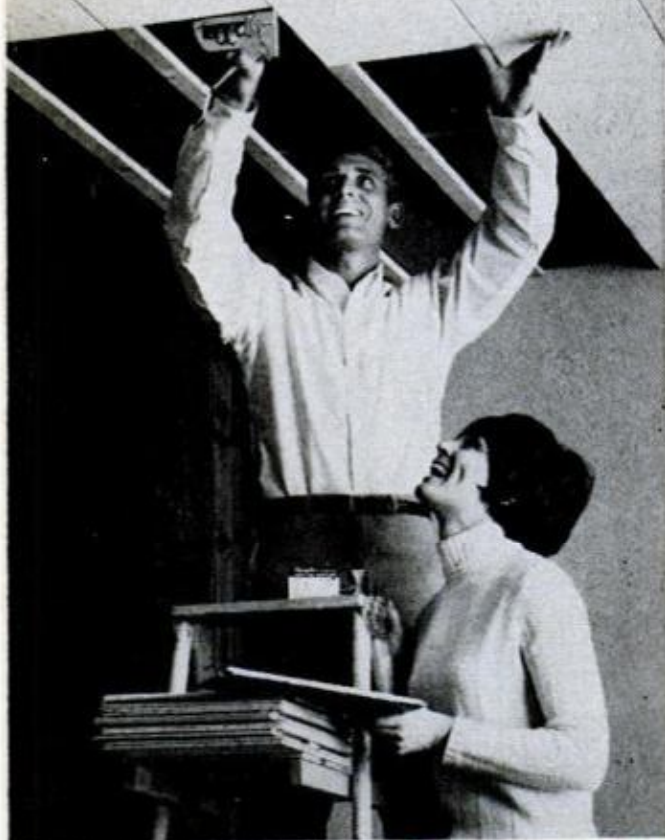
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DETROIT LISTENING POST

(Continued from page 38)

wrong—the devices cost too much to produce—or carbuilders have already experimented with something similar and discovered a drawback not evident to outsiders. Case in point: a periscope rear-view mirror. Plymouth and Lincoln have produced show cars with over-the-top mirrors, but nobody's put one on the market at a price of less than an arm and a leg. Until now. A Michigan company will bring one out next month. It will give the driver a virtually unlimited view of the road from the rear. The firm making the mirror, Para-Vue Co., of Roseville, Mich., hasn't landed any orders from car producers, but it hopes to stir up interest by selling the device as an add-on requested by car owners.

WANT TO TOUCH-UP your car? You can get a booklet explaining how to prepare the surface, wet and dry sanding methods, the spray-shield technique, feather edging and other pointers used by professional painters by sending a self-addressed envelope to Dupli-Color, 1601 Nicholas Blvd., Elk Grove Village, Ill. 60007. Ask for the do-it-yourself book.

NEW PASSIVE RESTRAINT CONCEPT developed by the Firestone Tire & Rubber Co. that covers passengers from knees to shoulders and door to door with a "security blanket" in a collision was recently demonstrated. A blanket stored in the back of the front seat is activated by a sensor which sets off propellant cartridges in pistons mounted on either side of the inside of the trunk. Blanket, deployed in one-thirtieth of a second, is designed to restrain three 200-pound persons in a head-on crash at 40 mph. Photo below shows the O-ring a passenger pulls to free himself from the blanket and leave car after it stops. ★★★



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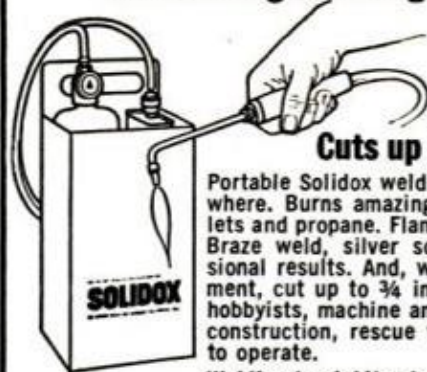
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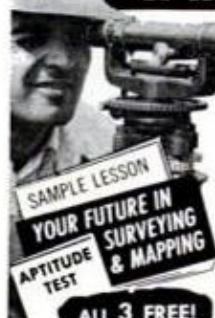
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By **GEORGE REIGER**,
Outdoors Editor

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Singlepoint blanks out your view of the target with one eye and substitutes an aiming point for it. The target and aiming point are seen independently by closing alternately each eye, or seen simultaneously with both eyes open. The shooter sees a spot of light, apparently floating in air. He superimposes this on his target.

Floating spots are not new. Thirty years ago British aircraft used reflector sights to claw the Luftwaffe from the skies. Nor is the sight-collimator concept new. We all can bore-sight a rifle. (See *How to Sight In a Rifle*, page 132.) But fusion of these two concepts in one sight is new.

For further information write Normark Corp., 1710 E. 78th St., Minneapolis, Minn. Believe me, it's worth the postcard. ★★



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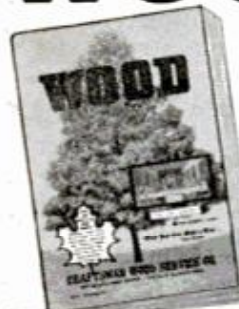
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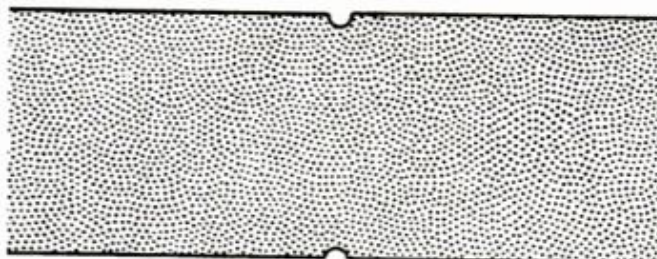
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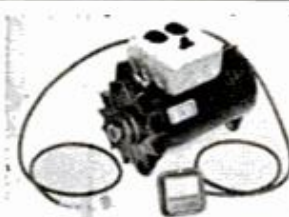
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BY ROB KINSON



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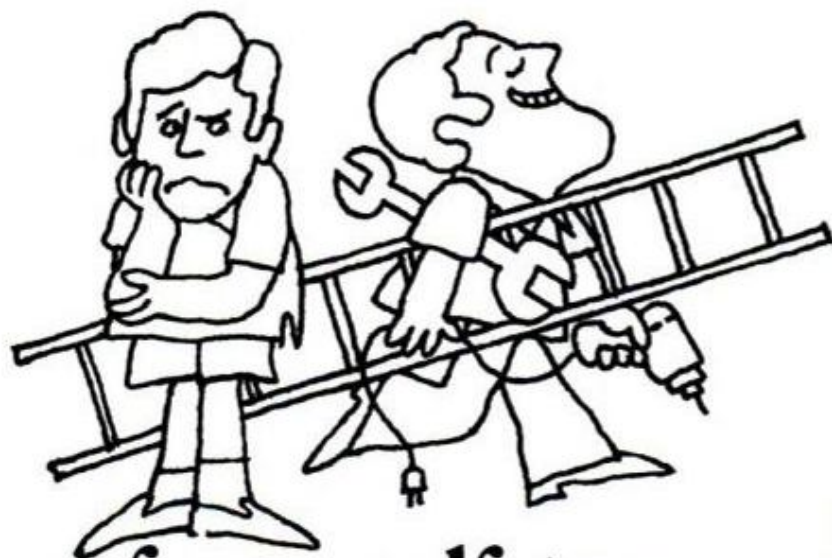
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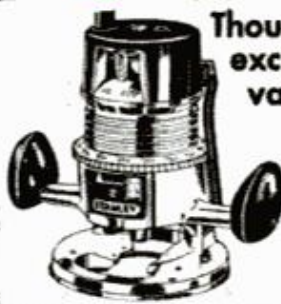
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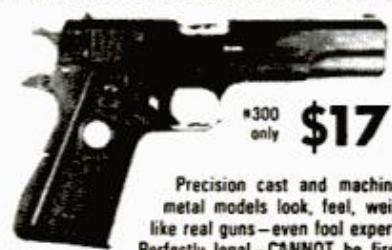


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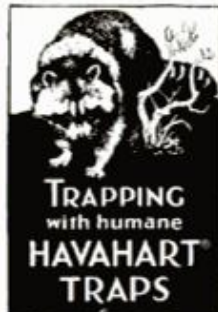
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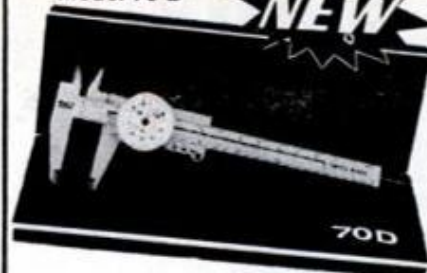
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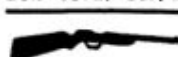
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(Continued on next page)

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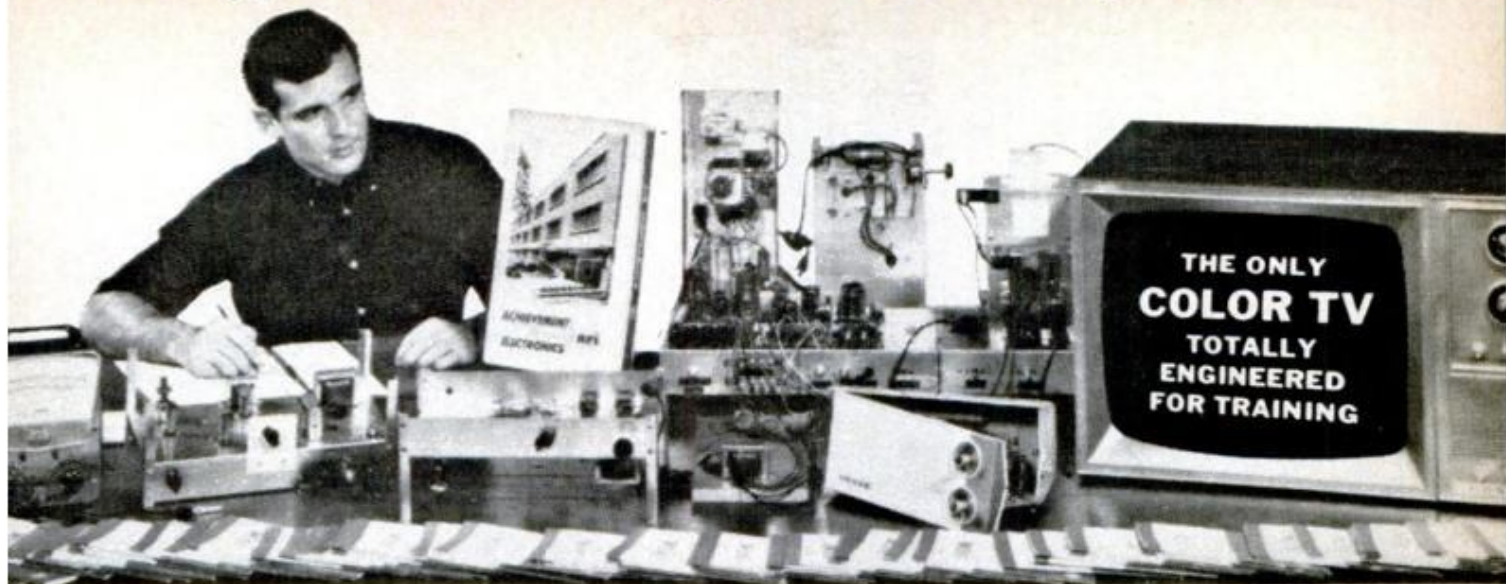
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JOB AND BUSINESS OPPORTUNITIES IN ELECTRONICS COMMUNICATIONS RADIO-TELEVISION

SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Longevity

Thanks to good maintenance, my 1963 Buick Electra is still going strong at 90,000 miles. However, a problem has cropped up. Even with a tune-up, the engine cuts out at 60-70 mph. I've discovered that the distributor points slip and close. What's the hang-up?—Gus Daskalakis, Santa Ana, Calif.

Worn cam lobes, a worn shaft bushing or both. Give in, Gus. Get a new distributor, and your car could go another 90,000.

Cool it

My 1967 Dodge 318-cu.-in. V8 with 2-barrel WW-3 Stromberg carburetor has a percolation problem you wouldn't believe. It starts without trouble when cold, but restarting when the engine is hot is very hard. Two rebuilt carburetors and one new one haven't improved the situation. The heat riser is okay, and apparently so is everything else. A fuel-line pressure regulator has even failed, and my mechanic has thrown in the sponge. Can you help?—Daniel J. Baird, Philadelphia.

Raise the carburetor off that hot intake manifold and I think your trouble will be over. Start by using two carburetor base gaskets; that is, double the thickness. If that doesn't work, add a third.

Which wrench?

I have a 1969 Chevelle Malibu V8, 307-cu.-in. How do I loosen the distributor so I can time the ignition? My conventional socket and wrench set won't fit.—John A. Sego, Hickory, N.C.

You'll have to use a flex socket, an offset wrench or a box wrench that has a short handle.

Cagey gauge

Over the years you've answered questions about troublesome fuel gauges. I was about to buy a new gauge for my 1964 Plymouth Fury when I decided to make one more check. I jacked up the rear of the car and found that the gas-tank unit and the main line to the fuel pump were connected by a piece of rubber hose that

broke the ground and made it necessary to use a spring-steel grounding clip that was attached to the fuel line on each side of the rubber. This clip was badly rusted, so I cleaned it and also cleaned the area of the fuel line to which it connected. My fuel gauge trouble disappeared with the rust.—John Tek, Cleveland.

Good show.

Tanked

My 1968 Torino GT with 390-cu.-in. engine and Holley 4-bbl. carburetor won't keep its idle. The car starts to run like a tank a week after a tune-up. Should I have the carburetor rebuilt?—Sgt. Fred Dominey, Okinawa.

No. If the carburetor was causing the trouble, the car would "run like a tank" all the time. Something is affecting the idle jets of the carburetor—probably dirt or water which is being put there by the fuel. I'd have everything from the fuel tank to the carburetor cleaned out, especially the fuel tank.

Sprung valve springs

I have a 1969 Pontiac GTO with ram air, 4-bbl. carb, a close-ratio 4-speed and heavy duty limited-slip rear end with 3.90 gear ratio. At 10,000 miles two valve springs broke and a push rod bent. About 800 miles later, I found two more broken valve springs. What gives?—John P. Dealy, Burrton, Kans.

Probably the whole engine if you're not more careful. I don't know of any reason why valve springs on this high-torque engine should break, with one exception—overpeaking. If you like to surpass the red line on the car's tach, I suggest you install a high-performance kit that contains a set of specially hardened racing springs. You can buy such a kit at a speed shop.

Temper, temper, temper

You were wrong, wrong, wrong in indicating that front windshields are of tempered glass in the piece, Creeping crack (Auto Clinic, page 82, March PM). Wind-
(Please turn to page 78)

Correct your engine's idle ways.



At idle, your engine does a lazy job of burning the gasoline. So there's a build-up of abrasive soots and unburnt resins that might cause engine trouble.

Quaker State Motor Oil has a special ability to protect against these trouble-makers. Because it's refined only from 100% Pure Pennsylvania Grade Crude Oil, the finest natural lubricant in the world. It's specially blended and fortified to neutralize acids, prevent rust, and keep abrasive deposits in harmless suspension.

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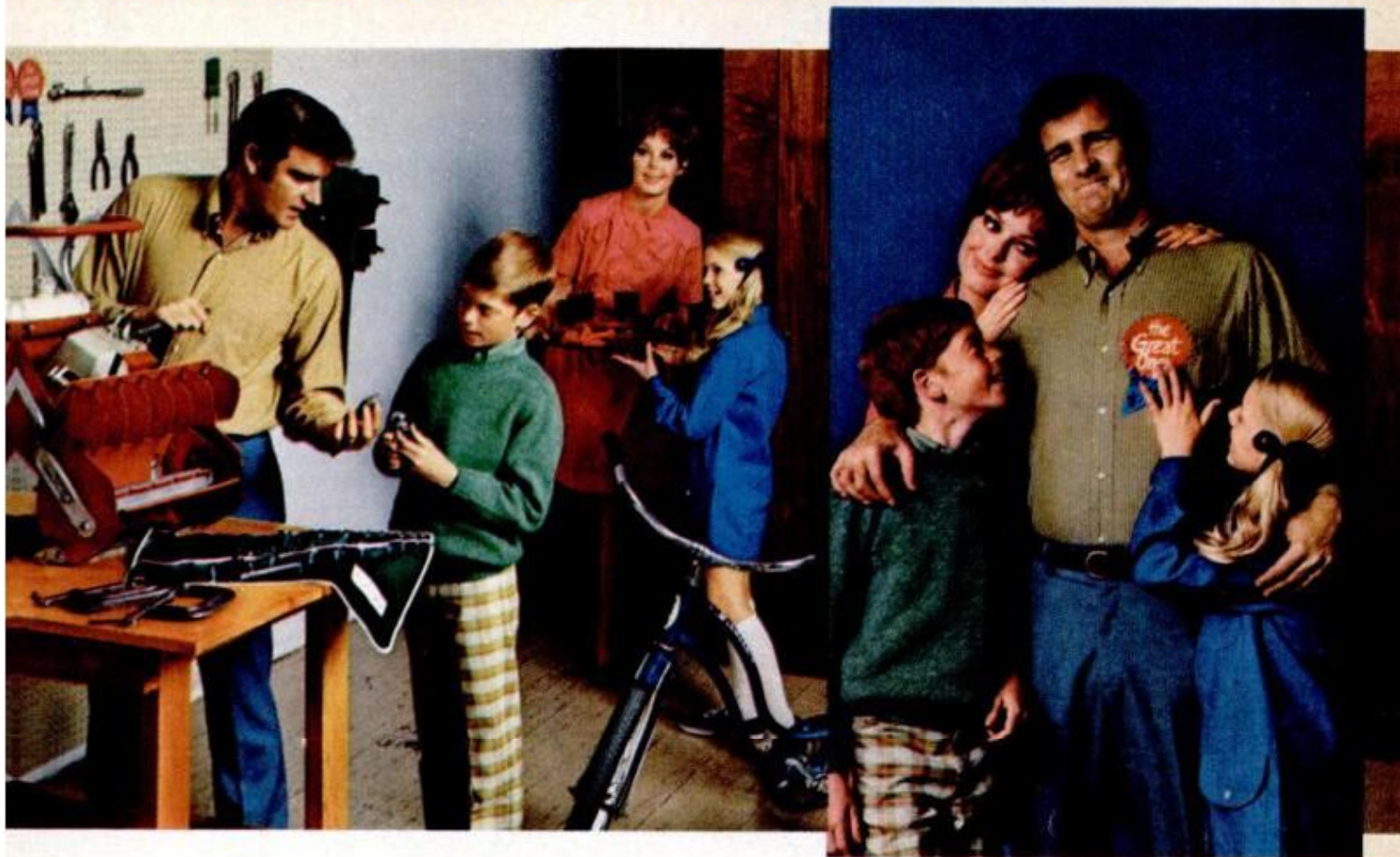
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AUTOMOBILE CLINIC

(Continued from page 74)

shields are laminated. Other glass in a car is tempered.—Harold A. Perilstein, Perilstein glass Co., Philadelphia.

I know, know, know. But the other thing I said is right. Once the windshield is damaged, the crack will spread and the windshield will eventually have to be replaced.

Fickle fan

I own a 1969 144 Volvo with B20B engine. On three different occasions, the slip-coupling fan has loosened and has damaged the radiator. The dealer hasn't been able to solve the problem.—John Masoncup, Gallup, N.M.

Perhaps the lock washer is bad or missing, and your dealer hasn't thought of it. But if he has, it is possible that high temperature is causing the metal fan to contract and vibration is doing the rest. A new fan has been issued which overcomes this problem. Its part number is 140-683541. Hardware needed to attach it consists of a spacer (part No. 140-686104) and four screws (part No. 140-940161).

Hog-tied

The heat-control valve in my 1966 Ford pickup developed an annoying rattle, so my mechanic tied it in the open position. Although this has stopped the noise, it's given me some starting troubles on cold mornings. Is there any way to lick the problem all around?—Ben J. Wekenborg, Argyle, Mo.

Install a new heat-control valve. The spring used in this one has lost tension. I wouldn't ride with it wired open for too long, because it will cause hesitation and bad performance.

A shocker

What can I do to keep from getting a shock every time I get out of my 1970 Chevelle SS?—R.J. Welsh, Essex, Md.

You could try placing a ground strap beneath the car, or you could try spraying antistatic electricity compound on the

vinyl. This is available at auto supply stores. I find the best shock reducer is to keep hold of the door handle until I get my feet on the ground.

Bungled blinker

I got the surprise of my life the other day when I took my 1969 Oldsmobile through inspection. Although the dash light blinked and I heard the inevitable clicking, I was told by the inspector that my right-turn signal was not working. I had had it repaired a few days before. Did the repairman do something wrong?—John Bellagio, Camden, N.J.

He probably installed the wrong flasher. Whenever a new flasher is installed, be sure that its part number is the one called for.

Service Tips

● **1970 Eldorados** may make you think you're seeing double, but you're not. There are two crankcase drain plugs, and both of them must be removed in order to drain the oil completely. The two are necessary because of the off-beat contoured design of the oil pan.

● **Buick's new cooling system** for 1970 can throw you if you're not careful. It's a translucent plastic reservoir that you can look through to see the coolant level. You don't have to remove the cap. However, it should be checked with the engine at operating temperature. All earlier-model Buicks are checked with the engine cold.

● **AMC**, remember, put ball joints on the 1970 models. Previous models used trunnions. These ball joints are equipped with lube plugs. Use them every 24,000 miles unless you drive in an area where things are dusty or wet. In that event, lube every 12,000 miles.

● **Chevrolet station-wagon rear bumpers** that need a new plastic reflector have to be well cleaned to assure good adhesion. Remove all the old adhesive from the bumper and clean the recess area with mineral spirits. Then, with the bumper at a temperature of 70° to 90° F., peel off the backing of the new reflector, but be careful not to touch the adhesive. Place the reflector into the recess in the bumper and press it firmly.

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

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... HERE'S THE PROOF!



PTA



Additive A



Additive B



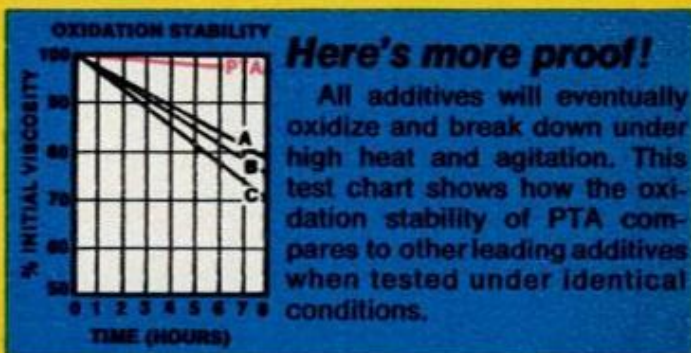
Additive C

These four steel blocks have been subjected to identical test conditions to determine the load bearing limits of the four leading oil additives. During this standard film strength test a hardened steel roller was rotated against a steel block at a constant pressure. All blocks were tested for the same length of time and with the same amount of lubricant. Note the small wear scar on the PTA lubricated block—and the severe scoring on the other blocks. **Proof** that PTA maintains its lubricity after other additives lose theirs.



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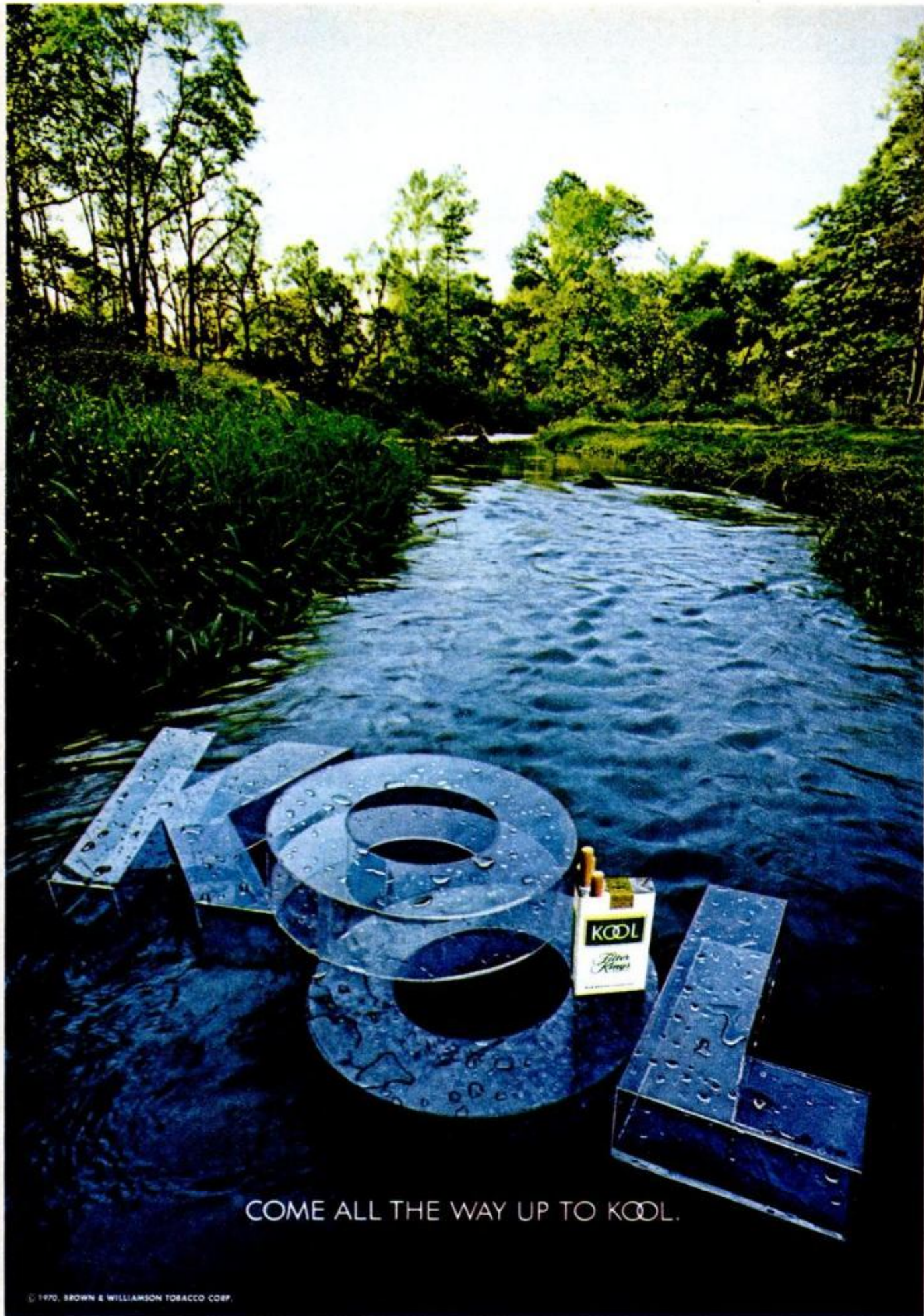


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COME ALL THE WAY UP TO KOOL.

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MADE IN OHIO BY ROBOTS

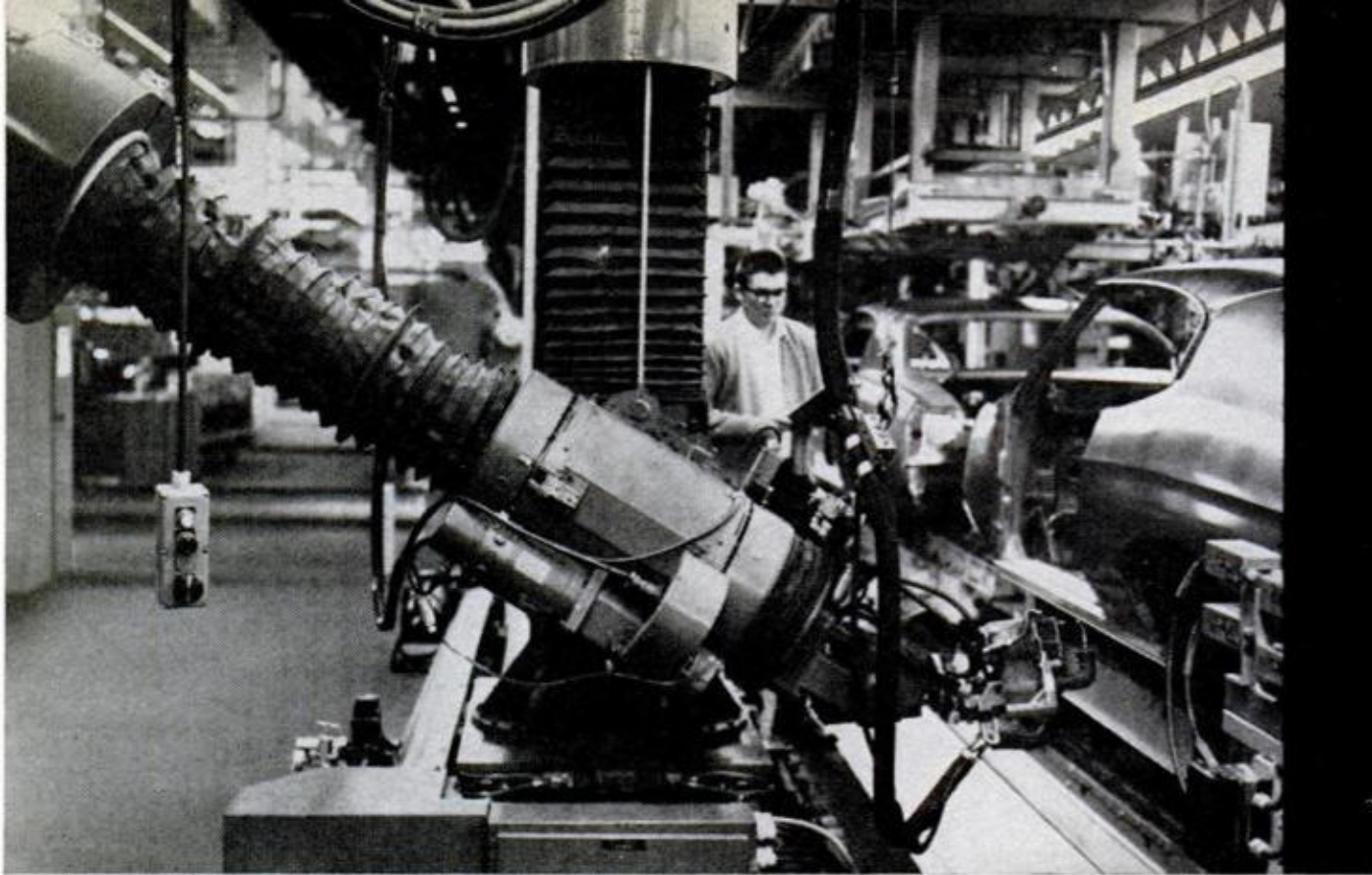
Chevrolet's new Vega—a one-ton wonder on a 97-inch wheelbase—is getting the quality built in on an assembly line 'manned' by machines with hands

By ROBERT LUND, Detroit Auto Editor

Illustration by Roy Grinnell

THEY'RE NOT MAKING THEM like they used to at General Motors' new Lordstown, Ohio, assembly plant. They're making them in the most modern, automated, robotized carmaking complex in the world, a plant that could become the copybook layout for new auto factories for the next 25 years.

GM is using apprentice robots at Lordstown, an idea that may be as much of a milestone in automaking as the



continuously moving assembly line. Where the moving assembly line brought the car to the worker so he could get his hands on it from a stationary position, Lordstown is a step toward producing cars virtually untouched by human hands.

Detroit visionaries are convinced the day will come when an automobile salesman will take your order, punch out the specifications on a machine that will feed a tape directly into the nearest assembly plant, programming the vehicle for production. From this point on, the machine will take over. As soon as the salesman completes his description of the order, the machine will flash back an acknowledgement: "Shipment scheduled for Sept. 27, 14:23 hours."

GM's response to such speculation is a haughty, "Bosh!" The untouched-by-human-hands theory is so farfetched, GM contends, it doesn't deserve the dignity of a "No comment."

The reason GM is reticent about claiming credit for its pioneering at Lordstown is obvious. The United Auto Workers Union is opposed to any movement that might take jobs away from its members. GM has had problems in the past trying to automate its

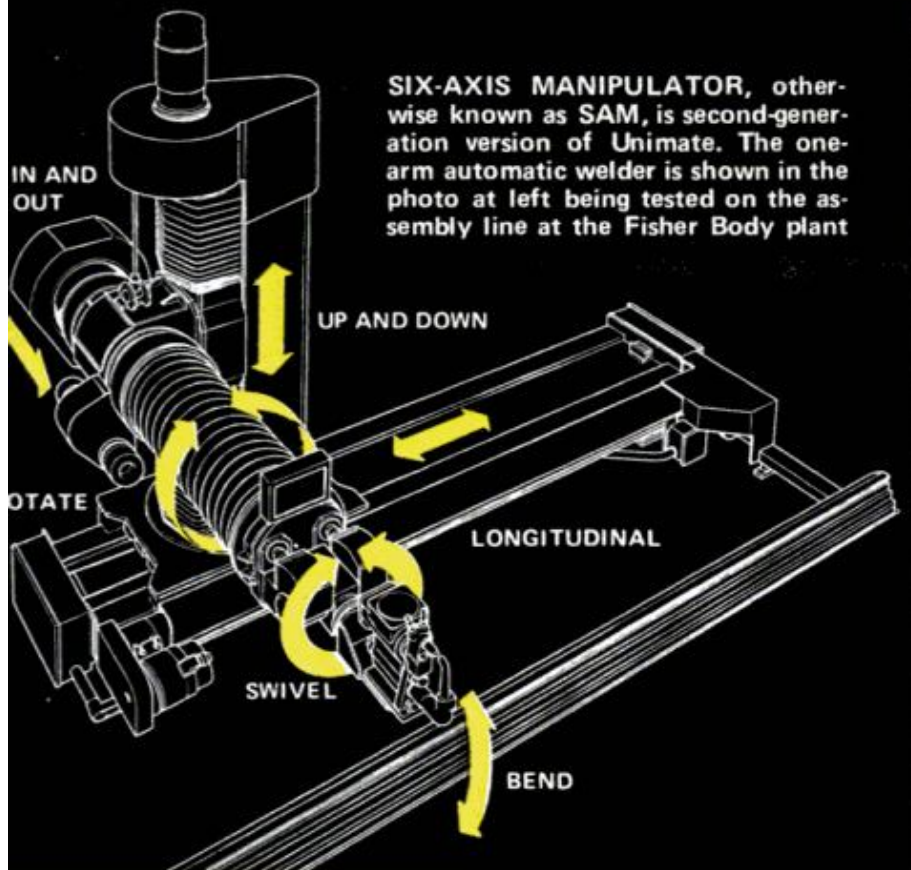
plants and it doesn't want to fuel the fire by discussing the idea of robot factories.

But Lordstown is the most robotized auto assembly plant ever, whether GM claims the title or declines it.

Lordstown is actually two plants. One is a metal fabricating plant operated by Fisher Body Div. Fisher stamps out sheet metal and does much of the sub-assembly work on body parts—doors, deck lids, fenders.

A second facility, where the car is assembled, is about a city block away from the Fisher plant. The second plant is operated jointly by Fisher and Chevrolet. Both plants are devoted to production of a single car—Chevrolet's mini, the Vega. The main assembly plant has a single production line, off of which GM can produce Vega in four body styles—sedan, fastback, wagon and panel truck.

The two plants are connected by a covered conveyor line. Finished sheet metal can be shipped off the end of the line at the Fisher factory to the appropriate station in the assembly plant without being exposed to the elements. There's no waiting for parts to be trundled from one plant to another, no tie-



SIX-AXIS MANIPULATOR, otherwise known as SAM, is second-generation version of Unimate. The one-arm automatic welder is shown in the photo at left being tested on the assembly line at the Fisher Body plant

welded. Jigs and fixtures are then removed and the Unimates take over, welding the vehicle together. Something over 85 per cent of all welding on Vega is done by machine.

GM avoids making any gee-whiz claims for machine welding over hand welding, but there are definite advantages with the machine method. The weld is always the same, leading to better quality and presumably a more reliable product, and the machine never takes a day off, although it is subject to wear and down-

time for replacement or repair.

ups because trains or trucks can't travel, no risk of parts being damaged in handling or transit, no panic phoning back and forth between feeder plant and mother plant. Except for the Vega engine, which is made at Tonawanda, N.Y., Lordstown is a self-contained operation.

GM doesn't want to take a position of championing machine over man. It's not good politics. But it's significant that GM claims Vega, the least expensive car in its catalog, will be as fine and tight an automobile in terms of quality construction as any car GM has ever produced. Including Cadillac. In a company where the powers-in-command inevitably soft-pedal and understate, that's a mouthful.

The machines-in-lieu-of-men that cause GM to bite its tongue when the word "robot" comes up are located in the assembly plant. The machines are called Unimates. The name comes from the Danbury, Conn., company, Unimation, Inc., that produces the equipment.

Automatic welding is not new to the auto industry and the limited use to which GM is putting its robots is not likely to win the auto firm an award for trailblazing. The Unimates are capable of far more complicated jobs than GM has assigned to them. As I gathered on an unofficial trip to Lordstown, the company appears to be feeling its way with its benign Frankensteins. What can they do? How reliable are they? How will the union react?

GM has 26 Unimates at Lordstown, the largest crew of industrial robots in a single plant in the United States. It might be more accurate to say the company owns up to having 26 machines, because it would be unlike GM not to have a spare or two on standby for emergency duty if one of the "soldier" machines conks out. The robots are paired up opposite each other in twos, 13 on each side of the line.

Initially, the 26 units will be limited to a single function—welding body parts. Just before the line reaches the Unimates, the underbody and sides of the car are brought together and tack

The company that supplied GM with the equipment says it has some of the answers. The robot's "birth certificate" as supplied by Unimation, Inc., reads:

"The Unimate robot is a mechanical arm controlled by a solid-state memory

(Please turn to page 204)

Too *Fast* in **FOG**



A truck swept out of the mist and hit the convertible from behind: the start of a fantastic 29-car collision on the New Jersey Turnpike. Toll: 6 persons dead, 20 cars demolished, 6 trucks destroyed or damaged.

By E. D. FALES JR./Illustration by Roy Grinnell

ONE DAMP MORNING TWO YEARS AGO Dr. Edward Jaffee was driving between two points in New Jersey—from his home in Cherry Hill to his office in Pennsville, 30 miles to the south. It was a familiar, routine trip for the 34-year-old dentist. But as he approached Woodbury, he ran into fog and immediately dropped his speed to below the legal 60 mph.

Just beyond Woodbury he braked hard when he saw that the fog ahead looked more orange than gray. Fire! Then he heard the bang of metal against metal, and he could see that cars and trucks were piling up. At least one car was aflame.

A huge gray tank truck loaded with volatile propane tried to stop, but it skidded off the road and landed in a gully. Dr. Jaffee spun his wheel, managed to miss the wreck and kept roll-



ing. He had narrowly escaped disaster in a chain collision—an experience he would never forget.

A year later—Saturday, Nov. 29, 1969—Dr. Jaffee again was southbound on the Jersey Pike. Again, he was driving to his office. A small box on the seat beside him contained a patient's dental plate—a piece of work he was particularly proud of.

At 7:28 a.m. he passed the place where the 1968 chain collision had occurred. Soon he approached Exit 2, which leads off to the right toward Swedesboro. He had just topped a small hill in his blue '69 Mercury convertible when he hit fog. It was a light mist, but he slowed to 50.

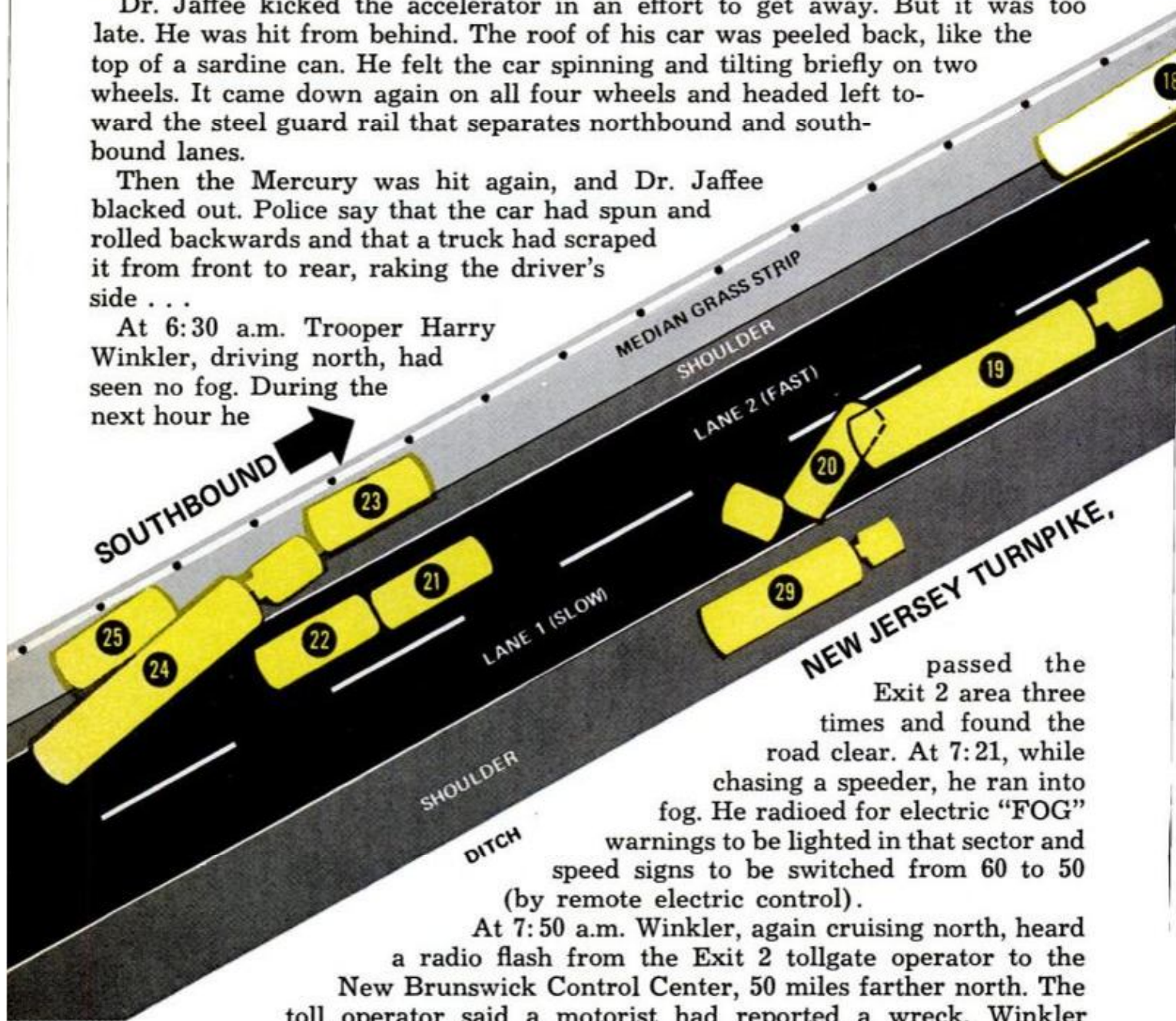
In the next 10 minutes the fog thickened. It now was a low-hanging "pea souper." Cars that passed him quickly vanished in the gray mist ahead. Painfully remembering the year before, he chopped his speed to 30 and checked that his seat belt was fastened.

He watched his rear-view mirror closely. He was proceeding cautiously at 7:40 a.m., when he became aware that something big was sweeping up from behind. Within seconds he saw in his mirror that it was a huge flat-front truck. It was coming fast—too fast. He knew it could not stop in time.

Dr. Jaffee kicked the accelerator in an effort to get away. But it was too late. He was hit from behind. The roof of his car was peeled back, like the top of a sardine can. He felt the car spinning and tilting briefly on two wheels. It came down again on all four wheels and headed left toward the steel guard rail that separates northbound and southbound lanes.

Then the Mercury was hit again, and Dr. Jaffee blacked out. Police say that the car had spun and rolled backwards and that a truck had scraped it from front to rear, raking the driver's side . . .

At 6:30 a.m. Trooper Harry Winkler, driving north, had seen no fog. During the next hour he



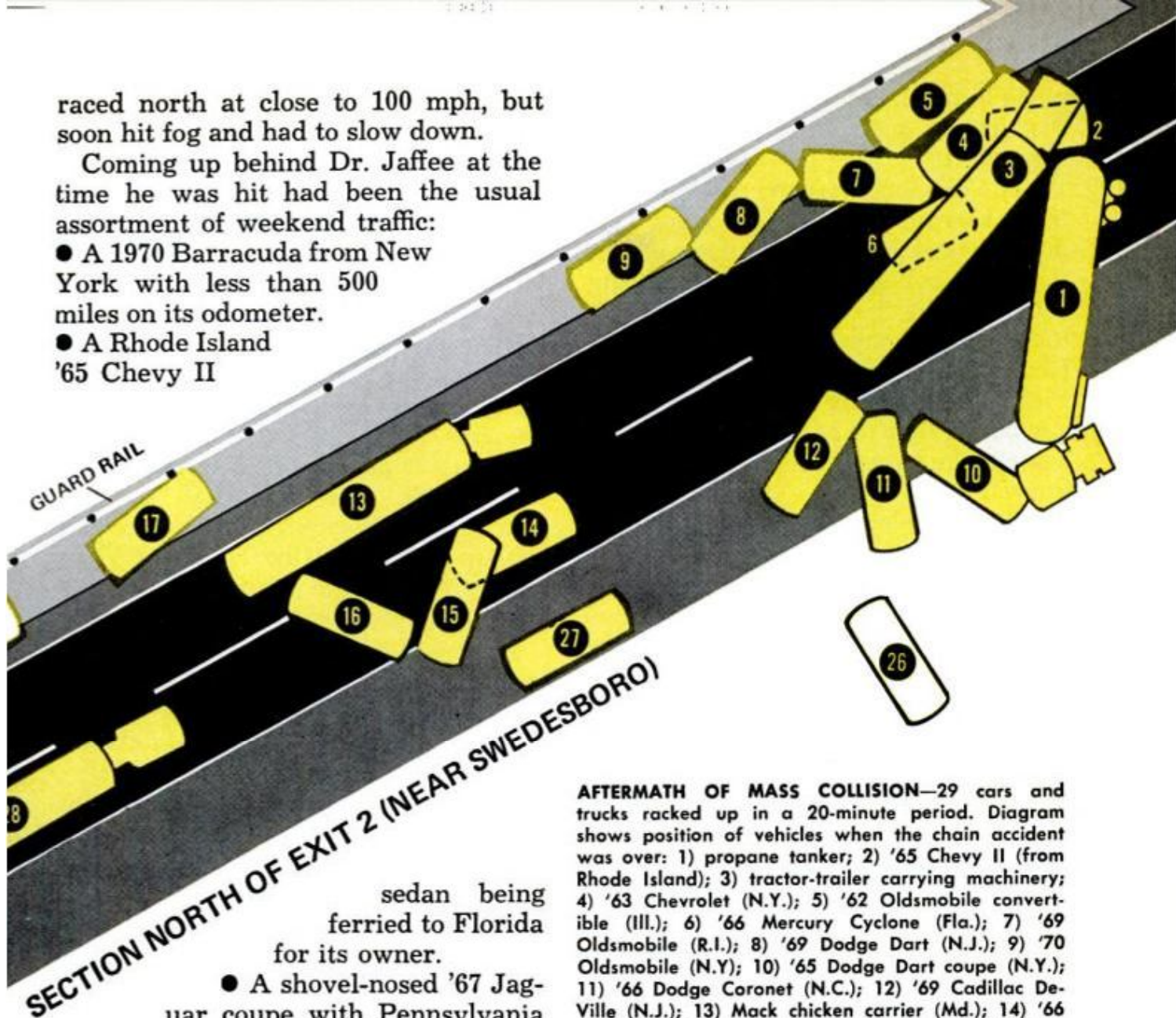
passed the Exit 2 area three times and found the road clear. At 7:21, while chasing a speeder, he ran into fog. He radioed for electric "FOG" warnings to be lighted in that sector and speed signs to be switched from 60 to 50 (by remote electric control).

At 7:50 a.m. Winkler, again cruising north, heard a radio flash from the Exit 2 tollgate operator to the New Brunswick Control Center, 50 miles farther north. The toll operator said a motorist had reported a wreck. Winkler

raced north at close to 100 mph, but soon hit fog and had to slow down.

Coming up behind Dr. Jaffee at the time he was hit had been the usual assortment of weekend traffic:

- A 1970 Barracuda from New York with less than 500 miles on its odometer.
- A Rhode Island '65 Chevy II



sedan being ferried to Florida for its owner.

- A shovel-nosed '67 Jaguar coupe with Pennsylvania plates.
- A '63 Tempest from New Jersey towing a two-wheel U-Haul trailer.

In addition, there were families in cars from several states. A station wagon from Virginia contained several children and was driven by a young mother.

With the first impact, Dr. Jaffee's seat broke, and he was torn from the safety belt and hurled into the rear seat.

No one can say which truck, or trucks, hit Dr. Jaffee's Mercury. There is evidence, however, that a gray propane tank-trailer and its tractor also veered left, as Dr. Jaffee had, across the two southbound lanes. Perhaps it hit the steel center rail, for its left front wheel later was found smashed and the rail dented.

Whatever happened, the tanker seems

AFTERMATH OF MASS COLLISION—29 cars and trucks racked up in a 20-minute period. Diagram shows position of vehicles when the chain accident was over: 1) propane tanker; 2) '65 Chevy II (from Rhode Island); 3) tractor-trailer carrying machinery; 4) '63 Chevrolet (N.Y.); 5) '62 Oldsmobile convertible (Ill.); 6) '66 Mercury Cyclone (Fla.); 7) '69 Oldsmobile (R.I.); 8) '69 Dodge Dart (N.J.); 9) '70 Oldsmobile (N.Y.); 10) '65 Dodge Dart coupe (N.Y.); 11) '66 Dodge Coronet (N.C.); 12) '69 Cadillac DeVille (N.J.); 13) Mack chicken carrier (Md.); 14) '66 Plymouth Valiant (N.J.); 15) '69 Jaguar (Pa.); 16) '70 Barracuda (N.Y.); 17) '69 Mercury Monterey (N.J.), Dr. Jaffee's car; 18) GMC tractor-trailer (Md.); 19) White tractor-trailer (Md.); 20) '63 Pontiac Tempest (N.J.) with U-Haul; 21) '66 Pontiac station wagon (Ga.); 22) '66 Ford Fairlane (N.J.); 23) '69 Pontiac station wagon (Md.); 24) Mack tractor-trailer (Mass.); 25) '68 Pontiac Bonneville (Conn.); 26) '68 Camaro (Md.); 27) '67 Chevelle (Md.); 28) Mack leasing tractor-trailer (Pa.); 29) Cabrini moving van (N.J.).

to have rebounded heavily across the road, the tank itself falling on its side.

It was an enormous tank and U.S. safety investigators say it carried propane gas under pressure—a dangerous cargo. According to police, it was overloaded and weighed roughly as much as 28 automobiles—76,340 pounds. It stopped 85 feet beyond the dentist's car, its tractor section still attached. The tractor had snapped around so that it faced backwards. But it was still right side up. The windshield had ex-

ploded outward, a good indication that the driver may have been thrown through it.

For a moment after the truck crashed there was silence. But both lanes were now blocked, a hidden fog trap set, and the chain collision was about to begin.

One of the first cars to come out of the fog was the '65 Chevy II from Rhode Island—the one being ferried to Florida. Its young driver may have stopped in time or he may have bumped against the overturned tanker; no one knows.

Then, suddenly, the others were there. Out of the fog they came, one by one, sliding, spinning, crashing, until soon 10 cars were bunched. Not all had collided, but one or two had hit the tanker hard. And suddenly, in one wreck, there was the yellow flicker of flame.

People popped out of cars. Someone noticed the tanker cab: It was burning inside. But most frightening was a little plume of white gas that danced weirdly about the tank itself. A hair-

line crack had opened in its top, near the midsection, and the dangerous liquid propane was leaking out under pressure, turning to gas as it hit the air. Heavier than air, it drifted to the road, where, according to police, it began feeding the fire.

Above other sounds, people at the scene now heard a second truck. Through the gray veil came a tall, green tractor-trailer filled with machinery—a monster that weighed as much as 20 automobiles, or about 57,000 pounds. The truck had a "cab-over" control cockpit, with the driver's cab up front over the engine. (When engine repairs are needed, the whole cab is tilted forward.)

A driver and a woman companion rode in the cab-over. The driver's first warning of danger, he testified later, was "two little red lights—taillights, I guess . . . I hit the brakes with everything I had, but I never got to see the car. I just hit it." He said he had been running 55-60 mph but had "backed off" to 35 in the fog.

No one knows which car this truck hit first, but it rammed ahead and cut a swath through the bunched cars. There was a hollow, rolling sound followed by the tinkle of glass. Then the truck smashed against the propane tanker. The impact spun the enormous tanker around, opening the left lane.

The machinery truck now swerved toward the open lane, sweeping cars before it. Some cars were thrown to the right, and a man in one of them was killed. The truck driver and his companion were hurled into the road ahead. (Investigators think the cab-over may have spilled forward.) He and the woman landed 25 feet beyond the wreckage. Though hurt, he picked up the injured woman and ran, carrying her away from the propane truck.

Spilled gasoline mixed with the propane and fed the flames. Soon tall yellow tongues of flame reached through clouds of oily smoke, and in the blast-furnace heat the machinery truck began to melt.

WHEN YOU DRIVE IN FOG

In researching this article, writer Ed Fales drew on long experience in driving in everything from "pea soups" to light mists. His first rule of driving in a super-highway fog: Don't, if you can avoid it.

Second rule: Know how to recognize four basic fog conditions and the problems they create. Cut speed to suit the conditions.

● Condition 1 Fog:

You can see $\frac{3}{4}$ mile. At 60 mph you cover that distance in 45 seconds. **CAUTION.**

● Condition 2 Fog:

You can see $\frac{1}{10}$ mile. At 60 mph you cover that distance in 6 seconds. **DANGER.**

● Condition 3 Fog:

You can see 100 feet (5 car lengths). At 60 mph you cover that distance in 1.1 seconds. Even at 30 mph you cover it in 2.2 seconds. Pull off the road as soon as you can. **EXTREME DANGER.**

● Condition 4 Fog:

NO VISIBILITY. Get off road, beyond the shoulder, if possible.



GRIM JOB OF PROBING SMOLDERING WRECKAGE fell to troopers and firemen. Five victims perished in fires

In chain collisions trucks have been known to grind up on top of cars and then slide forward upon them. One car now was seen jammed under the tractor's front. Trapped inside the car was a young male driver, burning to death. This was the Chevy II bound for Florida. A few feet farther back the truck's trailer was on top of a second car: a '66 Mercury Cyclone. A young woman was trapped inside.

About this time a man was seen standing by the gas truck, holding his head. This may have been the propane truck driver. It may have been the same man who then was seen dragging victims to safety. While he was doing that, a car came out of the fog and hit him, sending him sliding.

People now were jumping from cars, screaming and crying. Some wandered in dazed circles.

Trooper Winkler, approaching from the south, saw the fog turn from gray to fiery orange. He knew he'd found the accident. After he'd scanned the area, he ran back to his car and sent a highway SOS. His tense voice was recorded on tape at the New Brunswick control center: "I've got a propane truck here, and one, two, three, four—about six cars on fire. I'm going to need help!"

Within seconds, troopers were enroute from as far as 30 miles away. So were firemen from Swedesboro, Murphysboro and several other New Jersey towns.

After sending his alarm, Winkler ran north up the road, lighting flares.

A shadow slid by: a '68 Camaro bound for Maryland. It went into a spin and landed in the ditch.

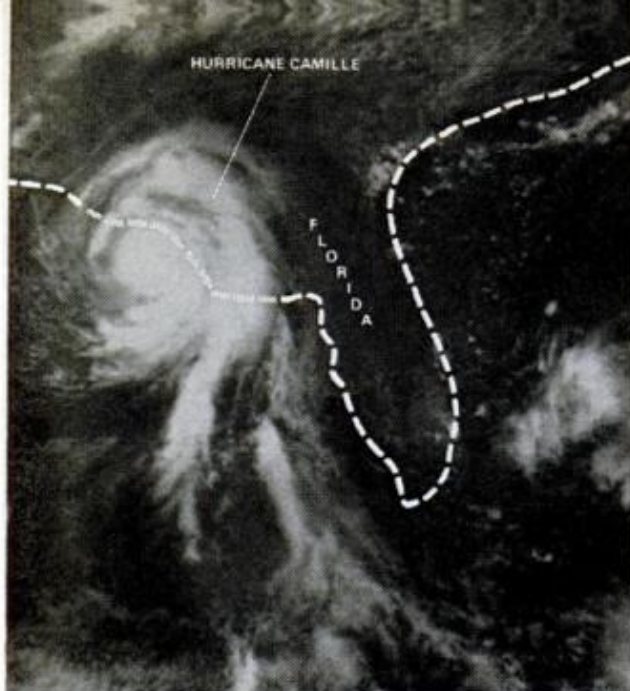
A Maryland car, a '67 Chevelle driven by a young family man named Blake, also went by. Blake cut left, saw the way blocked, then dodged right and made a skillful stop on the shoulder. His family jumped out and ran. Then a car hit young Blake.

A '66 Valiant with Jersey plates proceeded cautiously. The driver spotted the wreck in time and stopped. Then, noticing the overturned tanker, he put his car in reverse and backed away. Moments later his car was hit, its rear tossed high in the air. The Jaguar from Pennsylvania had rammed it.

All this happened in the right ("slow") lane. Over in the left lane a New York driver brought his sleek '70 Olds, just out of the showroom, to a stop. But coming up behind him was a third truck, a big Maryland chicken-carrier. When it bumped the Oldsmobile, the Olds shot ahead and hit a '69 Dodge Dart. Next came the '70 Barracuda from New York. Possibly trying to miss the chicken truck, its driver veered to the right. With a resounding crash, his car struck the Jaguar, which had just knifed under the Barracuda.

Meanwhile, only a few feet away, Dr. Jaffee's car lay smashed against the

(Please turn to page 212)



HURRICANE CAMILLE WAS TRACKED by weather satellite ESSA 9 and photographed as it swept up from Cuba and hit the U.S. coast (shown by dotted line)

The most vicious wind ever to hit the U.S. mainland, it roared up from the Gulf, blasted Mississippi and flooded Virginia, killing hundreds and smashing \$1 billion in property. They called it Hurricane Camille

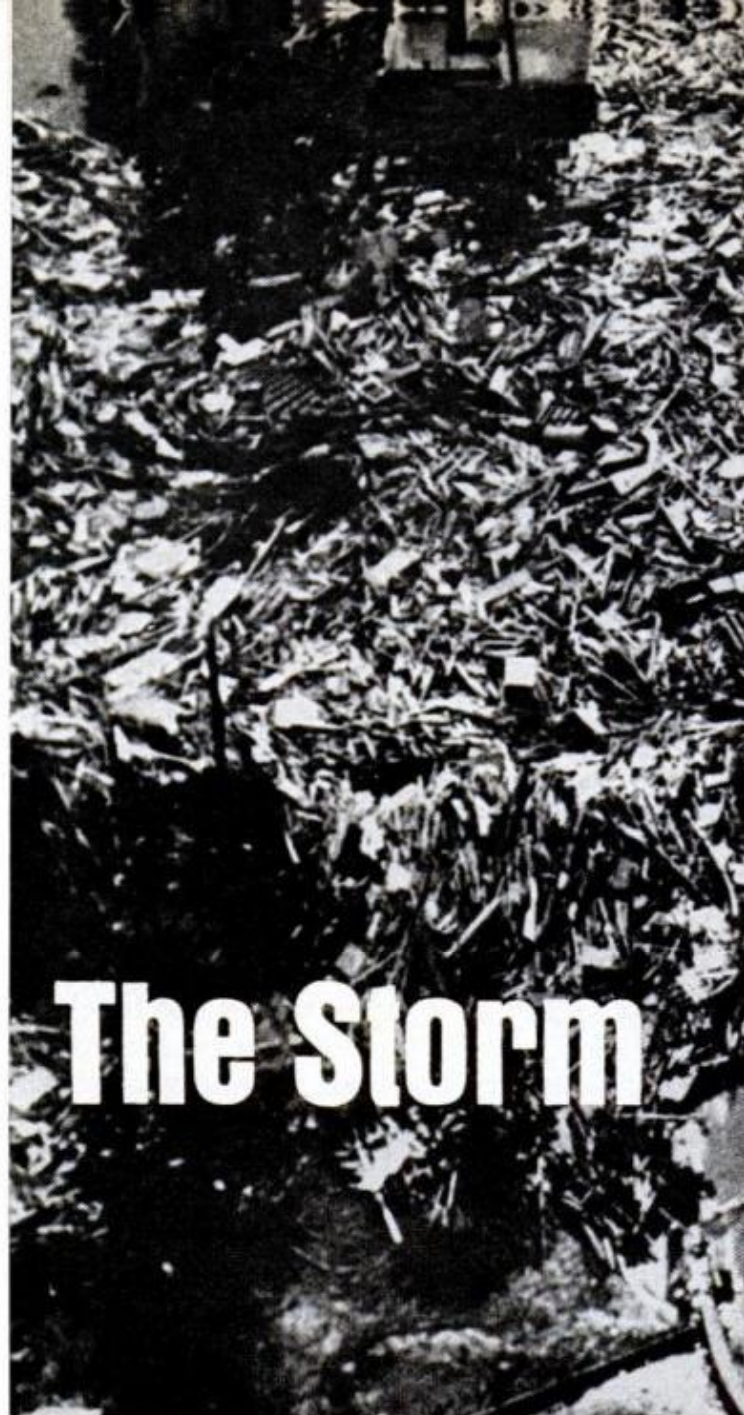
By E. D. FALES JR.

THE WIND ROARED DOWN from the Mississippi hills and blew the Gulf of Mexico away. It emptied rivers and swept bayous dry. The end of the world seemingly had come on Sunday, Aug. 17, 1969, for never before in memory had the bayous been without water.

Three hours later, at 8:00 p.m., the wind reversed itself. The Gulf of Mexico rushed back. House-high waves slammed ashore—15-foot waves on a 30-foot tide. Frightened residents retreated to second floors, then to attics. When the sea followed, people kicked holes in roofs and climbed out to seek escape. They were blown away.

In Pass Christian a man vanished in a seacloud and landed on a schoolhouse roof a mile away. Another man saw his neighbor's big brick house rise off the ground as if pulled up by a crane.

By 9:00 p.m. four cities along 50 miles of Mississippi's lovely "chain



The Storm

of pearls" coast—Pascagoula, Biloxi, Gulfport and Pass Christian—were being blown apart. Seventy miles south, down in Louisiana's Mississippi Delta, the captain of an oil company LST felt a great shock. His ship had collided with two big freighters. The frightening thing was that he couldn't see them.

Near the beach in Biloxi, a gasoline station had been built for strength against the sea. It was anchored by big steel I-beams sunk in four feet of concrete. As the wind rose above 180 mph, the station blew away and the steel beams were bent back until they lay along the concrete.

This was a wind. Weather Bureau men called it the worst storm in his-

They Still Don't Believe



GREATEST DAMAGE was done along Mississippi coast (inset) but the mighty storm still had punch when it reached Virginia, causing more death and destruction. It finally petered out in the Atlantic. Fantastic collection of debris (photo above) litters bridge at Bay St. Louis, Miss. This picture was taken the day after killer storm ripped the area

tory. They called it Hurricane Camille.

But Camille was not a typical hurricane. It was a compact bomb, only about 50 miles wide; hurricanes usually are hundreds of miles across. It was like a supertornado that spawned many lesser tornadoes. As any Oklahoman knows, even the smallest tornado is an explosion of the first order.

Tornadoes explode when nature gets wound up too tight. Something was clearly wound too tight on Saturday, Aug. 16, when Weather Bureau men, probing the Gulf with radar, found a monster that had come up from Cuba during the night. Characteristically, it was whirling in a lazy circle.

Navy, Air Force and Weather Bu-

reau planes sped out to meet it. "We've got 50 knots of wind out here," radioed an Air Force crew. Soon shore-based radars were picking up a twister of a cloud 10 miles tall. It glittered in the morning sun, 200 miles west of Florida. Then it steamed north, a juggernaut aimed at Mississippi's sandy coast.

The Weather Bureau issued frequent warnings as Saturday wore on. Residents were told that this was one of the worst storms ever spotted in the Gulf; everyone should prepare to flee.

Still, many people along the coast thought Camille would surely turn east toward Alabama and Florida. But at 4:30 a.m., Sunday, it was still pushing north. That's when lanky Bill Tilson, head of the Mobile, Ala., Weather Bureau office, pulled out all stops. He sent messages alerting the Mississippi coast: *The storm is coming your way. Get out!*

Sunday brought the usual nervous jokes. People scared by hurricanes like to phone the Weather Bureau and ask, "Will this be a one-bottle storm or a three-bottle storm?" They get together for hurricane parties, which sometimes become brawls. But mostly, hurricane parties give frightened people a

WIND AND RAGING FLOODS gutted this double row of houses in Biloxi, leaving empty shells standing



THREE OCEANGOING FREIGHTERS were blown ashore at Gulfport, at the north end of the harbor

chance to huddle together (with or without a drink) in the face of danger.

One who joined no group was owner Paul Hearon of Biloxi's Amoco gas station, two blocks from the sea. At 8:00 a.m. he decided he'd better move his tires uptown on the hill. It was slow work because people kept buying white gasoline for lanterns and stoves. Everyone knew that the electrical power would fail.

At noon Hearon finished his job and

FANTASTIC MOUNTAIN OF DEBRIS filled main street of Pass Christian the day after Camille passed by





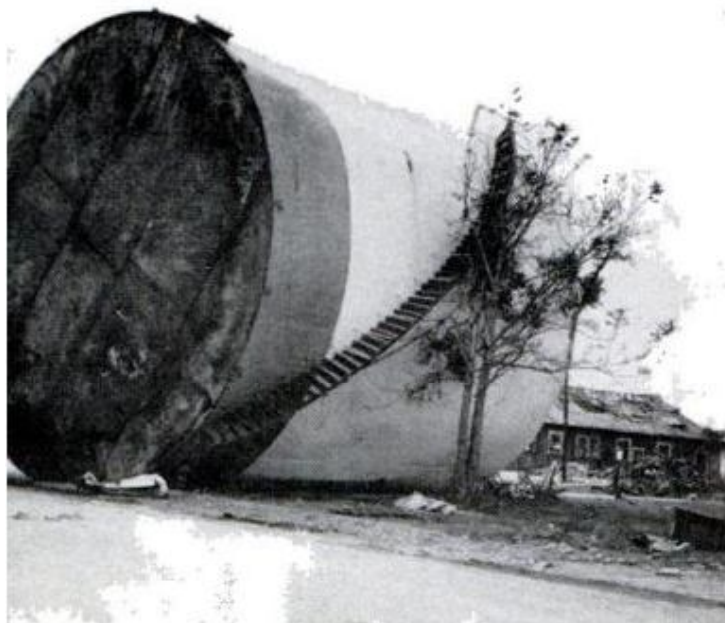
PIRATED BY FUGITIVE, this shrimper was carried 14 miles to Biloxi yard. Its home port is Morgan City, La.

switched off the Amoco sign. "You'd better go north while you can," he told his customers. "It's starting to rain hard." Then he locked up and headed for the hills.

Down on the beach, where U.S. 90 skirts the Gulf, owner George Pattison of the Pontiac agency told his men to move 75 cars uptown to a lot behind a hotel. Next door at the Biloxi Yacht Club, owners who had not moved their boats inland were tying them down. The club had a hurricane wall of steel and concrete.

On U.S. 90, behind the Yacht Club,

STORM UPROOTED OIL storage tanks in Biloxi's back bay area, floating them away like huge corks



Mr. and Mrs. Bill Hood checked out 53 scared guests from their T-shaped Towne House Motel. Seven other guests lingered. "This looks like a strong place," one of them said. "If the tide gets high we'll go upstairs. Are you going to leave?"

Mrs. Hood said no.

"Then we'll stay, too," said an Air Force lieutenant and his bride. So did five others. They decided to immediately move upstairs into Rooms 11 and 12, close to U.S. 90. At noon a young couple came to the motel. "We have no car to escape in and no place to stay," they told Hood. "May we come in?" Hood gave them Room 16 on the second deck.

A half mile east, at the armory, 100 young National Guard trainees nervously checked the rescue boats they might need later. On a pier, two visitors watched the tossing sea in delight. Friends pleaded with them to join the thousands now heading inland. They refused. "We want to see a good storm," they said.

Boats hurried for port. A 50-foot yacht with only an old man and a boy aboard headed for the drawbridge in the mile-long Biloxi Bay Bridge, in an attempt to reach safety well up in the bayous.

The *Wade Klein*, an 85-foot trawler out of Morgan City, La., met the storm off Biloxi and sneaked in to anchor behind an offshore island. One of the crew, a fugitive wanted by the F.B.I.,

had pirated the ship from its owner a few days earlier.

By 3:00 p.m. Sunday the beachfront—really a 50-mile-long city of 100,000 people—was feeling a 35-mph north-east half-gale. Some of those on shore noticed three black snakelike funnels twisting toward the coast, working against the wind. They were waterspouts—tornadoes over water. At 5:00 p.m. the wind suddenly jumped to 60 mph.

Twenty-five miles west of Biloxi, at Pass Christian, Civil Defense Director Parnell McKay began urging people who had not already escaped to move into two big schools. McKay asked Police Chief Gerald Peralta to try to drive to the swank three-story Richelieu apartments and urge the 24 occupants

Then the LST was hit with a barrage. 'The wind is blowing rocks!' a crewman shouted.

still there to go inland. The Richelieu lay only 750 feet from the Gulf.

McKay then turned to the problem of getting food to 1000 people in the Catholic and public high schools. He learned that a small group was also in the Episcopal church.

The wind was piping up, and U.S. 90 was blocked now, but Chief Peralta and another officer nudged their car down the beach, dodging waves. Soon they reached the brightly lighted Richelieu. In one room a father and son played with a toy airplane. Music came from another. In still another room a few people had started a hurricane party and one man offered Peralta a drink. He declined.

"We went to each door and knocked and asked everybody to get out while they still could," he says. About half complied. Then Peralta radioed to the firehouse and told McKay: "The others insist on staying."

McKay was angry. "Chief, you go back and tell them I want the names of next of kin for everybody there.

We'll have to know who to notify when this is over."

When Chief Peralta finally returned to the firehouse, he found it full of people. Though the building was on a hill, water came in and soon people were climbing on the fire trucks to stay above it.

At 5:00 p.m. the eye of the storm, surrounded by winds of over 200 mph, was still 90 miles south of the coast and passing the mouth of the Mississippi, where the oil company LST, an offshore drilling tender, lay anchored. At one time the eye passed so close to the ship that a weather man later figured a sailor could have jumped and swum into dead calm only a few feet away.

Life aboard the LST became a nightmare. The crew watched in amazement as a succession of objects were carried out into the Gulf: a church organ, a Ford pickup truck, a motorboat riding on top of a car.

In addition to its anchor, the LST was secured by a line to a huge tree on shore. Then the wind and waves hit the ship with such force that it dragged its anchor and pulled the tree over. The ship was propelled backwards out into the Gulf.

Then the LST was hit with a barrage. "The wind is blowing rocks—rocks!" a crewman shouted. The stout steel mast started to bend. When the portholes began blowing out, the captain thought he would cut the anchor, start the engines and try to run the ship ashore. The trouble was he couldn't see shore. He couldn't even see his ship's rail. He decided against it.

The scream of wind rose. Now came the snakes: rattlers and cottonmouth moccasins, not swimming or crawling *but flying through the air*. They'd been blown from the swamps. Five landed squirming, fighting, on the bridge. Others fell on deck. One slithered below decks, where a crewman killed it. Then came the collision. The LST was hit by two unseen ocean freighters, and all three ships drifted off together.

Ashore in the powerhouse behind

Biloxi's Broadwater Beach resort, the hotel engineer watched costly lobby furniture float out of the back doors. Three big ships came up on land, their long steel keels screaming on the sand and concrete. At Pascagoula, the tanker *Mormacsun* climbed out like a great sea animal seeking land.

The alarm to man the rescue boats reached the Biloxi National Guardsmen when the wind suddenly reversed itself toward 8:00 p.m. and the tide came rushing in. The men sloshed through knee-deep water to board six landing craft called LARCs. They rumbled toward town. The wind was 80 mph and growing stronger.

It was about 9:00 p.m. when screams rose above the noise of the wind at the Towne House Motel. Owner Bill Hood knew the couple in Room 16 were in trouble. But to get outside would be tough. U.S. 90 was deep in ocean. The Amoco station up the street was gone. So were surrounding houses. Lightning flashed—a sign of tornadoes.

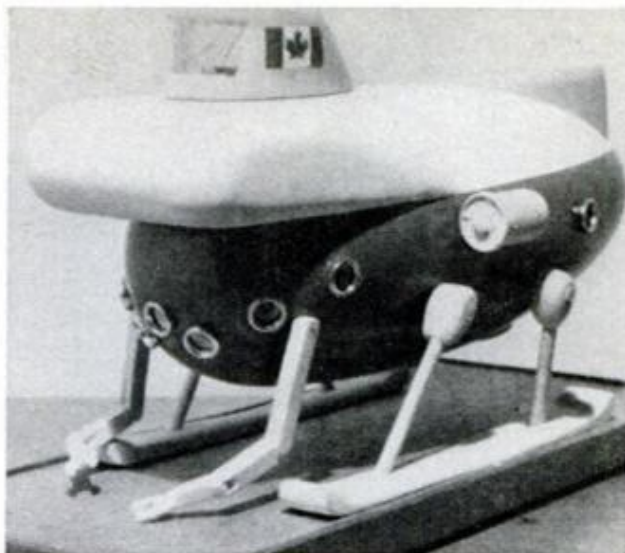
And then Hood *heard* the tornadoes. "I've heard them before and I know the sound," he says. The west sky turned red with electrical fire. The big Pontiac garage next door exploded. Hood saw the Biloxi Yacht Club spin around. Then it blew away like paper before an electric fan. A yacht whirled ashore. "If that hits us we're gone," he said. When he looked again the whole east wing of his motel—built of heavy concrete block—was missing.

Screams still came from Room 16, and there were thuds—furniture floating against the ceilings downstairs. Hood said: "We've got to get to those kids."

"I'll go with you," said the Air Force lieutenant. It was almost impossible to open the door against the wind. When the men got out on the porch it was like being on a ship's deck in a storm.

Waves crashed over the railing and smashed them against the wall. They crept from door to door. It took 20 minutes to reach No. 16—the fourth

(Please turn to page 218)



Canadian submersible

Shown as a scale model, this new submersible will be used by Canadian armed forces for underwater searches, submarine rescue and research. The 25-foot sub will carry two.



Low-slung, high-speed Lotus

Unusual features of the new 200-mph Lotus 72 include amidships radiators and extremely low build. The racer, powered by a Ford Cosworth DFV V8, is in Grand Prix competition.



Supersonic lollipop

Newest French confection is the 24-inch Concorde lollipop, named for the SST.

PM OWNERS REPORT
BUICK RIVIERA

A Nationwide Survey Based on
1,200,000 Owner-Driven Miles



OWNERS SAY:

'Fantastic Styling, but How About a Little Trunk?'

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

RIVIERA DEVOTEES bask more than a little in their own good taste. Styling ranks as the main reason for purchase. Says a Texas bookkeeper, "I like the ooohs and aaaahs of passersby and the is-that-*your*-car, and the sideways glances from owners of older Rivieras!"

But as always, lush styling brings concessions. Eventually these come to the surface, though usually not until owners live with their cars a while. The Riviera's small trunk came in for most criticism, with pinched rear-seat legroom next on the list.

An Indiana engineer complains, "Fat vinyl side moldings can be yanked off by brushes in a car wash." An Ohio retiree, "Lousy visibility out slanted rear window and past high bucket seat-backs." "I would like to see them take

the rear skirts off the car, or at least make it look okay without them." "I liked the '67 grille treatment better—concealed headlights." "Wish Buick would restyle the Riviera to make it more distinctive from other GM lines." "Bring back hidden headlights." "Trunk certainly needs to be much larger; also could use less plastic."

Not everyone bought his Riviera for looks alone. Here are other reasons:

"Typifies *nouveau riche* look," is the unusual admission of a New York distributor. And, "Good resale value" was listed by a number of owners, though an equal number complained of low resale value. One gent mentioned his previous Gran Sport had gone down \$4500 in three years.

"I buy a new car every three years. This is my fifth Buick, second Riviera,



ABSOLUTELY NO NEGATIVE WORD on handling—Riviera owners give cars rave reviews in this area

was well pleased with my 1967." Lots of repeat buyers: "Good experience with my 1963, 1966, and now my 1970 Riviera." And a 75-year-old Missouri engraver sighs, "Was driving a 1955 Roadmaster since 1955, couldn't wear it out, but it was too much out of style." So styling even got to him.

As mentioned, the Riviera's least-liked feature is its tight trunk. "My only major complaint," says a TV station manager, "is that the trunk is very shallow, most of it being taken up by the spare." Similarly, "Not enough room for suitcases." There's relatively little legroom in the rear seat, and a few owners went so far as to suggest making the Riviera a two-passenger car. None, though, wanted a wider selection of body styles (as did Toronado owners, some of whom would have preferred sedans and wagons).

People expect expensive cars to be put together better than cheap ones, a reasonable demand that's not always observed by assembly-line workers. Representative comments on quality and workmanship: "My Riviera is well put together, but the paint job is terrible. I'll never understand why they build a \$7000 car and finish it off with a two-bit paint job." Another owner says, "The dealer had to repaint the car because it came in two different shades of dark gold." Or, "I wanted a car that wasn't cheaply put together. The

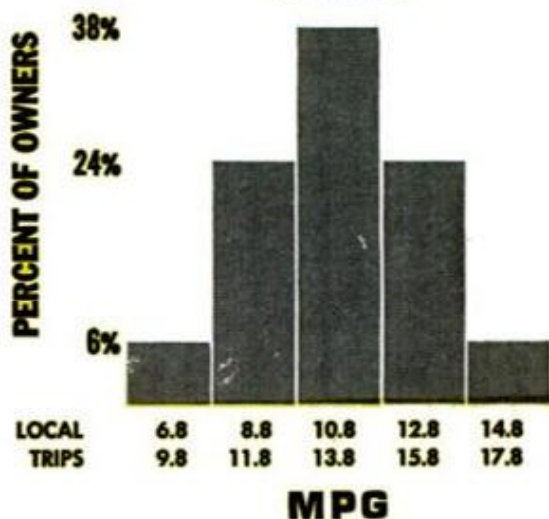
SEPTEMBER 1970



MANY COMPLAINTS, though, on trunk. Too small and shallow, even with spare hidden under floor

RIVIERA FUEL MILEAGE CHART

455-cu.-in. V8

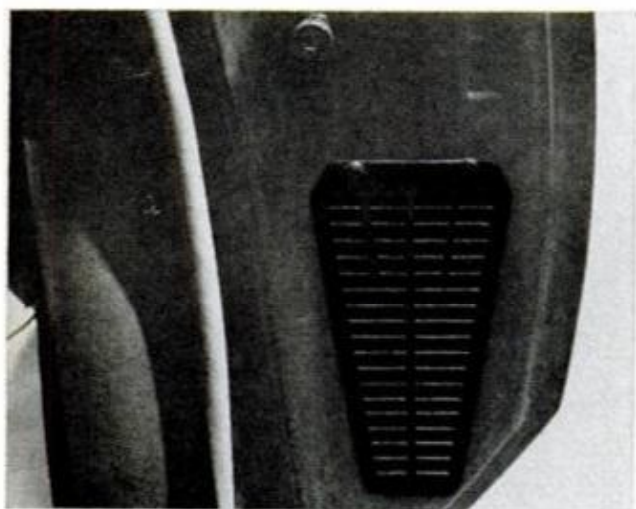




COCKPIT COMES OFF okay except for idiot lights and gripes that it's hard to tell where hood ends



QUITE A SQUEEZE back here for big feet; also it's a long stretch for rear riders to reach door handles



FLOW-THROUGH VENT SYSTEM lets air out here and below backlight. Many would prefer windwings

workmanship is very, very poor. There are screws missing, loose clips, paint scratches, defroster installed improperly." "Workmanship excellent, considering the way they make cars today." (But why "considering"? Have we become so inured to poor workmanship that we're willing to excuse it simply because other cars are also poorly put together?) "I can see that *some* pride was taken in the workmanship of my Riviera anyway." "Quality is generally very well done—no complaints."

Of specific mechanical ills, and there were very few, the most surprising was: "My Riviera burns oil—about a quart every 400-600 miles." Not many owners mentioned it, but enough did to form a pattern. Another owner echoed, "So far I'm getting 800 miles per quart." Again, "Seven quarts in 4000 miles." And, "While mileage is

still low (3100), oil consumption seems excessive. Compared to my 1965 GS and 1968 Riviera, I have used three times as much oil. I'll have to wait to see whether oil consumption is the fault of design or low mileage. Dealer couldn't find anything wrong and claims it will improve with miles, but to date I'm not happy about it."

Concerning handling, these jottings: "Best all-around handling car I've ever owned." "I appreciate the ease with which the car can be handled under all road conditions. Also smooth acceleration and ease of braking." "Handles well at high speeds; corners well in town."

But conversely, "No complaints except road tramp. Requested wheel balance at 6000-mile check; still rough at 65-80 mph. May be out-of-round tires or weak suspension." "Glass-belted tires are terrible—can't be balanced." "Belted tires are absolutely awful. I had to *replace* three of them at my own cost!"

About the Riviera's ride and general comfort: "Very nice. Just like sitting in my easy chair. Can drive all day and feel good at the end of the trip." "Comfortable front seat, rear a little tight on legroom." "Suspension could be better—ride is not up to my expectations." "My 1970 Riviera rides considerably harder than my 1967, although not objectionable. It handles better, however." "When driving, one feels part of the car." "Overheard one passenger who had ridden 200 miles in the back

Summary of 1970 Riviera Owners Reports*

Total miles driven 1,200,053

Average miles per gallon:

455-cu.-in. V8,
local driving .. 10.8
long distance .. 13.8

Why the Riviera?

Styling 40.1%
Past experience 29.7
Handling 8.9
Size 8.9
Performance 6.9
Comfort 5.9

Specific likes:

Style 50.0%
Handling 47.5
Ride 38.0
Comfort 29.5
Performance 18.0
Power 13.5
Roadability 7.5

Specific dislikes:

Trunk too small 16.8%
Poor workmanship 14.8
Poor gas mileage 7.1
Poor paint/finish 6.6
Rattles 5.1

What changes would you like to see?

More trunk space 26.0%

Better styling 15.8
Concealed headlights 7.3
Better workmanship 5.1
More legroom 5.1
Mudguards 4.5
Lower seatbacks 4.5

Had any mechanical troubles?

No 71.6%
Yes 28.4

What kind of trouble?

Electrical 20.0%
Oil leaks 10.0
Transmission 6.7
Battery 5.0

Did you repair it yourself?

No 98.1%
Yes 1.9

Dealer repairs satisfactory?

Yes 66.0%
No 34.0

Is the Riviera your only car?

No 59.6%
Yes 40.4

Other cars owned:

Chevrolet products 33.6%
Buick 23.2
Ford products 17.6

Pontiac 9.6
Volkswagen 8.0
Cadillac 5.6

Accessories/power options:

Airconditioning 65.9%
Power windows 63.1
Radio 54.7
Power seats 45.4
Stereo tape 40.0
Rear defroster 28.8
Vinyl top 21.2
Cruise control 20.0
Tinted glass 19.4
Tilt steering wheel 14.1
Lighting group 13.5
Power door locks 5.9

What accessories/options would you order next time?

The same 83.1%
Stereo tape 6.2
Rear defroster 3.6
Cruise control 3.1
Power windows 2.1

Age distribution of owners:

15-29 years 21.5%
39-49 years 43.0
50-plus 35.5

Would you buy another Riviera?

Yes 84.4%
No 15.6

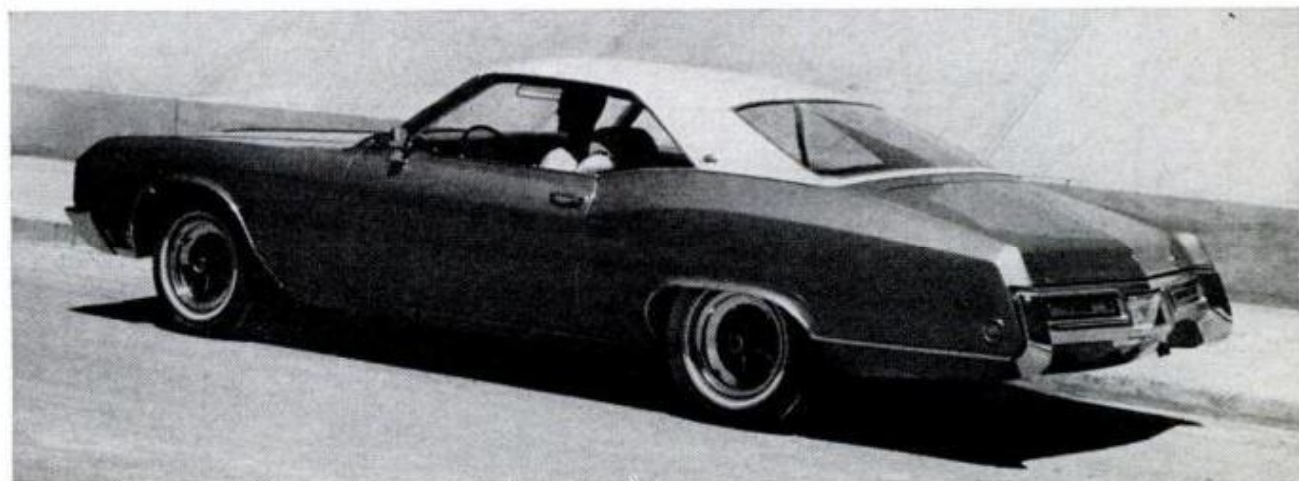
*Percentages might not equal 100% due to rounding and/or insufficient data.

seat. He cussed like hell." "Too much wind noise and motor sound, more than my Delta 88." "Front seats seem to angle back too far." "Smooth ride." "Very hard ride not present in my 1968 Riviera."

Running through our I'd-like-to-see-them-change notes: "When I open the trunk, water runs inside." "Doors are very heavy, makes opening them when the car stands at an angle difficult." "Put back hideaway lights, eliminate fender skirts." "More trunk." "I miss the side vent windows." "Can't replace tail or signal lights unless I drop the bumper." "Cannot replace dash

lights unless you take it to the dealer. They charge you \$23 labor to change a 39-cent bulb." "Go back to an instrument panel with gauges instead of idiot lights."

To sum up, these random parting shots: "I trade every year and can trade for less money on Rivieras than any other car." "Prestige, handling, looks." "It's a high-performance car with comfort." "Have had a fair and pleasant relationship with my Buick dealer for 10 years." "I rarely carry passengers in the rear seat or make long trips where I'd need more trunk space, so for me the Riviera is the greatest." ★ ★ ★



Just patented

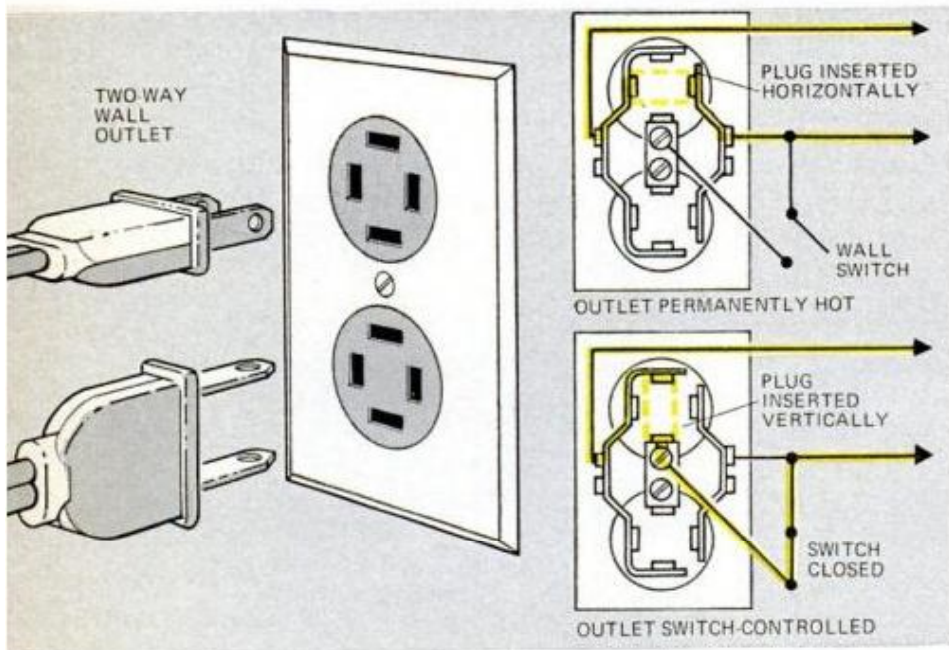
PM'S PICK OF THE NEW INVENTIONS

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



1. A DISABLED AIRLINER making a wheels-up landing would come down on a series of padded rollers in this unique invention. The rollers, built into a special emergency runway, are concave to keep the plane centered and are motor-driven to match its speed. A trough of water cools the rollers and

prevents sparks. Two adjustable outboard supports riding in tracks rise up to grip the wings and gradually brake the liner to a safe stop. The system is designed to eliminate the friction in belly landings that often causes fires and to save the time normally required to spray the runway with foam



2. TWO-WAY WALL OUTLET serves as either a switched receptacle or a permanently hot one depending on how you insert the plug. Each receptacle has four terminals instead of the usual two, as shown at left. With the plug horizontal, it contacts the two terminals at the sides. These are wired directly to power so the outlet is permanently hot. When the plug is turned vertically, it contacts the top and bottom terminals. These are wired through a wall switch so the outlet is hot only when the switch is turned on. Thus, when you plug a lamp in this way, it can be controlled from a distance. In conventional house wiring, switched outlets often end up in the wrong place for convenient use. With this two-way type, you could have them wherever you want

Inventors of the items shown on these pages are as follows: 1. Karl-Heinz Schnarr, Hannoversche Strasse 82, Bremen-Hemelingen, Germany, and Walter Kucken, Braahlandsweg 26, Bremen-Huchting, Germany (No. 3,490,722); 2. Glenn D. Smith and Robert G. Cook Sr., Dayton, Ohio

(No. 3,426,216); 3. H. Schneebeli and Co., Schaffhuserstrasse 307, Zurich, Switzerland; 4. Albert F. Abbott and Bruce J. Haskin, Seattle, and Marshall E. Klopich, Renton, Wash. (No. 3,444,811); 5. Gerhard Wagner and Walter Kinzel, Mainz, Germany (No. 3,492,683).



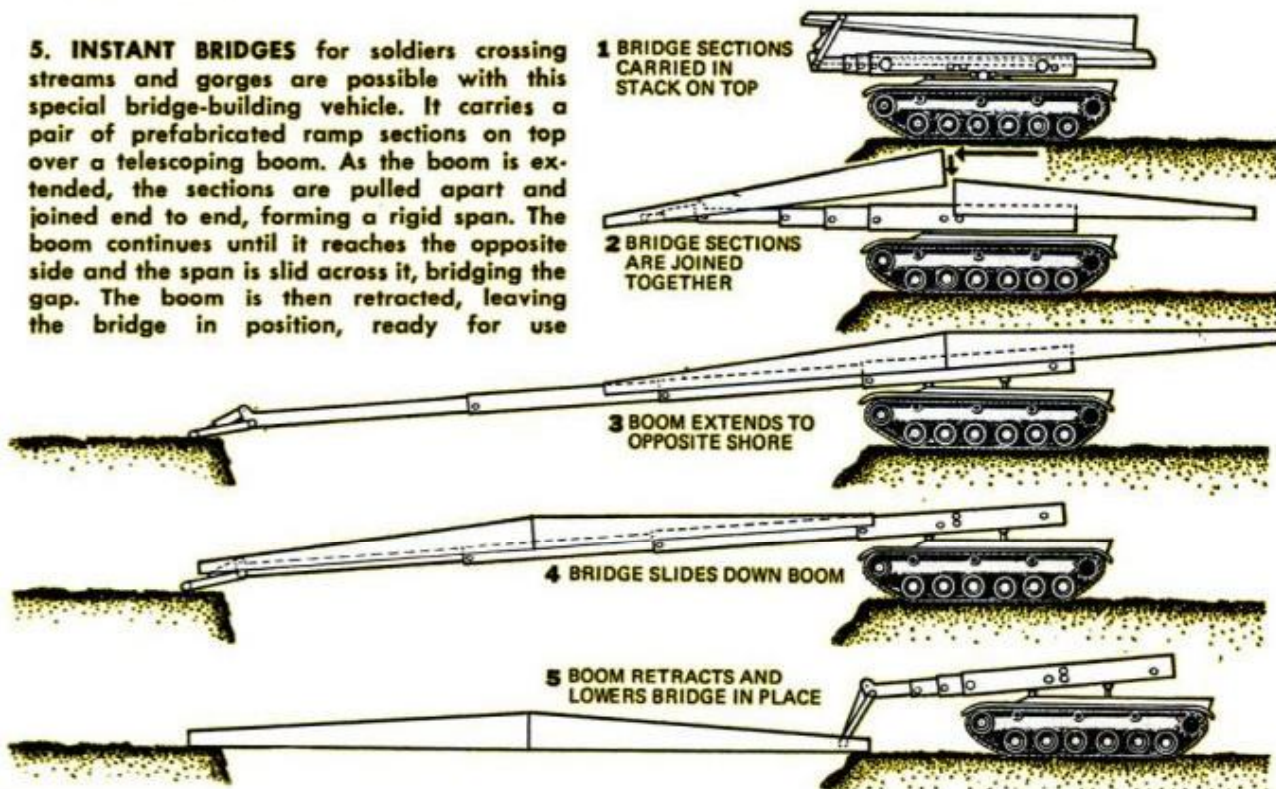
4. BLASTING TREES DOWN with explosive charges may soon replace the woodsman's ax in the fast, simple method for felling timber shown above. A straight-in cut is first made at the base of a tree with a chain saw to produce a long, shallow pocket. A thin plastic envelope is then slipped into the

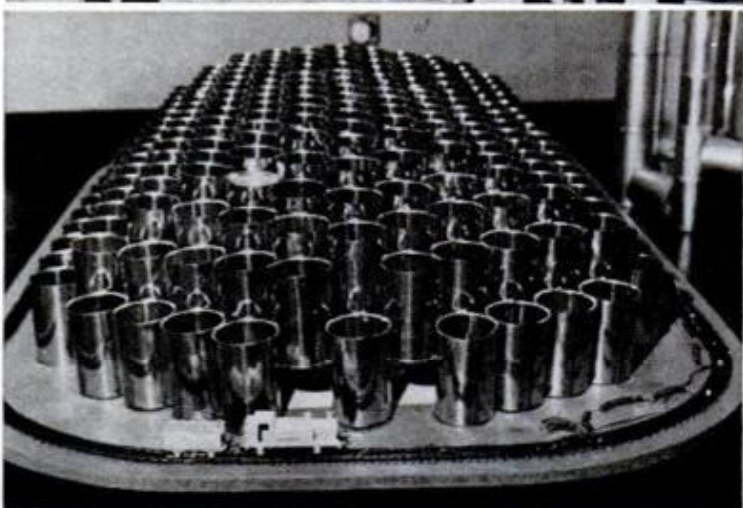


3. YOU CAN PEDAL UP A POLE or tree the way you ride a bicycle with this unusual climbing aid for linemen and tree surgeons. You just pump your legs up and down and you automatically go upward. Attached to each foot is a pivoted lever connected to a metal collar. As you press one leg down, its collar wedges tightly around the pole or tree, giving you a firm foothold. This frees the other leg so its collar can be slid upward. The action is repeated, one leg after another, until you reach the top

pocket and filled with a liquid explosive (top photo at left). A detonator is inserted in a hole in the mouth of the plastic envelope and fired electrically. The force of the shaped charge spreads sideways in a narrow path, severing the tree cleanly near the ground without endangering the trunk

5. INSTANT BRIDGES for soldiers crossing streams and gorges are possible with this special bridge-building vehicle. It carries a pair of prefabricated ramp sections on top over a telescoping boom. As the boom is extended, the sections are pulled apart and joined end to end, forming a rigid span. The boom continues until it reaches the opposite side and the span is slid across it, bridging the gap. The boom is then retracted, leaving the bridge in position, ready for use





London sound from Tin-Can Alley

To publicize its canned rice pudding, a British firm offered prizes for "unconventional musical instruments" made from cans. Entries included a tuba (upper left), an organ (left), which blew up during the demonstration, and an array of cans (lower right) that "bleeped" as a toy train passed over electrical contacts. Bandsmen (upper right) drew curious stares.



Not really topless—it's a see-through car

Drivers can enjoy the effect of an open-top car without the wind and the rain in their hair when the vehicle is fitted with a custom glass top that a London firm offers. Triplex Safety Glass Co. can put the see-through top on virtually any make of car. The toughened glass is tinted so that it blocks about 40 percent of the sun's heat. In particularly hot weather, the driver can use a zip-in lining to block the sunlight.



Glass carillon

Brandeis University has a "glass" carillon that sounds like the best of the metal ones, but weighs only 40 pounds. The electro-mechanical device, made by G. Finkenbeiner, Inc., of Waltham, Mass., contains 35 "glass" bells made of fused quartz manufactured by General Electric. The sound source in each glass bell is a thin, hollow thread of fused quartz tubing drawn into a foot-long, elongated-bell shape. Each bell is sealed in an evacuated glass tube with a tiny glass-tipped hammer that strikes the bell. The mechanical vibrations are electronically amplified 100,000 times and fed to loudspeakers.



Scores from 50-yard line

It took a football field to dramatize the 150-foot reach of the Lorain Moto-Tower, a crane used in building construction. The truck-mounted tower is also 150 feet high.



Land-and-water houseboat

Powered by a 90-hp stern-drive engine, the Combo-Cruiser zips along at 20 mph in the water. Loaded onto its low-slung trailer for towing, the 23-foot houseboat is a travel trailer, complete with bathroom, kitchen (including a refrigerator) and sleeping space for five adults and one child. The maker is Ship-A-Shore Corp., Mishawaka, Ind.



Tent-trailer that floats

NaviCamper, the boating-camping-trailer sports rig, now comes in Mark II and Mark III versions. The luxurious Mark III includes such features as running lights, compass, LP-gas stove, water tank and sink. The retractable pontoons on all three versions of the 18-foot-long unit are made of fiberglass.

Now: Atomic Power to

To eliminate battery failure in heart

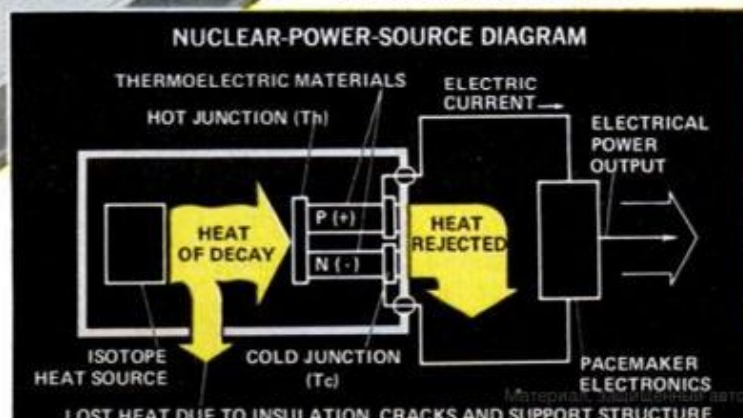
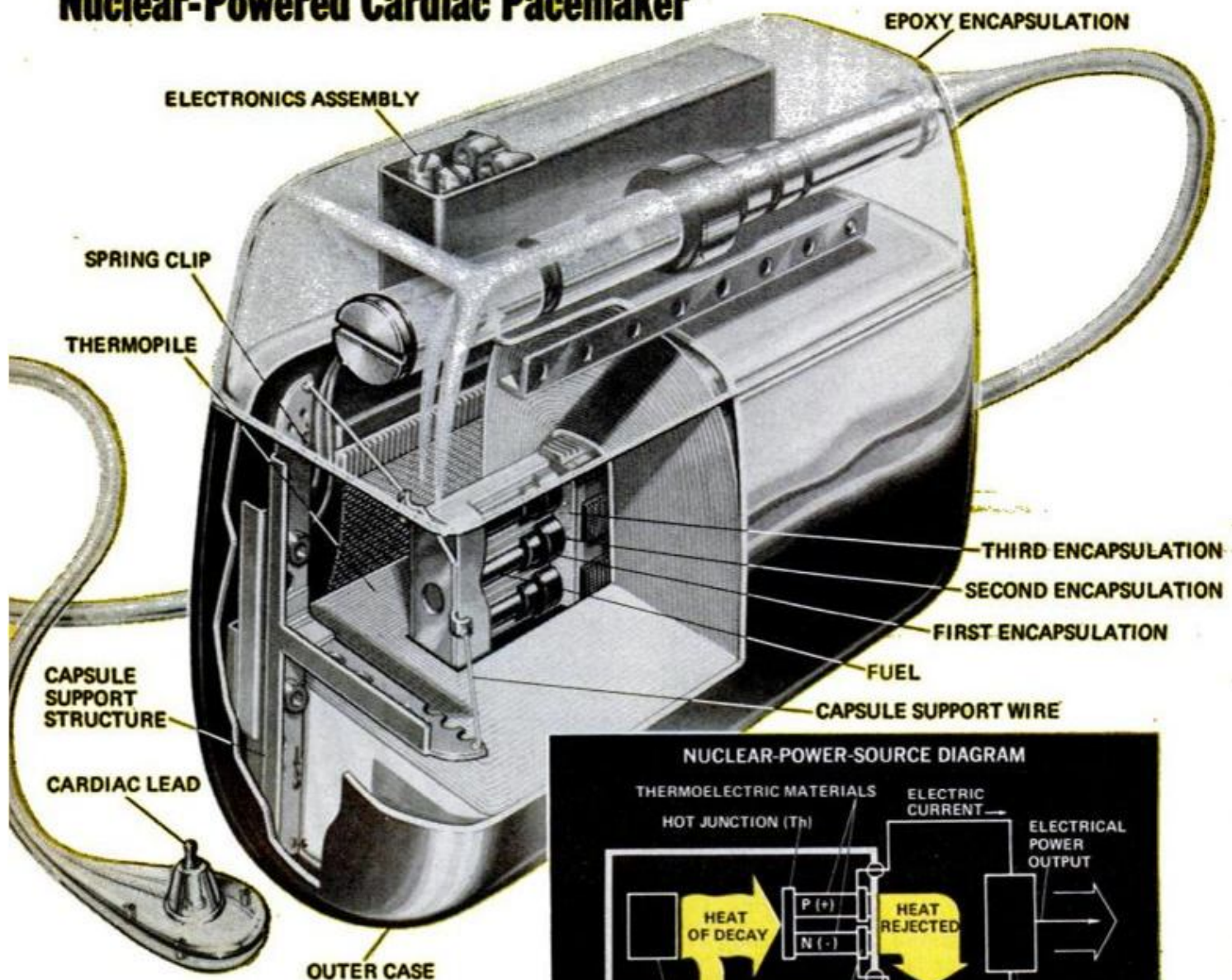
By **ARTHUR S. FREESE**

Illustration by Peter Trojan

ABOUT 100,000 PEOPLE owe their lives day-by-day to an electronic marvel smaller than a deck of cards and powered by tiny batteries implanted under their skin. Since its development 12 years ago, the heart pacemaker has made normal living possible for those who suffer from a malfunction of the nerves controlling the heartbeat, a rather common ailment.

Though tiny, the mercury cells that deliver a slight electric shock to the coronary muscles are relatively bulky and must be replaced about every two years. Scientists in the United States, France and Britain have been seeking a smaller, more permanent power source. In May, 1969, the first atomic pacemaker was implanted in a dog, a foxhound named Brunhilde, by National Heart and Lung Institute (NHLI) researchers. Nine days later

Nuclear-Powered Cardiac Pacemaker



Keep Your Heart Beating

pacemakers, a tiny amount of plutonium may be the answer

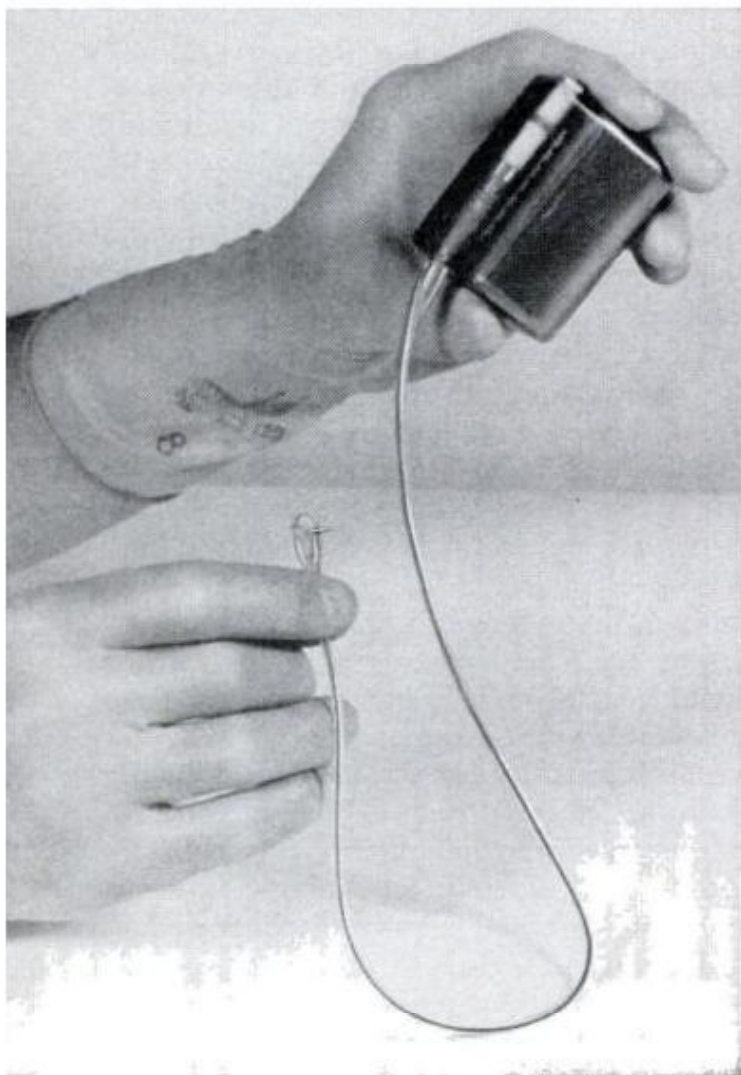
the French placed one in a deerhound. While NHLI trials with animals were still under way, the French made the first human implantation of a nuclear-powered pacemaker on April 28 of this year. The device was inserted in the chest of a 58-year-old woman. Dr. Paul Laurens, its developer, estimates that it should function without refueling for a minimum of 10 years.

The atom provides pacer power by thermoelectricity, the direct conver-

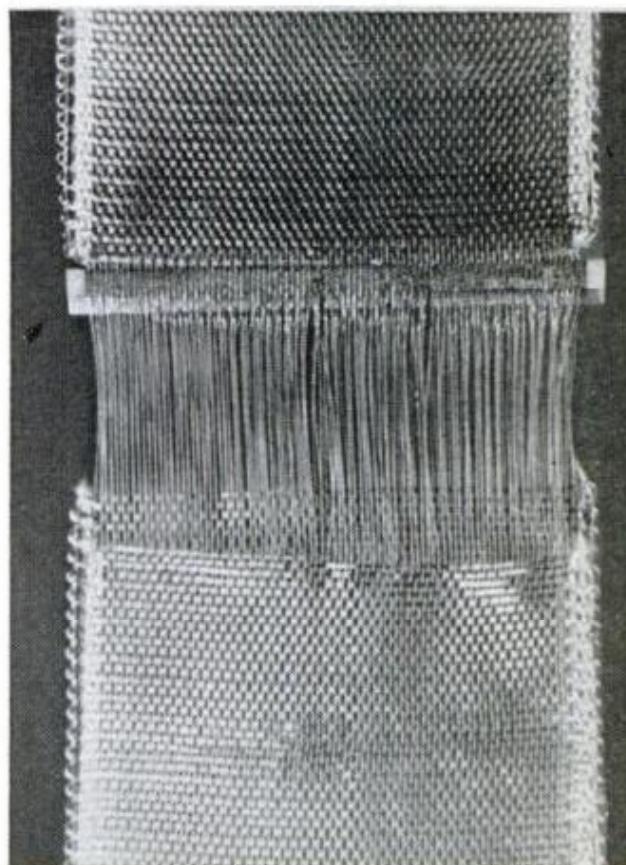
sion of heat into electricity. In the NHLI atomic power source, three tiny rods of plutonium 238 (each triply encapsulated in tantalum-tungsten alloy, Hastelloy "C," and titanium-palladium) are the source of the heat. The plutonium gives off alpha particles, but their penetrating power is so slight that they can be stopped by a piece of paper. About 500 milligrams (less than $\frac{1}{50}$ of an ounce) of plutonium is used.

According to Stanley Seiken, chief of the Atomic Energy Commission's Isotope Power Branch, the nuclear device is at present "a handmade laboratory system. We know it works. It's now a matter of adapting the design so it can be manufactured."

Dr. Sidney Levitsky, NHLI heart surgeon responsible for implanting the nuclear pacemaker in animals, estimates the life of the device as a mini-



FIRST NUCLEAR-POWERED PACEMAKER (left) generates electricity from a tiny amount of plutonium 238. Heart lead (above) is normally in contact with left ventricle of the heart. The thermocouple consists of eight metallic ribbons, each containing 88 hairlike wires (right) that surround the radioisotope fuel



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imum of 10 years and most probably 20. Seiken foresees the cost as probably \$3000 to \$5000 as compared to the \$750 to \$1000 for today's battery pacers. (Each set of batteries costs about \$250.) But the nuclear pacer will last as long as five or more battery replacements. Each replacement also means hospitalization surgery costs and the inconvenience and risk accompanying the operation.

The American atomic pacer is about two-thirds the size of a cigaret pack and weighs only three ounces—at this stage. Its stray radiation is "no greater than that from the radium dial of some wristwatches," according to NHLI. Surrounding the plutonium rods is a copper strap with six sets of ceramic tabs, each containing 88 thermocouples. These are nine inches long, 2/1000 of an inch thick (barely thicker than a human hair). The thermocouple is made of a copper and nickel alloy wire brazed to a copper and chromium alloy wire. The thermocouples are heated at one end by the decay of the plutonium and the resultant electricity is drawn off and fed into a conventional pulse generator to operate the electronics—the same as any other pacer's.

While the French seem to have stolen the lead by having made the first human implantation, their nuclear pacemaker is, according to Medtronic, the American company that supplied the electronic components, "still in the research stage." Nevertheless, the company insists that the device is "quite superior to the AEC's and quite a bit smaller." The French pacer is an inch and a half in diameter and an inch thick. It uses 150 milligrams of plutonium, less than a third of that used in the American pacer. Its thermocouples are made of a bismuth-tellurium compound, and it's claimed that this is superior to other compounds.

Meanwhile, several institutions are pursuing research on fuel cells that would create electricity to power a pacemaker—or possibly a complete artificial heart—from human body fluids.



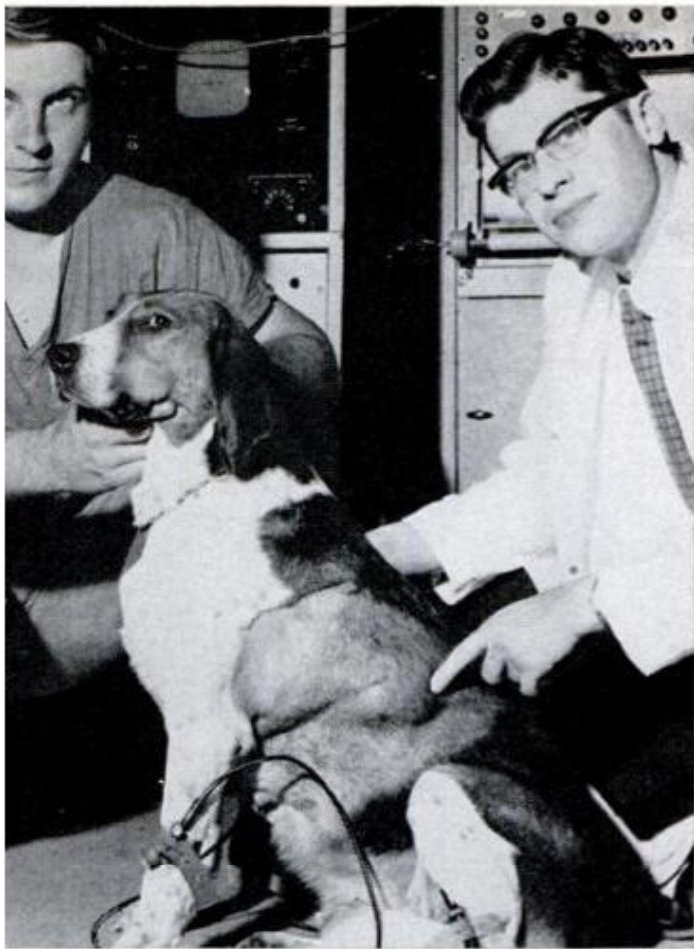
POWER FOR PRESENT-DAY PACEMAKERS comes from mercury cells; six cells form a battery that lasts an average of 18 months. Nuclear pacer implanted in dog (right) in May, 1969, is still working perfectly

Scientists have already produced small amounts of electricity by using the hydrogen from glucose and the oxygen from air. Glucose is a form of sugar found in blood serum. In one experiment a transistor radio played for three hours on the electricity produced from a pinch of sugar in a water solution. The power source consisted of two catalytic electrodes separated by a plastic membrane. Hydrogen atoms are freed from the glucose by one electrode and oxygen from the air is supplied by the other. When the hydrogen and oxygen combine, water is produced and releases electricity. In the human body such a fuel cell would draw oxygen and water from body fluids and the water would be absorbed harmlessly by the circulatory system.

At Emory University Medical School, Atlanta, Hal Warner, a biomedical engineer, has operated such a fuel cell on water and glucose and plans experiments with blood serum, the best probable source of glucose if such a device were implanted in an animal or human.

Biological fuel cells are still in the experimental stage. So, for that matter, is the nuclear pacer. Meanwhile battery-powered pacers are saving lives every day.

These electronic marvels are inserted



by a sort of life-and-death plumbing. Cardiac pacemakers sense when the heart beats normally and shut themselves off, to protect the heart and to preserve their own batteries. Yet they will promptly cut in should the heart miss even one of its 100,800 daily beats.

Your heart is essentially a hollow muscle, about the size of your clenched fist and weighs less than three-quarters of a pound. Its two upper chambers are called "atria" (plural of atrium) and its two lower—and larger—ones, "ventricles." Your blood is driven through your heart by a flowing muscular contraction (like squeezing fluid out of a balloon), starting with the topmost muscles and sweeping through at some 70 times a minute (nearly 40 million heartbeats a year).

Your heart is kept beating—and its rate determined—by a tiny lump of modified muscle at the back of the right atrium and close to its top. This is the sinoatrial node, your heart's *natural* pacemaker. It has been compared to an electric condenser which steadily builds up a charge, then periodically dis-

charges. This electrical impulse spreads through the atria, reaching another bit of modified muscular tissue, the atrio-ventricular node, which passes the impulse on to the ventricular muscles. It is this electric current which your doctor records on an electrocardiogram.

Disease or surgery of the heart can damage these vital nodes, or the conduction of their signals. The ventricles may then be slowed ("heart-block") to half their normal rate, or even less, and perhaps occasionally stop. This produces faintness, dizziness, unconsciousness and even death. These fainting spells are called Adams-Stokes disease.

To get disorganized hearts back on the beam, work began on artificial pacemakers in the 1950s. First used on a temporary basis, the common early ones had their electrodes implanted directly on the heart. Dr. Seymour Furman, attending cardiothoracic surgeon at New York City's Montefiore Medical Center, recalls that in 1958 "we had reached the point where we felt that in a desperate-enough case we could try it." That year, a Montefiore patient whose life depended on cancer surgery also had Adams-Stokes disease, which seriously reduced his chances of surviving the surgery. Furman tried his pacemaker—and it worked!

Furman and his team were the first to use a transvenous pacer, one whose electrode passes through the veins to lie in a heart chamber. But as soon as the surgery was over, surgeons removed this appliance. They next succeeded with a patient desperately ill with Adams-Stokes disease. But here the Furman team found they had a tiger by the tail—they were afraid to hang on and they couldn't let go. Every time they tried to cut off the device, the heart lost its rhythm. For three months they had to use the pacemaker. But then they knew—permanent pacing was possible.

The principle of the artificial pacemaker is simple—a painless electric shock of 3 to 6 volts can stir a heart

(Please turn to page 214)

How to Talk to Vietnam -Free



You can phone any serviceman almost anywhere in the world via MARS and a network of volunteer ham-radio operators

By ALBERT LEE

YOU CAN ARRANGE a personal telephone conversation with any GI in Vietnam—absolutely free—thanks to a little-known organization with the unlikely name MARS. Using the free MARS service is only slightly more complicated than placing a commercial person-to-person call through to Vietnam—if you know a few of the ground rules about how the organization works.

MARS (Military Affiliated Radio System) has a prime objective to act as an alternate network should regular

lines of communication be blacked out during a national emergency. But since hurricanes, earthquakes and similar tragedies are infrequent, MARS members keep in practice by handling the emergencies and commonplace chatter of everyday life between servicemen and their families and friends.

MARS is a joint venture of the Armed Forces with more than 22,000 civilian ham radio operators. To be a member, a civilian must be an FCC-licensed amateur radio operator with several thousand dollars already invested in sophisticated electronic equipment.

Short of occasional government grants of surplus radio equipment, civilian members receive no compensation for their efforts. The number of calls made by members varies widely, from a New York City lawyer who places a half-dozen calls a week, to Sen. Barry Goldwater of Phoenix, Ariz., whose round-the-clock radio station completes more than 100 calls daily.

Calls are transmitted by a method known as "telephone patching." More

ARRANGING CALL from Phan Rang, Vietnam, to Jacksonville, Fla., is USAF MARS Sgt. Ted Trojanowski



than 641,000 such patches went through from Vietnam alone last year.

Here is how a MARS telephone patch works: A soldier in Vietnam contacts his radio station on base and supplies your U.S. telephone number and address. The station puts through a short-wave radio call to the MARS civilian radio operator nearest your home.

The local MARS operator plugs his short-wave receiver into a commercial telephone (the actual patch); then he calls the telephone company and has them place a station-to-station call to you.

When you answer the phone, the hook-up is complete, and you're ready to talk to the soldier in Vietnam.

The MARS service is free, but you may have to pay a dollar or two for the commercial telephone call portion of the patch from the MARS civilian operator to you. A few MARS stations even pay this charge for you. A group of businessmen in Omaha, Neb., for example, pick up the tab for 70 percent of the calls transmitted through that city. Their bill runs around \$1500 a month.

You can generally tell how much a call will cost you by your location. Short-wave propagation from Vietnam is best west of the Mississippi River. Therefore, if you live on the Eastern Seaboard, you can expect to pay as much as \$1.35 from California or as little as 50 cents from Kansas. If you live in the West, you might pay only a dime for a local call.

The advantages of using MARS over commercial telephone lines to Vietnam are numerous. An AT&T call to Saigon costs you \$12 for three minutes person-to-person. Even if money is no object—an unlikely circumstance for most soldiers' wives—it is often impossible to contact a Vietnam serviceman over commercial lines.

There are just six commercial telephone locations in Vietnam, all clustered around Saigon. MARS has 78 stations spread evenly across the country. In many locations, MARS service is the

only communication available. Only 10 conventional telephone circuits are available for Southeast Asian use, and these are open approximately 12 to 15 hours a day.

But while MARS is by far the best way to contact a GI, it too has its complications. Most perplexing is the MARS regulation which requires that all patch calls originate from the serviceman rather than from you.

The reason: Soldiers are constantly being shuffled around the countryside in Vietnam. Sometimes entire platoons are simply listed as "in the field." To get a serviceman to the telephone, if you called, would be virtually impossible. And even if the soldier is stationed on a fixed base and can be pinpointed to a specific office, your call would undoubtedly tie up the phone lines for several minutes while he was paged.

The waiting list for calls is long. The rule of one-way communication exists to insure every GI a chance to call home. Even commercial telephone company executives ask that you arrange to have the serviceman call you instead of attempting to contact him yourself.

The easiest way to accomplish this is to write and ask the soldier to call you via MARS. However, it could take upwards of a week before the soldier could receive your letter and respond.

If you are in a hurry to arrange a call, a faster approach is available through another free MARS service—teletype messages. By contacting any

RETIRED TEACHER, James Cotter, Dearborn, Mich., uses ham equipment to patch servicemen's calls



local MARS member, you can send a 25-word message to any serviceman. The message goes by short-wave radio teletype and, according to a recent Navy poll, usually reaches the serviceman within 12 to 48 hours.

Here a problem lies in ferreting out a local MARS member who can send the message. It is possible that you may have trouble finding a nearby MARS station. Why? Because MARS, as large and efficient as it is in operation, is highly disjointed on the civilian volunteer level.

There is not one MARS organization but three: Army, Air Force and Navy-Marine Corps. If you want to send a message to a Navy man, you have to find a local Navy MARS member.

The three separate MARS headquarters in Washington, D.C., have no listings of members in specific areas which

MARS volunteers furnish time, skills and equipment to keep communications open

they are willing to release to the public. They will give you names of regional MARS directors, but finding a local member this way is like trying to get the name of your postman by writing to the U.S. Postmaster General—it's just not worth the effort.

MARS volunteers are usually well-known in their communities. A call to the reference library of your town newspaper will usually turn one up. If that fails, call the nearest amateur radio operators' club and you'll end up with a long list of MARS members. The Red Cross and city hall are also sources of information.

Once you have arranged your first patch call, the second and third will be easy. A Detroit wife talks to her husband via MARS every week. She maintains a list of things to tell him and keeps it next to her telephone so that she can rattle it all off before her three-minute limit is up.

A Chicago wife doesn't like the fact

that a radio operator must listen in on every call to know when to switch channels. She and her Air Force husband devised their own code. When he calls from Vietnam, they talk in their own private language.

Wives have also learned to remind their distant husbands that Vietnam is 13 hours ahead of Eastern Standard time. A couple of half-conscious conversations at 3:00 a.m. are generally adequate to get this across.

Though Southeast Asia demands the lion's share of the MARS service—over a million and a half calls since 1965—much of their phone patching is in other directions. You can use MARS to call any American fighting man, almost anywhere around the globe. There are a couple of noteworthy exceptions, such as England, where British regulations forbid U.S. ham radio operations in their frequencies. Egypt and most communist countries also outlaw MARS service.

No location is too inaccessible for MARS service. Navy MARS, for example, puts through about 10,000 calls to Antarctica during the four-month-long freeze-over each year.

MARS welcomes messages and calls for any reason. But it suggests that you go directly to a military recruiter or Red Cross chapter if a real emergency should occur. News of serious injuries or deaths in the family can best be handled by military or Red Cross emergency communication networks.

MARS volunteers furnish time, skills and tie up millions of dollars in equipment to keep communications open between you and servicemen. They do not care whether you use their free service or choose to call commercially—as long as you call.

As one radio operator in Da Nang put it: "When a soldier gets a letter from home he's happy. When he sets down the MARS telephone receiver after talking to someone special back home, he's ready to scale 10-foot walls."

MARS is morale building on both ends of the line. ★★★



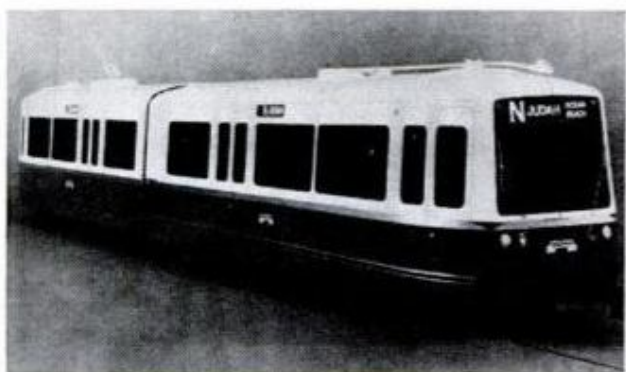
Honda's three-wheeler

Snow, sand and mud are not obstacles to Honda's new US90, a three-wheeled vehicle powered by a 4-cycle, 89-cc engine. The US90 comes apart for carrying in a car.



Probe heart with sound

A camera can photograph ultrasonic echoes of sonar impulses bounced off the heart's interior walls to record heartbeat and blood circulation data. This use of sonar is by Stanford physicians and scientists.



Articulated trolley cars planned for San Francisco

A fleet of 78 two-unit articulated cars may be operating on San Francisco's municipal railway by 1972. The airconditioned, electric cars will run on the surface and in subways.



Both French and German pilots may train in Alpha-Jets

Proposed as a training plane for French and German flyers, the Alpha-Jet will be built in both countries. First flying prototype of the near-sonic craft can be ready in 1972.

The Minis Are Out to Rule the Road



PM crosses the Rockies with Chevrolet engineers in a Vega 2300, drives a Pinto on Ford's proving grounds and revisits Lincoln-Mercury's hot-selling little Capri

By **MICHAEL LAMM**, West Coast Auto Editor

Photos by the Author

LAST MAY, Chevrolet invited *PM* to ride shotgun with six engineers putting final shakedown mileage on three preproduction Vegas. The route: Denver to Phoenix—high Rockies to desert lowlands. Travel time: two days. Our hosts: the six men mostly responsible for the Vega's design and development. The three cars were a Vega 2300 sedan with the 90-hp ohc Four and standard three-speed manual trans, a 90-hp Vega wagon with Powerglide, and a high-performance 110-hp Vega coupe with four-speed. All cars were hand-built prototypes, since assembly-line production had not started.

We had CB radio contact between all cars at all times. In addition to the Vegas, we also had for comparison a new VW, a Toyota Corona and a Maverick.

By June, it would be too late to make major changes in the Vega, but, for example, one engineer considered the accelerator spring too strong, so he ordered a different stretch rate. Another engineer was testing to see whether the Vega really needed a vibration damper on its driveline. Without it, the

(Please turn to page 114)

By **BILL HARTFORD**, Auto Editor

Photos by Bruce Moss

PREPRODUCTION PINTOS were corraled in the Romeo, Mich., Proving Grounds of the Ford Motor Co. for test driving early last June. On the way there, before even seeing the new model, I thought about a lead to kick off a story about the new minis . . . "They'll sell themselves. That's for sure. It's been a long wait for these American 'Volkswagens' which—like their German rival—will keep the same styling for years to come. At last, with Pinto and Vega joining Gremlin, there will be a choice of domestic cars to break the status habit, that will be really economical to own and operate, that, with tender, loving care, should be as 'new' and as satisfying to own four years from now as today . . ."

Right on the money. There's been a steadily growing market for cars of this description, and I was sure, as Ford promised, that the Pinto would be one of them. It was only late '68 when Ford engineers got the go-ahead to start with a 94-inch wheelbase and build a 'better Volkswagen.' Between that time and Feb., 1969, when the final design was approved, the amazing bug was prob-

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JOINING THE GREMLIN (center left) in booming mini-car market is Ford's sleek Pinto (top), lowest of the minis. Vega hatchback coupe (center right) and station wagon are additional body styles to sedan on cover. Selling faster than it's made is Capri, offered by Linc-Merc dealers and built by Ford of England



PINTO



GREMLIN



VEGA



CAPRI



HATCHBACK VEGA, officially called the coupe, combines fastback styling with station-wagon convenience. Test car is equipped with optional custom interior: includes woodgrain accent, passenger-assist handle

VEGA (Continued from page 112)

four-cylinder engine set up a barely perceptible hum at 2600 rpm and a related, more noticeable buzz at 4000 rpm. The damper happened to be intricate and costly, so if the car could do without it, the saving might be used elsewhere.

Of the Vegas on the trip, the 90-hp sedan, with its 2.53 axle, equaled the fuel mileage of the VW—24.6 mpg at high speeds in flat country. Average Vega consumption is about 28 mpg in normal driving. Acceleration of the 3.36:1-axled, 110-hp coupe beat the Maverick up hills. And cornering ability with the coupe's H-D suspension and front and rear antiroll bars put the Vega far ahead of its competition on mountain curves. Even the plain-Jane wagon felt more stable to me in fast maneuvering than the three compari-

son cars. Yet all Vegas have what amounts to a big-car ride—very smooth, quiet and unchoppy.

Both the coupe and the wagon have surprising amounts of cargo space. The rear seats of both cars fold flat, giving the coupe a lot extra storage volume and the wagon a whopping 50.2 cu. ft. The sedan carries 9.1 cu. ft. of luggage by virtue of its deep trunk shape. And for a change, trunk space is *usable*, not all chopped up by the spare tire and gas filler.

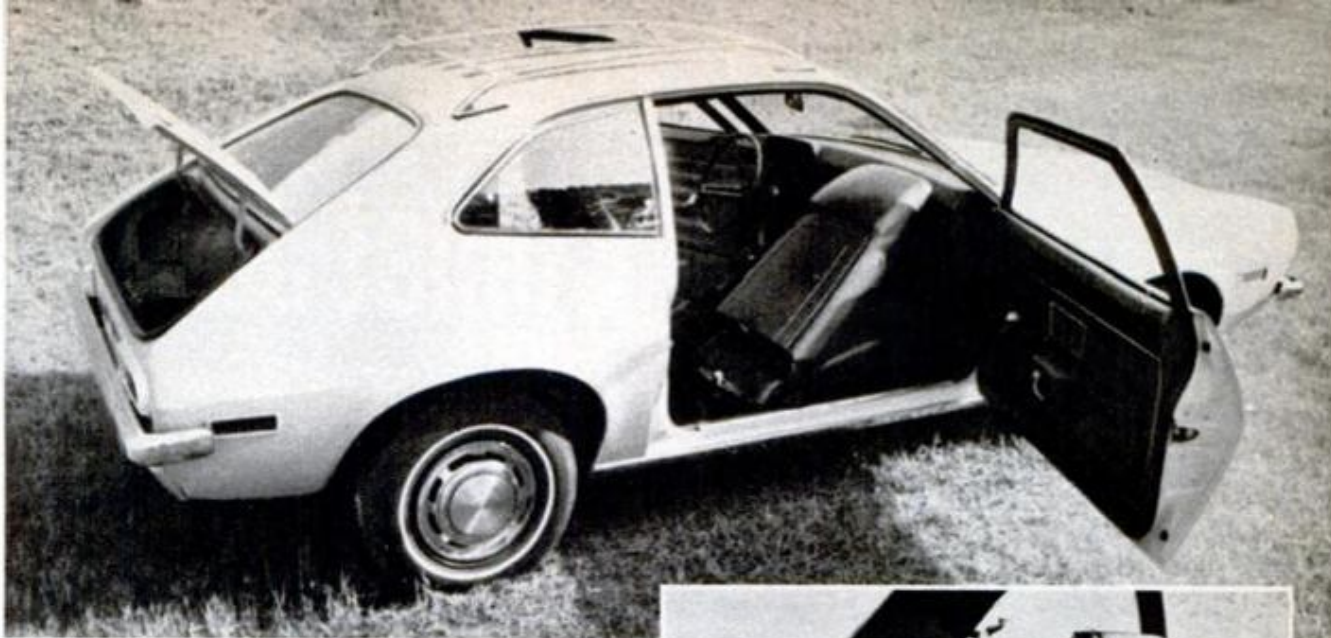
Front seats in the three body styles are full-sized and comfortable, adjustable for rake. There's no fender-well encroachment on legroom. Rear legroom tends to be short—33.8 inches, but that's five inches more than the Mustang fastback.

The all-new engine is an in-line,

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THE '71 MINIS—HOW THEY COMPARE

Car	Body Style	Wheel- base (in.)	Overall Length (in.)	Overall Width (in.)	Overall Height (in.)	Track (f/r., in.)	Engines (Displacement—4 cyl. except as noted—ohv except as noted—carburetion)
American Motors Gremlin	2-dr. sedan,	96.0	161.3	70.6	51.8	57.5/57.0	232 cu.in. (3800 cc)-6-1bbl. 258 cu.in. (4200 cc)-6-1bbl.
Chevrolet Vega 2300	2-dr. sedan 2-dr. coupe, wagon, sedan deliv.	97.0	169.7	65.4	51.2	54.6/54.1	2300 cc (140 cu.in.)-ohc-1&2bbl.
Ford Pinto	2-dr. sedan	94.0	163.0	69.4	50.0	55.0/55.0	1600 cc (97 cu.in.)-1bbl. 2000 cc (122 cu.in.)-ohc-2bbl.
Lincoln-Mercury Capri	2-dr. sports coupe	100.8	167.8	64.8	50.9	53.0/52.0	1600 cc (97 cu.in.)-1bbl.



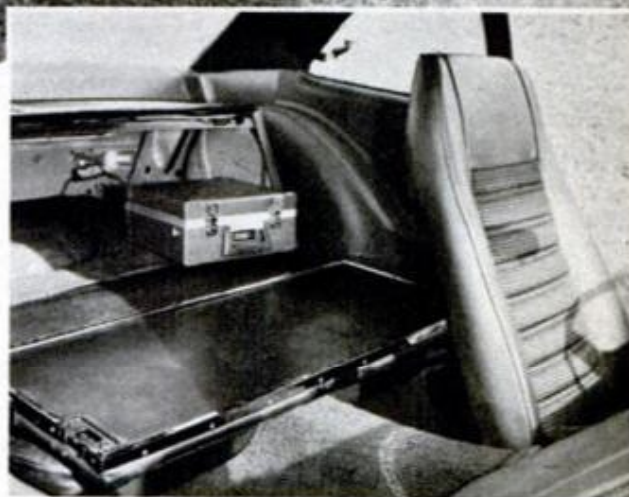
PINTO OPENS UP for easy access to rear seat which folds down, becomes platform, goes through to trunk

PINTO *(Continued from page 112)*

ably more discussed in Dearborn than in Wolfsburg. Meeting VW "head-on" was the rallying cry.

Here was the result! I scrutinized the Pinto and I drove it. And I'm sure that the people responsible for it—having spent all-too-short months designing a new car within dimensional limitations and price range of a VW, and striving to better VW's comfort, convenience, performance and appearance—would take it as the most flattering indication of their success that it was well after I first saw and drove the Pinto that I remembered this was a VW-sized automobile!

Ford rearranged VW dimensions inside and out to come up with a car that's nothing like a Beetle, yet competitive in almost every respect. True, the Pinto design sneaks in a .5-inch longer wheelbase, four inches more length and about eight inches more width, but it's over a half-foot lower, of conventional front-engine design and styling, and one-up on VW in all people-packaging dimensions except headroom. Add to that "comparable" initial cost, economy, performance and simplicity of design, an even smaller turning radius than VW and similar versatility, like the fold-down rear seat (giving 38.1 cu. ft. cargo space, but, alas, it's an extra-cost option), and



the result is an automobile that makes all the sense that VW has been making since its 1949 U.S. introduction.

I drove two Pintos—one with the standard, 1600-cc, British-built engine and all-synchro, four-speed, floor-mounted manual transmission, and the other with the optional, German-built, 2000-cc overhead-cam engine and three-speed floor-mounted automatic (four-speed stick will be available with this engine soon).

Axle ratio with all engine-transmission combinations is 3.55. The engines, with compression ratios of 8:1 and 8.6:1, use regular fuel and are rated at 75 hp at 5000 and 95 hp at 5700 rpm, respectively. While I didn't make timed performance runs, it was obvious the stronger, higher-revving two-liter ohc is a desirable option for this 2013-pound car. It gives the little extra performance that can be used to beat VWs away from traffic lights. Overall impression is that the Pinto should appeal

(Please turn to page 220)

FORD



The Ford, Lincoln-Mercury

Comet Joins the



COUGAR



THUNDERBIRD



MONTEGO

COMET

FORDSPORT DAY at Brands Hatch in Merry England is an annual motoring spectacular where you can see Fords that you never see here. Owners of little passenger cars—Cortinas, Anglias, Escorts, Capris, and somewhat larger Zephyrs, Corsairs and Zodiacs—go out to thrill to a full day of fanfare and Ford-powered competition: Formula Fords, twin-overhead-cam Escorts, 3-liter Capris and other FoMoCo performance machines—even an F1 car with the extraordinary Cosworth-Ford—the winningest engine on the Grand Prix circuit.

All this may sound like a lot of British ballyhoo over scaled-down kiddie cars. Why, even the GP engine (183 cu. in.) is only a little "larger" than Maverick's 170 Six! And the Maverick—smallest of

FORD CONVERTIBLES, in XL series last year, are LTD models for '71

COUGAR CONVERTIBLES and hardtops are restyled, longer, wider

THUNDERBIRD HARDTOPS and Landau roof models have redone grille

MONTEGO here is Cyclone Spoiler model. Comet is L-M's new compact

Lineup

Big Stars

By **BILL HARTFORD**,
Auto Editor

Photos by Bruce Moss

Ford's cars (until Pinto and Capri)—is about as big as the English deluxe sedans or saloons as they are called. But as the waiting list for Gremlins and Capris grows and as lines start forming to see the Pinto and Vega, it's obvious that Americans are getting a new perspective on size this year. The imports, and the new domestic minis with their nimble handling and zippy four-cylinder engines may also give us a new perspective on the meaning of performance.

There's no Fordsport Day, U.S.A., but last June was the press introduction of Ford and Linc-Merc's '71s—parading hot performers like the Mach 1, Torino Cobra and...sssnarl.... Cyclone Spoiler. Again, "wider stance, greater length and more rakish angle of the windshield," describe even the tamer models. The day of the small car may be dawning, but there is still a strong demand for larger, higher-pow-

TORINO COBRA, one of 14 mild to wild intermediates, comes only as SportsRoof

MUSTANG MACH 1, longer and wider for '71, has an all-new "flatback" SportsRoof

MERCURY continues family-size Marquis, Monterey; discontinues Marauder models

MAVERICK is back with four-door sedan that's 7 inches longer than two-doors



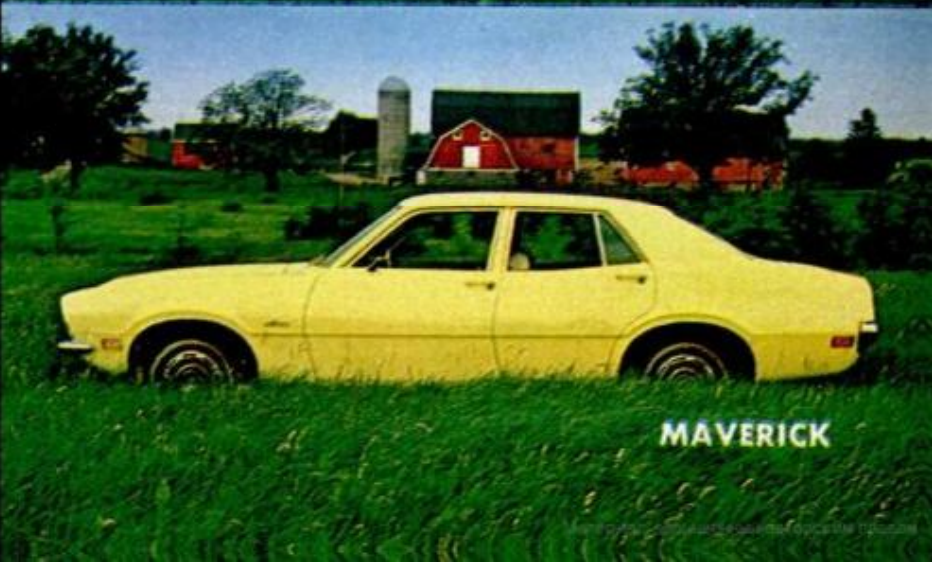
TORINO



MUSTANG



MERCURY



MAVERICK



LINCOLN CONTINENTAL, slightly changed outside, gets side impact beams, standard Michelin radials



CONTINENTAL MARK III, unchanged in sheet metal, offers longer list of standard, optional features

ered luxury cars (yup, even "compacts" among them are available with options like V8s, air and power steering). Ford's "bigger" cars certainly meet this demand—while still, by the way, incorporating more safety features for '71 and controlling exhaust emissions within the currently defined limits.

Maverick and Comet are essentially the same car. Maverick has a four-door model—thoughtfully placed on a longer wheelbase—that's in addition to last year's two-door sedan and the superbly executed '70½ "Grabber" Sports Sedan. The same three-model approach holds for L-M's Comet, the sporty two-door being a "GT." Traditionally offering what buyers regard as a "step-up" from Ford, L-M has in the Comet more trim, appointments, power options and 302-cu.-in. V8 power. Still more options for the '71 Maverick—such things as electric clock, rear-window defogger, convenience and accent groups, high-back buckets, just to start the list—should put the average selling price of the car well above that for the more austere Pinto and hence out of price, as well as size competition—in case you were wondering about Maverick's low-price tag *vis-a-vis* Pinto's only slightly lower predicted price.

Torino and Montego, intermediate-size car lines of Ford and L-M, respectively, share the same wheelbase and offer a plethora of body styles. Torino is a couple up on Montego with a convertible and SportsRoof hardtop models.

Both lines—running with a good thing—are little changed from last year. Look for only the predictable changes in a facelift year: new or revised grilles, new ornamentation—also a lot of new paint colors. Inside and under the skin of all the cars—from the base models through Cobra, GT and Brougham and the Cyclone, GT and Spoiler—are new design and technical features, and new options and power team features. Electric rear-window defroster (or heated backlight as it's called by L-M) is an option as is a really sharp-looking two-tone vinyl-knit upholstery. The simple addition of a return spring integral with throttle control cable (on all car lines) gives a smooth pedal feel. On hardtops and convertible (and on Mustang and Ford) door glass is mechanically held to prevent slip, simplify replacement.

Ford and Mercury, the so-called "full size" cars, have been extensively redesigned and the best word to describe them is . . . smooth. Hide the wipers, eliminate the vent panes, recess the door handles, do a little wraparound and French curve treatment on the bumpers and the result is a "family car" conceived more in fine modelers' clay than Play-Doh. Ford's got 19 models spread out among the Custom, Custom 500, Galaxie 500, LTD and LTD Brougham lines. XL has been discontinued. Mercury has 15 models in its Monterey, Monterey Custom, Marquis and Marquis Brougham lines. Convertibles and Marauders are no more. Both FoMoCo

divisions have more "sedan/hardtop" models this year. The term refers to a car with four-door hardtop roof style, using thinner pillars than a sedan and frameless window glass. Side impact beams are in the doors of all models (as well as those of Mustangs, Cougars, Mercurys and Continentals). A 400-cu.-in. V8 (derived from the 351 Cleveland engine) is all new. The regular-fuel powerplant has a compression ratio of 9.1 and, at 4.0x4.0 in., a perfectly square bore and stroke.

Mustang, while retaining enough vestigial design elements to identify it immediately, is most changed since its introduction in '65. Wheelbase is up one inch, overall length up 2.1 inches, width up 2.4 inches. All models have wider track and are lower, but, most significantly, the flatback is flatter than ever for '71! The line is severe, but I'm sure Mustang has correctly monitored the

pulse of the sporty car buyer again. The SportsRoof comes in base model, Mach I and Boss 351. The convertible, hardtop and Grande hardtop complete the line and give the option of rear visibility! Hidden wipers, 60° windshield angle and flush door handles are other styling snares or aerodynamic design elements, depending on your orientation. Power windows are among many new options and a new top linkage in the convertible model looks and works better and gives more rear seat room. The 250-cu.-in. Six replaces the 200 as base engine for the line, and standard in the Boss 351 Mustang is the 351 HO high-performance V8 set up by Holman & Moody. The 429 CJ and CJ-R replace last year's 428s.

Cougar, too, gets its most extensive changes since it first hit the road with the '67 model. Changes parallel those for Mustang—longer wheelbase, longer,

(Please turn to page 222)

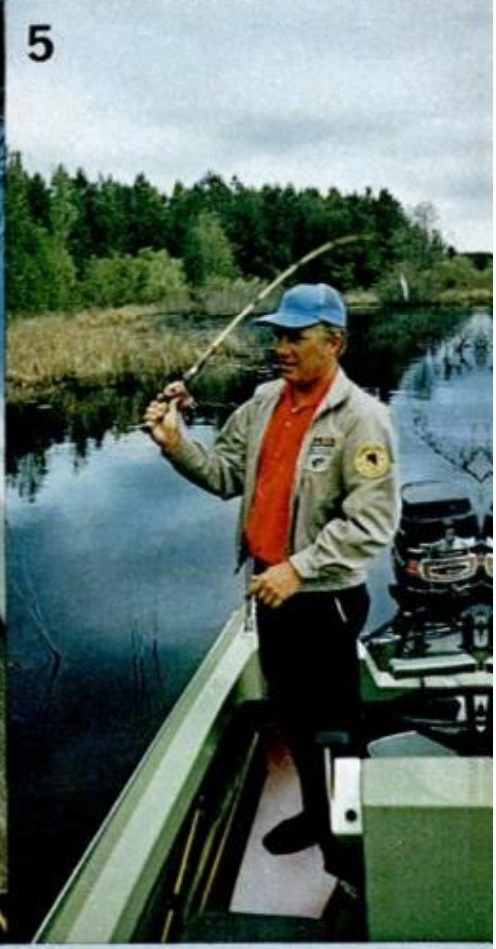
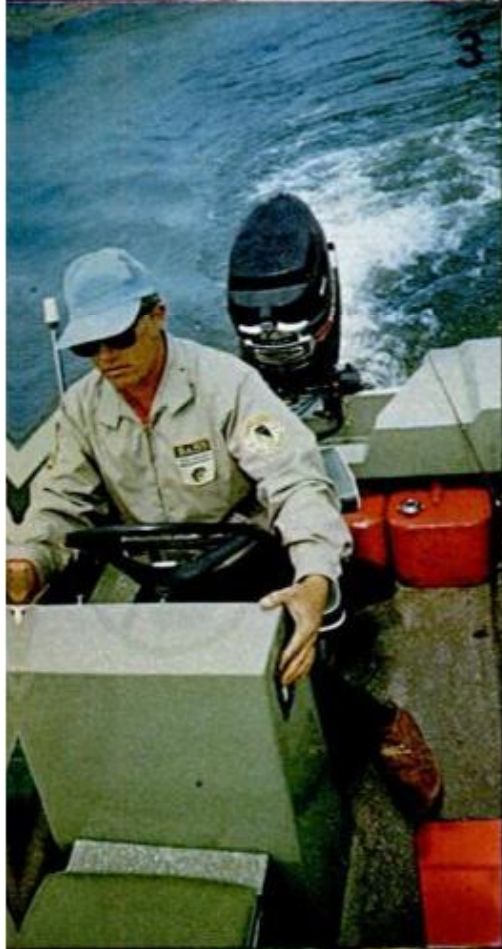
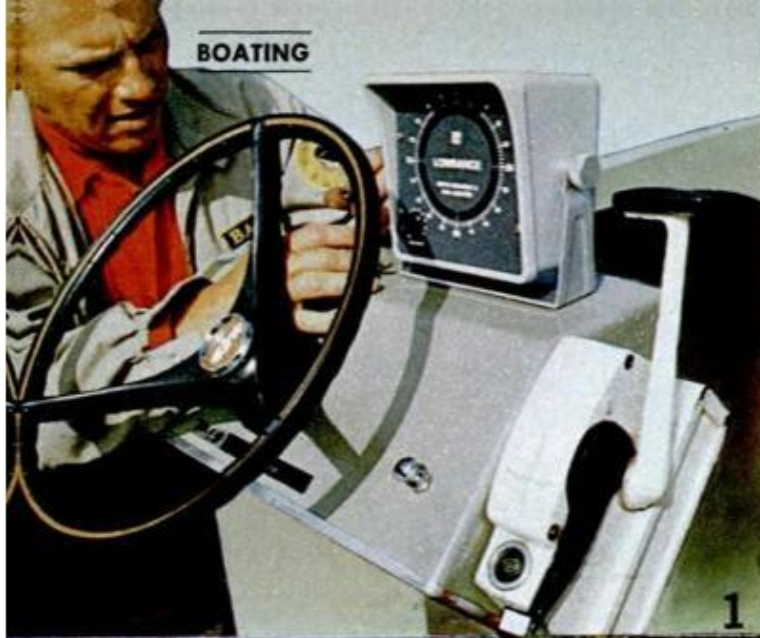
1971 FORD AND LINCOLN-MERCURY SPECIFICATIONS

Car	Body Style	Wheel-base (in.)	Overall Length (in.)	Overall Width (in.)	Track (f/r in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
Maverick	2-dr. sedan, 4-dr. sedan	103.0 109.9 ¹	179.4 186.3 ¹	70.6 70.7 ¹	56.5/56.5	170-6-1bbl., 200-6-1bbl., 250-6-1bbl.
Comet	2-dr. sedan, 4-dr. sedan	103.0 109.9 ¹	181.7 188.6 ¹	70.6 70.7 ¹	56.5/56.5	200-6-1bbl., 250-6-1bbl., 302-2bbl.
Mustang	2-dr. hdt., SportsRoof, convertible	109.0	189.5	74.1	61.5/61.0	250-6-1bbl., 302-2bbl., 351-2&4bbl., 429-4bbl.
Cougar	2-dr. hdt., convert.	112.1	196.9	75.1	61.5/61.0	351-2&4bbl., 429-4bbl.
Thunderbird	2-dr. hdt., 2&4-dr. landau	115.0 117.0 ²	212.5 215.0 ²	78.0 77.4 ²	62.3/62.3	429-4bbl.
Torino	2-dr. hdt., 2-dr. SportsRoof, convert., 4-dr. hdt., sedan, wagon	117.0 114.0 ³	206.2 209.0 ³	76.8 ⁶ 75.4 ³	60.5/60.0	250-6-1bbl., 302-2bbl., 351-2&4bbl., 429-4bbl.
Montego	2-dr. hdt., 4-dr. hdt., sedan, wagon	117.0 114.0 ³	209.9 211.8 ³	77.3 75.4 ³	60.5/60.0	250-6-1bbl., 302-2bbl., 351-2&4bbl., 429-4bbl.
Continental Mark III	luxury coupe	117.2	216.1	79.4	62.34/62.34	460-4bbl.
Ford	2-dr. hdt., convert., 4-dr. hdt., sdn., sdn./hdt., wagon	121.0	216.2 219.0 ⁴ 219.2 ⁵	79.2	63.0/64.0 63.3/64.3 ⁴	240-6-1bbl. ⁷ , 302-2bbl., 351-2bbl., 390-2bbl. ⁷ , 400-2bbl., 429-2&4bbl.
Mercury	2-dr. hdt., 4-dr. hdt., sdn./hdt., wagon	124.0	224.7	79.3	63.0/64.0	351-2bbl., 400-2bbl., 429-2&4bbl.
Lincoln Continental	4-dr. sedan, coupe	121.0 ³ 127.0	220.5 ³ 225.0	79.4 ³ 79.6	64.3/64.3	460-4bbl.

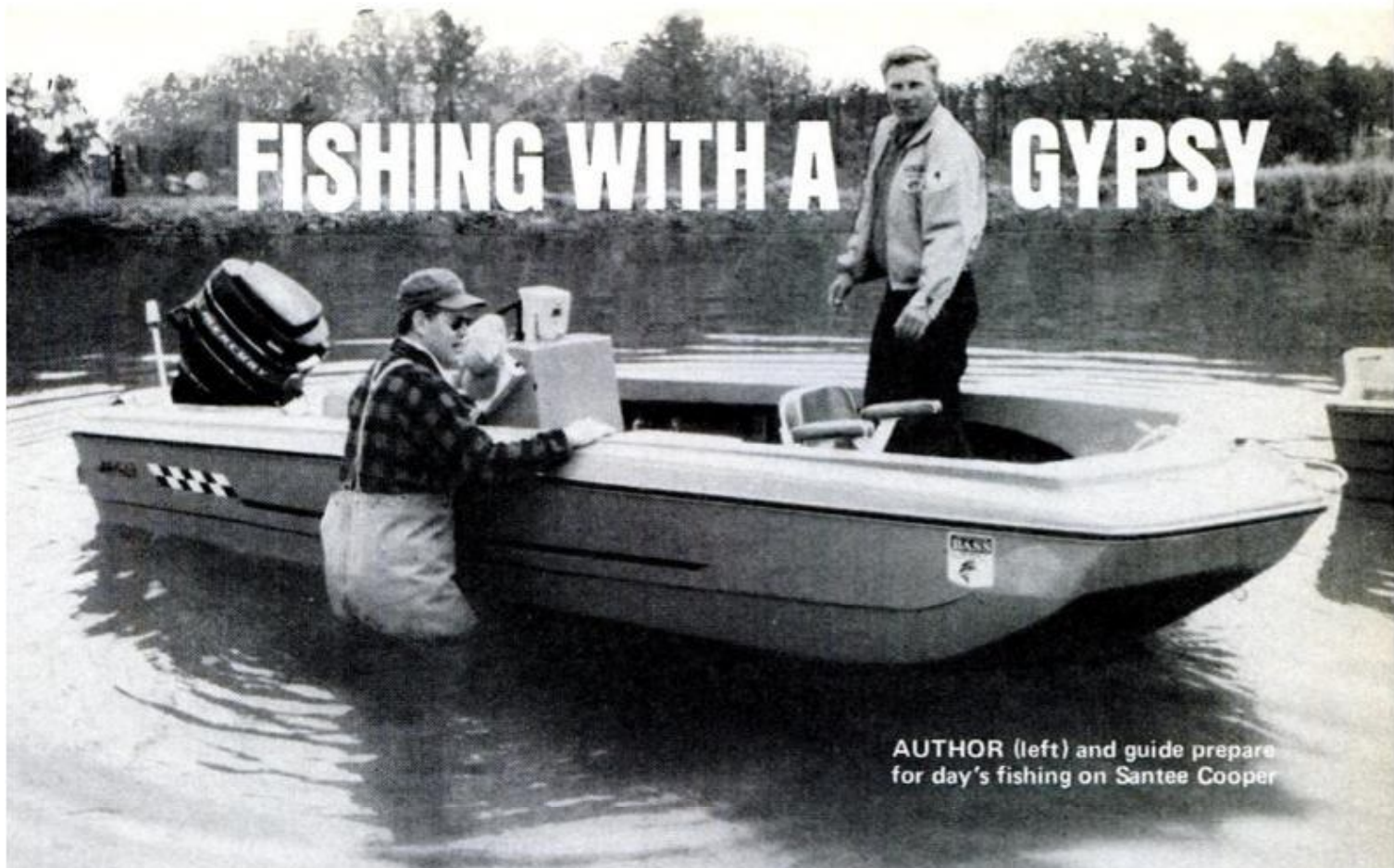
1, 4-dr. models; 2, 4-dr. landau; 3, 4-dr. wagon; 4, 6-passenger wagon; 5, dual-facing rear-seat wagon; 6, 2-dr. models, 76.4 for 4-drs. and 76.7 for convert.; 7, not available in California

*Not all engines available in all models

BOATING



FISHING WITH A GYPSY



AUTHOR (left) and guide prepare for day's fishing on Santee Cooper

PM took MFG's new Fishin' Gypsy into South Carolina with another fishin' gypsy, 30-year-old Roland Martin, as guide.

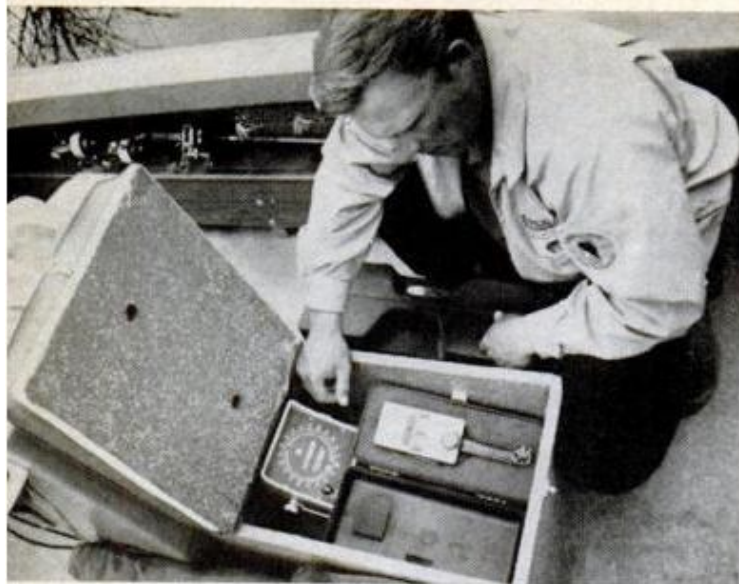
By GEORGE REIGER, Boating and Outdoors Editor

A FORMER U.S. ARMY OFFICER who taught school in Brazil and then drifted through a dozen different states before settling in South Carolina is currently one of the hottest anglers on the BASS (Bass Anglers Sportsman Society) Masters competition circuit. Just last year Roland Martin joined BASS and promptly took second place in the first fishing contest he entered, at Toledo Bend Reservoir on the Texas-Louisiana border. In March he took top honors in the \$6500 Lake Seminole Tournament held on that famous lake along the Georgia-Florida line. In between tournaments and guiding assignments, PM persuaded him to help us test the merits of MFG's Gypsy.

Built primarily with anglers in mind, the Fishin' Gypsy can double as a family ski boat. In fact, the newness of this boat is actually in its interior layout—not in its hull design—and MFG fanciers will recognize the familiar Gypsy 15 cathedral-Vee hull, a bow rider with forward sponsons. Its manufacturer claims more square footage capacity than other similar designs of equal length, and we can attest to the ample casting room for two men—even three, if necessary.

It's rated for an 85-hp outboard; we used an 80-hp Merc—a remark-

1) Martin finds ample room atop MFG console for installation of Lowrance depth indicator. 2) Forward storage space is best for bundled items that won't slip out lower opening. 3) Mercury power tilt lets Martin run with fingertip control around stumps, over shallows. 4) Storage area for rods is adequate but needs lock for rods left overnight. 5) Stern has plenty of casting room. 6) Gypsy really moves with 80-hp engine. 7) Displacement caused by author's weight on bow is hardly noticed in horizontal line of boat



IF YOU FISH with artificials, live baitwell doubles as a storage box; padded top also makes it a seat



CENTER CONSOLE SEATING offers best balance and visibility on speed runs through watery outback



NOT ALL OUR TIME was spent in testing the MFG hull; that big bass on the right weighed 8¾ pounds

ably economical engine in this power rating. We found the boat extremely quick on takeoffs but with a tendency to rear up while accelerating to plane with just one man aboard. The hull is stable and corners well, but it will skid in too sharp or fast a turn.

Lakes Moultrie and Marion—the two major components of the Santee-Cooper reservoir and drainage system—are perfect for testing boats as well as catching lunker largemouths. With a stiff breeze, the 170,000 acres of water make for good test runs over choppy to downright stormy seas. The 7½-mile-long Diversion Canal connecting the lakes provides a fine straightaway.

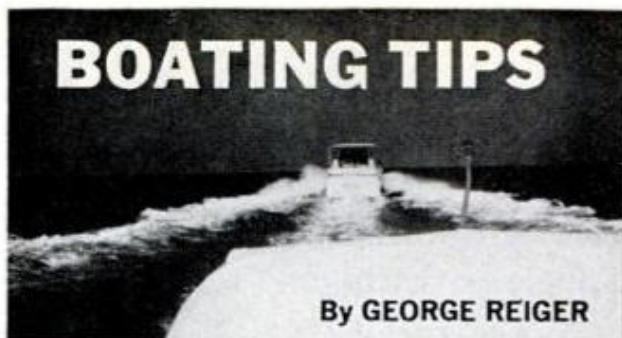
During our three-day test, which included some terrifically rough runs across Lake Moultrie, we found little to complain about in the hull's ability to take punishment. In addition, the high freeboard kept us relatively dry.

But I herewith submit a plea to all small-craft engineers—not merely MFG's—to consider carefully the *durability* of every piece of interior hardware they install. Just because a lid will open and close without jamming at the factory, or wood screws seem as strong as nuts and bolts for attaching a seat top, this does not mean these items will hold up under real-life use—or should I say, abuse? In three days of riding rough seas, I bent the arms off the front seat, pulled it loose from the floor and broke the hinges off the baitwell cover. Now I don't fancy myself a Joe Btfsplk or even King Kong—just a big guy holding on for dear life while riding over some vicious water! If you're putting your Gypsy through a tough season, you might consider some interior reinforcing.

The boat has a load capacity of 1420 pounds and, with mechanical steering, swivel seats and live baitwell as standard items, sells for \$899 f.o.b. Union City, Pa. If you'd like to contact Roland Martin for fishing the Santee-Cooper, write c/o Jones Boat Landing, Box 319, Cross, S.C. If he doesn't answer right away, he's probably out fishing! ★★

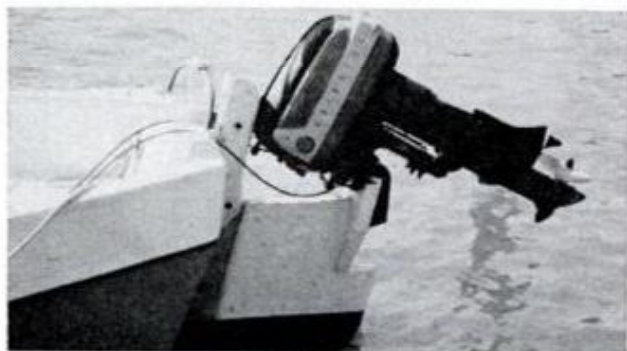
POPULAR MECHANICS

BOATING TIPS



By GEORGE REIGER

DROP A LINE HERE, cross a line there, and you're all set for the night. Then while you're ashore, a wind comes up and makes a mockery of your jury-rig docking arrangement. The boat at right was rigged this way. Poor owner! Secure your boat for the night as though doing it for the summer. Rig lines for a hurricane; not merely for the halcyon days of summer boating.



DOWN SOUTH (bottom left) you'll sometimes see a pair of bamboo or fiberglass outrigger-type poles with tension-spring lines being used to hold a boat away from the dock and thereby protect it from unwanted piling bumps and barnacle scratches. Lines tied directly to the dock pull the boat in; the straining poles keep the boat out. The poles also help absorb the shock of wakes if your boat is docked on a frequently traveled waterway, and can be easily installed on any dock.



SEPTEMBER 1970

YOU CAN'T ALWAYS DEPEND on it, but running in behind a large boat may be a lifesaver when the wind comes up while you're far offshore. Though dangerous to ride too close to the leader, two or three "swells" back from a sizable yacht will go a long way toward "laying down" the wind and waves of choppy seas.



SAILBOAT AUXILIARY a nuisance to carry? Dr. S. T. Brown of St. Petersburg, Fla., has the "insurance power" storage and ease-of-handling problems licked. He mounted his auxiliary directly on the rudder, out of the cockpit, high and dry for normal sailing, but readily accessible and easily steered with the tiller. Imitators, anyone?

A GREASE SUCTION GUN, says Harvey Shepardson of Lilliwaup, Wash., will remove gummy residues from outboard motor tanks before storage. Benton S. Clark of Colorado Springs says your trailer hitch ball can be protected with an old tennis ball with a hole slightly smaller than the hitch ball diameter.

MAN IN SEARCH of a concussion? A snag will flip him out; running aground will hurl him into the bow. Helmetless and standing, he courts disaster.



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PM OWNERS REPORT
AMC HORNET

Economy

A Nationwide Survey Based on
1,507,000 Owner-Driven Miles

By **MICHAEL LAMM**
West Coast Auto Editor



and Handling Tops But, Oh, Those Workmanship Blues

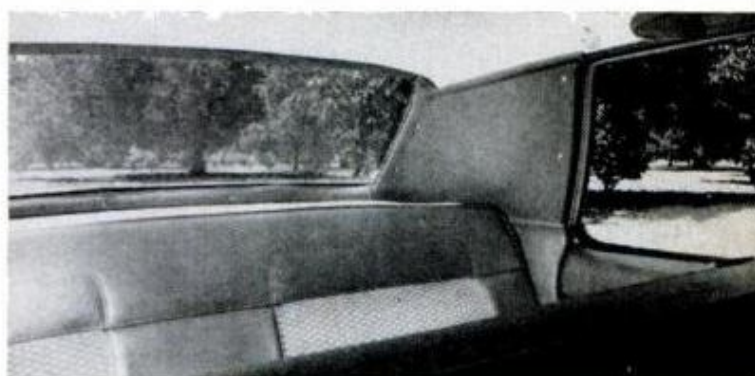
REASONS people buy small cars tend to be more rational than reasons for buying big ones. Example: Riviera owners (see page 96) agreed that styling was their main buying motive—not a particularly sensible or functional reason.

On the other hand, Hornet owners, perhaps because they put a greater value on their money, gave these reasons for buying the AMC compact:

"An economical car with most of the features of a big luxury job." Or, from a Kentucky merchant, "I chose the Hornet for 'charisma'—a combination of performance, price, good looks, and sane balance." Too, several echoed this Pennsylvania factory worker: "I traded in my Volks because I wanted a roomier car." Or, "I wanted a compact. This was the lowest-priced I could find."

"The Hornet is a big little car," wrote a New York railway conductor. "Best damned car I ever owned." "Beautiful car—love it more all the time." "Good, inexpensive transportation." Lower price than Nova, better handling and feel than Maverick." "Economy, and U.S. parts as opposed to foreign." This last statement cropped up a number of times.

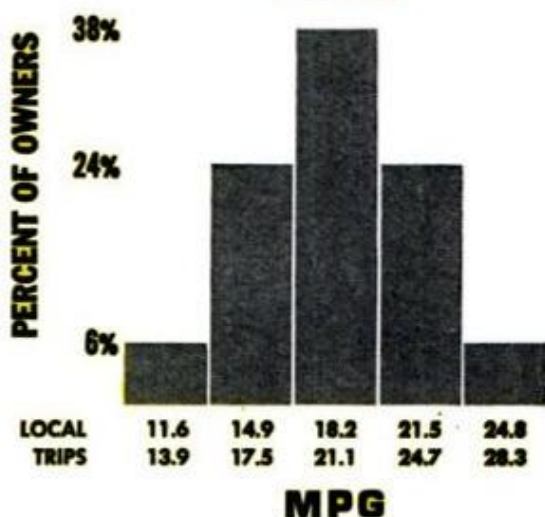
Still, when we asked what owners thought about their Hornet's quality



OWNERS LIKE ROOMY INTERIOR but not rear pillars. Only 17.8 percent ordered power steering; while it's not needed, it does give a faster steering ratio

HORNET FUEL MILEAGE CHART

199-cu.-in. Six



Summary of 1970 Hornet Owners Reports*

Total miles driven	1,507,531
Average miles per gallon:	
199-cu.-in. 6,	
local driving ..	18.2
long trips	21.1
232-cu.-in. 6,	
local driving ..	18.4
long trips	21.3
304-cu.-in. V8,	
local driving ..	14.8
long trips	15.9
Engines:	
199-cu.-in. 6	55.1%
232-cu.-in. 6	39.0
304-cu.-in. V8	5.9
Transmissions:	
Automatic	72.0%
3-speed manual	28.0
Body styles:	
2-door sedan	67.8%
4-door sedan	32.2
Series:	
Hornet (base)	61.2%
Hornet SST	38.8
Why the Hornet?	
Economy	44.2%
Styling	30.8
Size	23.4
Past AMC experience ..	15.7
Price	13.7
Handling	3.1
Specific likes:	
Economy	48.0%
Handling	47.7
Style	35.5

Size	16.3
Comfort	15.7
Power	9.6
Ride	8.7
Performance	6.7
Specific dislikes:	
Workmanship	25.1%
Rattles	8.4
Gas mileage	6.0
Finish	5.5
Brakes	4.6
Visibility	4.3
Ride	3.2
What changes would you like?	
Better workmanship ..	11.3%
Better rear vision	6.9
Styling	6.5
Better vent system	6.2
Quality of materials ..	5.8
More headroom	5.8
Better seat style	4.5
Had any mechanical troubles?	
No	68.3%
Yes	31.7
What kind of trouble?	
Carburetor	24.6%
Electrical	10.9
Brakes	10.0
Transmission	7.3
Gas gauge	5.5
Did you repair it yourself?	
No	98.1%
Yes	1.9
Dealer repairs satisfactory?	
Yes	53.5%
No	46.5

Is the Hornet your only car?	
No	55.9%
Yes	43.1
Other cars owned:	
AMC products	21.4%
Chevrolet	19.4
Buick	11.4
Ford	11.4
Volkswagen	8.5
Dodge	8.5
Oldsmobile	8.0
Pontiac	7.5
Accessories/power options:	
Automatic transmission ..	72.0%
Radio	63.7
Power steering	17.8
Light group	10.3
Belted tires	10.3
Airconditioning	9.7
Tinted glass	4.1
Power brakes	1.2
What accessories/options would you order next time?	
The same	54.6%
Power steering	12.2
Airconditioning	11.9
Power brakes	7.8
Radio	5.0
Bigger engine	4.1
Age distribution of owners:	
15-29 years	24.1%
30-49 years	37.2
50-plus	38.6
Would you buy another Hornet?	
Yes	75.1%
No	23.9

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

of workmanship, we got these answers: "Rather poor. Floor mat loose and sagging, rough edges under dash, clutch pedal wobbles, doors leak, windows don't work easily." "Terrible even compared to the 1969 Rambler I owned. Problems may be due to first of model run." "Looks like the factory overdid mass production—too much mass and not enough production." "Technically a fine car, but small details just not done right." Yet, we also did get answers like this: "After comparing the Hornet with two other

major U.S. autos in the same price, I found workmanship to surpass both."

Owners are well pleased with fuel economy, and surprisingly enough, the larger 232-cu.-in. Six gets a trifle better gas mileage than the 199. Reason might be that it takes a heavier pedal foot to keep the smaller version up with traffic. What makes our findings more surprising, though, is that buyers order automatic transmission much more often with the 232 than with the 199, and theoretically the automatic should bring down mpg. However, the 232 au-



HORNET'S HANDLING rates right behind economy as a specific like. Roadability, ease of parking, and stability through corners all get good marks. "It fits into $\frac{1}{2}$ to $\frac{2}{3}$ of a parking space," says one owner. The 232-CID Six gets better gas mileage than the 199-incher, which will be dropped for 1971. Relatively few buyers order the 304-CID V8

tomatic comes with a 2.37 rear axle, while either engine with manual trans has a 3.08 rear-end ratio, so that helps account for the 232's better mileage.

As for ride and handling, owners said: "Handles very well in traffic and is steady on the road for a small car." "Good stability on curves at high speeds." "The 232 engine with automatic makes a good, snappy combination—easy steering and fine roadability." "Will move right around other cars stuck in the snow." Still, "Needs better shocks." "Rather hard ride on bumpy roads." "Rear springs seem weak when carrying passengers."

We always ask what owners would like to see changed or improved about their cars. Answers are significant, give good clues to what drivers consider weaknesses. "A fully synchronized manual transmission would be nice. Other AMC cars using the same 232-in. engine have all-synchro, so why not the Hornet?" "Front wheelwells should be closed to stop water and salt from hitting the front door hinges." "Make V8 standard." "Bring back overdrive," said a few old-timers. "Can't lock right front door from driver's seat without breaking my arm reaching around headrest."

About comfort: "Driving slowly on

concrete, it rides a little stiff, but after 60 mph, it goes along like a whisper jet." "Road noise is high, but this is not a complaint. If I'd wanted a smoother ride and less noise, I would have had to pay a premium." "Excellent air circulation." "Gives a hard ride." "I am 6-6 and not uncomfortable." "Rate comfort next to Mercedes formerly owned." "My passengers like the surprising room in the rear but dislike solid windows and having no ashtray." A Pennsylvania carpenter digresses, "My honey loves it—she says it feels just like the seat opens its arms and gathers her right in."

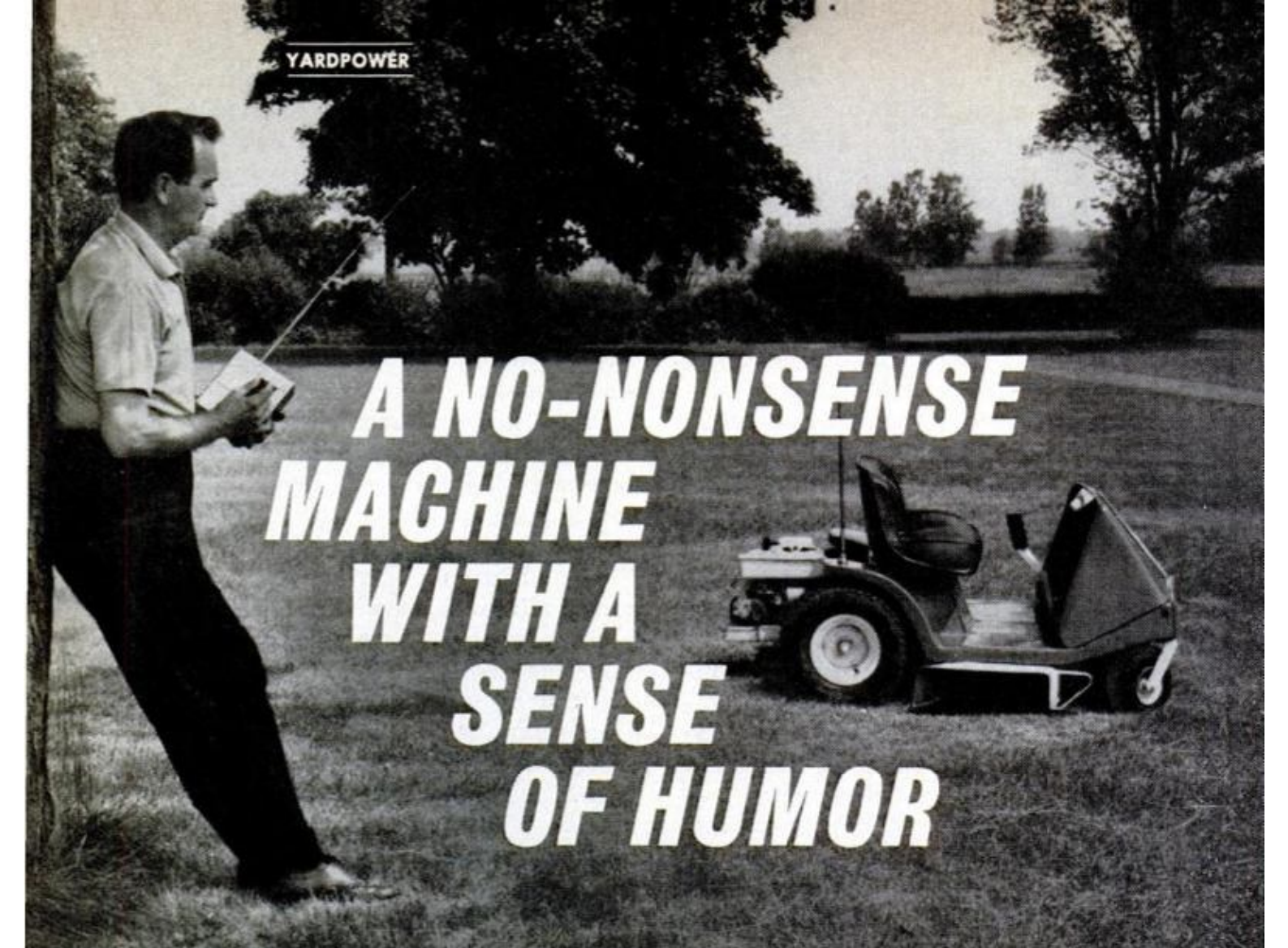
The Hornet's styling gets good marks, although owners rate it second behind economy as a reason for buying (and third behind economy and handling under "specific likes"). A retired Minnesotan sums up many owners' feelings about concessions to styling: "Needs a larger trunk, not so much rake to windshield (glare), and bottoms of fenders should be flared so wheels don't toss gravel onto lower body, because this chips the paint."

Dealer opinions run the gamut; most owners feeling they're getting fair shakes. Some report parts hard to get. Lots of repeat buyers, though, as with the Rebel and Ambassador. ★★

CONSIDERING OVERALL CAR SIZE, that's a whale of a trunk. Gas filler on early Hornets tended to gurgle due to misalignment of the connecting hose

"IT'S A BIG LITTLE CAR," wrote one owner; easier to get into and out of than most. Curved windows let water from roof drip onto exiting passengers' legs





A NO-NONSENSE MACHINE WITH A SENSE OF HUMOR

If you want to astound your neighbors, this rugged little lawnmobile will go along with the gag, doing a beautiful job of mowing—or throwing snow—while you take it easy

By JAMES M. LISTON, Executive Editor

RADIO RECEIVER under dash operates push rods to control levers. Switches on the transmitter correspond to the control levers. Floor lever engages the mower

MAN'S MIDSUMMER DREAM of a mower that runs itself while he sips a cool one is now a \$1195 reality—on a par with a 10-hp tractor.

Equipped with a 42-inch rotary mower, the Remote-A-Matic lawnmobile can be operated by radio remote control so precisely that the operator—sitting on his patio—can edge flower beds, trim around trees, return the machine to the garage and shut it off without leaving his chair.

In winter, the "Mighty Mo" can be equipped with a snow blade or snow blower. You can clear your walks and driveway and enjoy it all from your

picture window or the shelter of your garage. The fun doesn't end there. The mower unit is easily detached and you have a golf cart or an all-terrain vehicle. (Well, *almost* all-terrain). When equipped with the bogie wheels and track used for snow—but without the skis—Mighty Mo will really go.

The utility cart (four feet wide, six feet long) is big enough to carry the Mighty Mo. Attach the cart to a hitch on your car and you can transport the lawnmobile to the golf course—or take it with you on camping, hunting or fishing trips. With optional large pulley, the vehicle will do 20 mph.

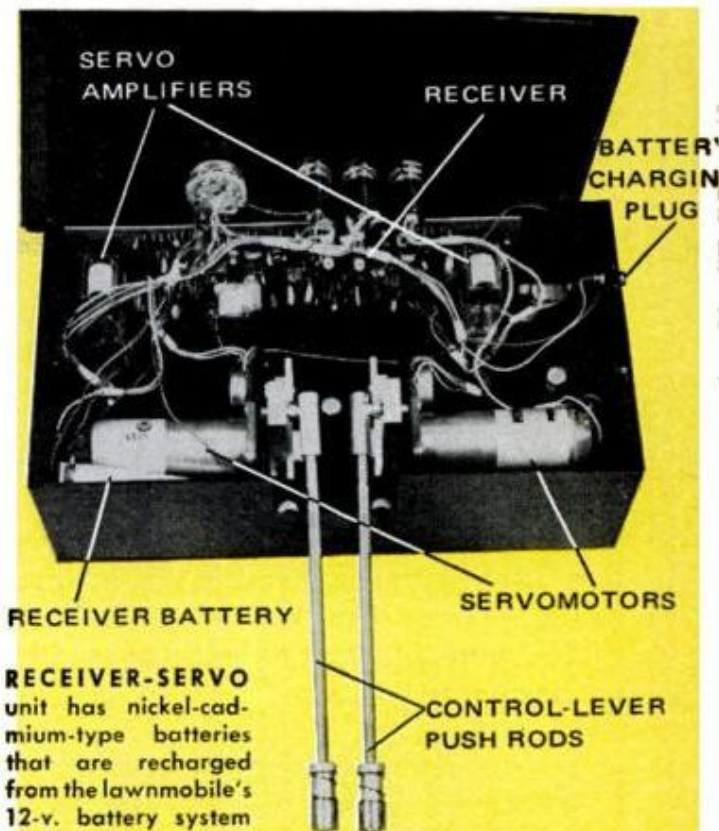
More fun can be had by equipping the unit with a second set of rear wheels, cleated rubber tracks, and skis for the front wheels (all available from the manufacturer). Then you have a highly maneuverable snow machine. It's not designed to compete with snowmobiles, but it's fun as well as transportation.

The unique mechanical feature of the lawnmobile is a cone-drive transaxle that combines transmission, clutch and differential. Forward, reverse and steering are controlled by two levers. Push forward on both to move ahead; pull back to reverse. Move one lever forward and the other back and the vehicle turns in its own radius. Steering is done by the rear wheels; front wheels serve as casters.

This transmission, called a Triple Action Transaxle, was used two years ago by *PM* editors to design *PM's Mini-Mover* (page 140, Aug. '68 *PM*). Remote-A-Matic chose the cone-drive transaxle because:

- It operates with the throttle at one set position; ground speed can be slowed to a crawl while full tip speed is sent to mower blade or snow thrower;
- It's efficient, steals little horsepower;
- Steering, acceleration and braking are controlled by only two levers; thus the vehicle requires only a two-channel system for radio remote control. A conventional tractor would require five channels.

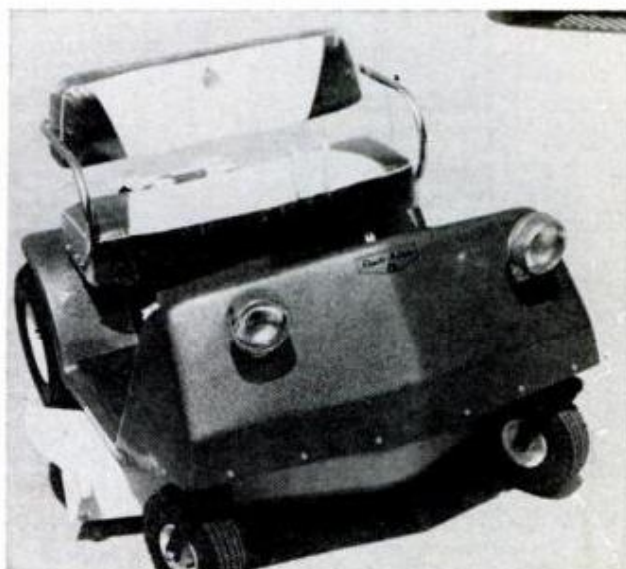
SEPTEMBER 1970



The electronic controls were developed by Harry Sampe, the company's chief engineer, who for years has been a R/C model plane hobbyist. The two-channel system operates on the 11-meter (Citizens Band) radio frequency at 100 milliwatts—a wattage requiring no license. The range is about 1000 feet. A six-foot-long wire under the dash serves as the antenna.

The transmitter is about the size and weight of a paperback book. The re-

"MIGHTY MO" sports a mighty three-blade, 42-inch mower that's easily disconnected: Remove six pins

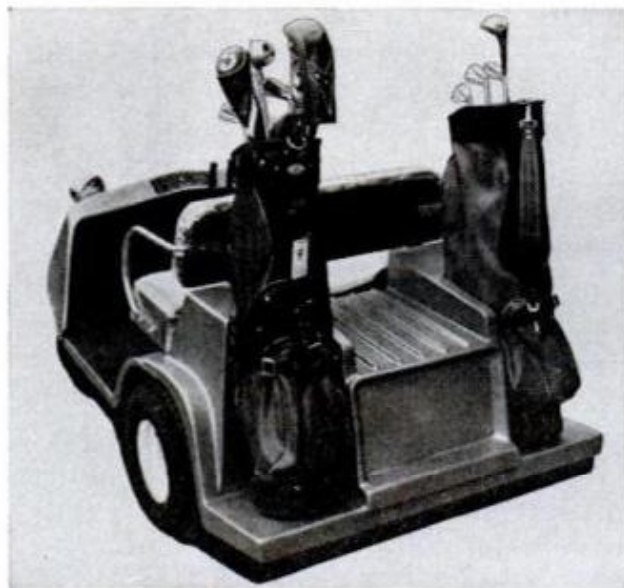
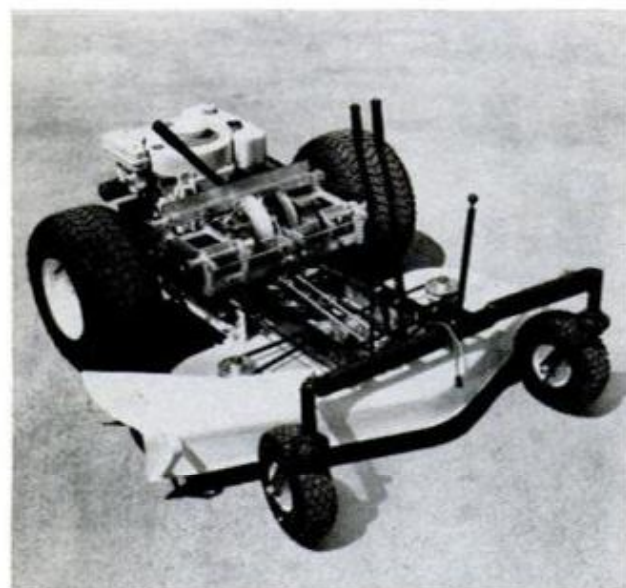
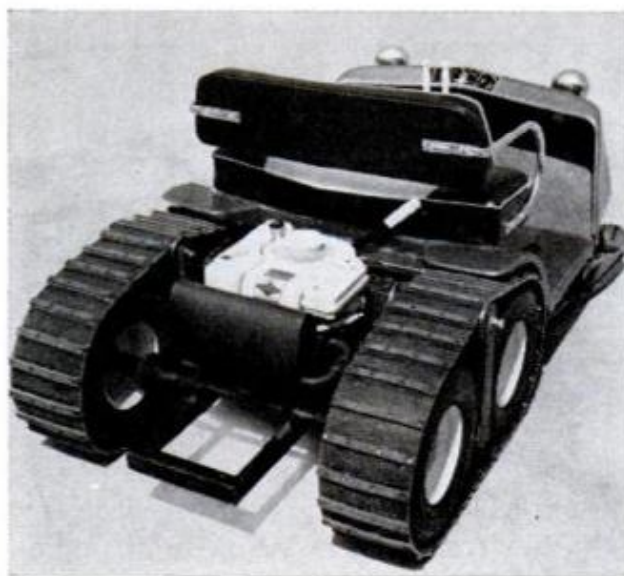
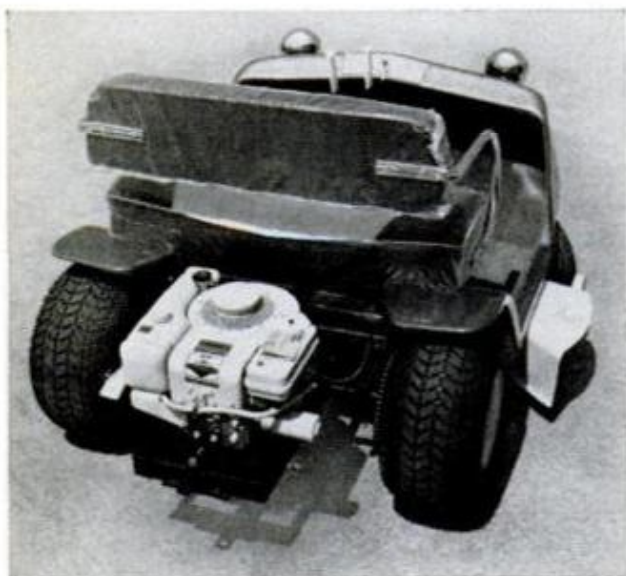


ceiver, with two servo amplifiers and electric motors—the type used in aircraft auto-pilots—is mounted on the dash just forward of the control levers. (Quick-disconnect ball joints on the levers can be snapped off for manual operation of the machine.) The system is digital proportional: for every degree of movement demanded on the radio control, the servo will respond proportionately.

Batteries in the transmitter are nickel cadmium and they are recharged from the vehicle's 12-volt system simply by connecting an adapter cable between the transmitter and receiver and placing a selector switch in the charge position.

Anything that operates on remote control needs safeguards against getting out of control. The lawnmobile has a "fail safe" system—a special circuit that "looks" at the total signal out of the transmitter. If the receiver is not looking at this signal, a relay drops out and kills the engine. Or if the signal to the receiver is lost—if, for example, the vehicle travels out of range (beyond 1000 feet) of the transmitter—the engine is killed. The range can be extended to over a mile by adding a whip-type auto antenna.

Since steering is done off the rear wheels and there are 360° casters on the front, there is no tendency to dig in and rut on sharp turns. Also, with



REAR-MOUNTED ENGINE is 8-hp synchro-balanced Briggs & Stratton with solid-state ignition. With fiberglass body off (four bolts), adjustment is easy

GOLF-CART CONVERSION is optional, includes a high-speed pulley and big muffler. Skimobile conversion includes front skis, track and bogie wheels

POPULAR MECHANICS

its center of gravity low over the rear wheels, the vehicle is virtually tip-proof. The tractor itself weighs 300 pounds—with the mower, 350—as compared with about 700 pounds for most garden tractors. Since nearly all this weight, plus the operator's is over the drive wheels, the company claims ideal traction for the vehicle.

A golf-cart attachment kit consists of a fiberglass rear deck (shaped to take two sets of clubs) that conceals the engine and is simply attached with two pins; a special quiet muffler, and a large sheave for increased speed. The advantages of a radio-controlled golf

cart become more apparent with use. Walking back to retrieve the cart or driving it to the next tee isn't necessary; it can be summoned by radio.

The radio controls and mower are optional equipment. For those who want a tractor, an in-plant vehicle, or an all-terrain-type vehicle for fishing and hunting, the base price is \$799, including running lights, starter and 12-volt system. The company expects the greatest demand from the mower market because of the machine's maneuverability and simple operation. Practically all units sold to date have been radio-controlled. ★ ★ ★

SPECIFICATIONS—MODEL X-150 LAWNMOBILE

Engine: Four-cycle, synchro-balanced 8-hp Briggs & Stratton, 19:44 cu. in., solid-state ignition.

Electrical system: 12-v. key start with starter, generator, solenoid, heavy-duty battery, sealed beam running lights.

Transaxle: Two levers give infinite speeds in forward or reverse on either wheel; control braking, clutching, turning, acceleration.

Tires: Rear: 18-9; front: 50-8 on 360° casters.

Mower: Full-floating 42-inch, three-blade with adjustable cutting heights.

Frame: Welded 1x2-inch rectangular tubing.

Drive: Independent rear-wheel drive, two live axles, chain drive.

Body: Two-piece molded fiberglass, red gold, blue or green in metal fleck finish.

Speed: Up to 10 mph for mowing; up to 20 mph with optional larger pulley.

Weight: 325 pounds without mower.

Overall dimensions: Length: 65 inches; width: 44 inches (less mower deck); height: 30 inches.

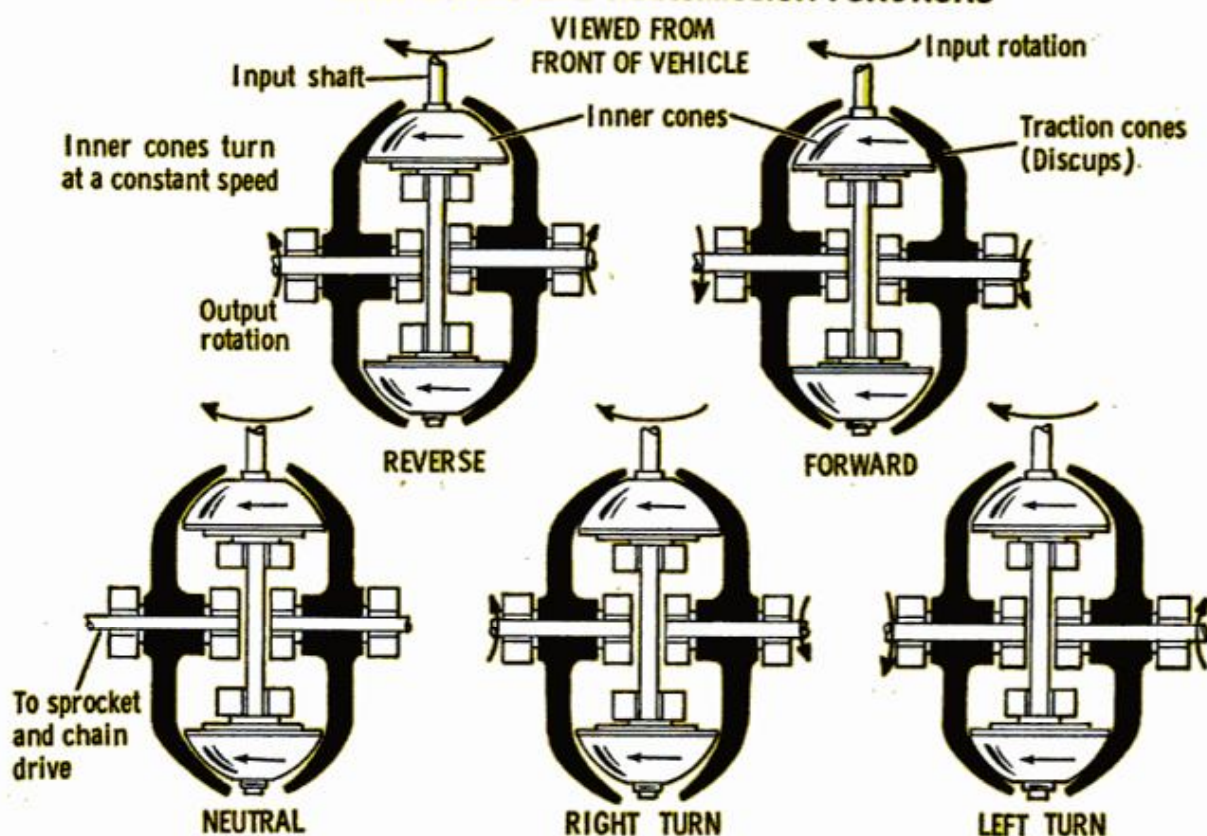
Turning radius: Zero (machine turns in its own radius).

Price: Lawnmobile: \$799; mower (3-blade, 42-inch cut) \$196.

Accessories: remote control (transmitter, receiver, power train): \$199.88; golf-cart attachment: \$178.25; snow blower (38-inch): \$179.88; heavy-duty trailer (4 by 6 feet): \$178.22; dozer blade: \$49.88; skis (fit front tires): \$37.50; bogie wheels, track, idler pulleys: \$199.

Address inquiries to Remote-A-Matic, Inc., 1012 Commerce Tower, Kansas City, Mo. 64199.

HOW CONE-DRIVE TRANSMISSION FUNCTIONS



How to Sight-In A Rifle



If you haven't been varmint hunting all summer, it's time to get your rifle from the closet for your preseason 'tune-up'

By **RAYMOND SCHUESSLER**

Illustrations by Roy Grinnell

OPEN SIGHTS ON RIFLES are carefully adjusted before they leave the factory. If your eyes are normal and you hold in the proper manner, you'll find most rifles shoot true to their sights. It's advisable, however, for every purchaser of a new rifle to test it before going on a hunting trip to be sure the sights are just right for his eyes, and also to make sure the sights have not been jarred out of line during transportation.

Because of individual peculiarities of eyesight, gun manufacturers do not mark range graduations on the rear sight of high-power rifles. You'll have to fire the rifle yourself and mark the sight for the ranges you expect to use in your own shooting.

Choose a spot where you can see the bullets strike. A bank of earth is excellent. Never shoot over water where bullets may ricochet and fly long distances. Many rifle clubs make their ranges available to hunters. Ask around.

Shooting should be done with a bench rest or in a prone position using sandbags or a log to brace comfortably your arms, and *not the rifle's barrel*.

First, bore-sight the rifle (Figure 1).

Remove the bolt and secure the rifle with its bore aligned on a distant aiming point. Look through the bore and adjust the sights at the same time; in this way you make the sight line parallel to the bore.

Replace bolt and fire three shots with front end of the rifle rested. The shots should form a small group. Adjust the center of this group to the aiming point. To do so, move the rear sight in the direction you wish the bullet to go, both vertically and laterally.

Memorize the following rule so you won't be confused as to proper sight alignment: *Always move the rear sight in the direction in which you want the point of impact to move.* If you want a rifle to shoot to the left, move the rear sight to the left. Conversely, the front

Figure 1



sight should be moved in the opposite direction for the same result.

The sight can best be moved in its notch with a hammer and a drift rod of brass or hard fiber about four inches long and at least $\frac{1}{4}$ -inch in diameter (Figure 2). The barrel should be supported by a block of wood, and the sight should be moved the smallest possible amount. A pencil or crayon mark on the sight and barrel will serve as a guide.

Telescopic sights offer even fewer problems. Telescope mounts must be tightened very securely since their short spacing multiplies the effect of any looseness. First make sure the screws fastening the base or bases to the rifle are tight (Figure 3).

Telescopic sights are adjusted vertically and laterally by knobs on the

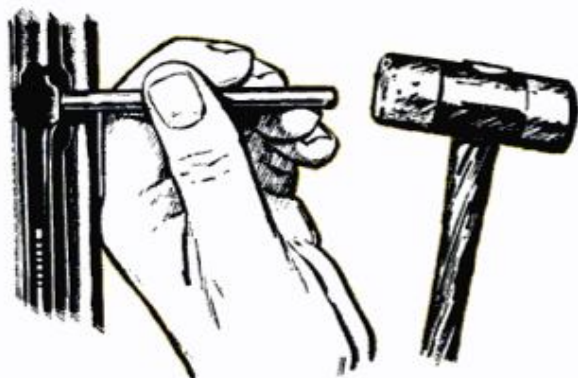


Figure 2

telescopic tube, protected with screw caps (Figure 4). These knobs are usually marked with arrows to indicate the change in direction of bullet impact. Graduations are in minutes or fractions of minutes. When adjustment is in the mounts instead of the telescopic tube, move the rear mount the way you wish the shot to go.

If the sights are graduated in minutes of angle, remember that a minute of angle corresponds about to 1 inch at 100 yards. At the short range of a sighting-in target, this will be proportionately less.

After adjusting, verify with three shots. If the sight adjustment was correct, these should group precisely on the aiming point. If not, readjust and check-fire until they do. Take a fresh

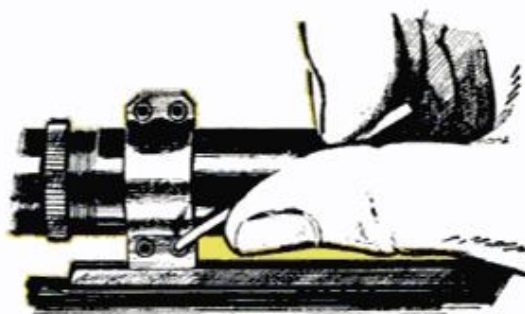


Figure 3

aiming point for each firing to make sure you can identify the groups.

Hunters, unlike match shooters who know the exact range of their targets at all times, most often shoot quickly at moving targets and at a variety of vaguely estimated ranges. This is a real test of a marksman. But he must be prepared with some technical knowledge of the bullets he uses and how they will affect his aim. For example, if you zero in 30-30 and 30-06 cartridges, both with 150-grain bullets, at 100 yards, the former will strike about 5 inches lower than the latter when firing at live targets 200 yards away.

Some hunters attempt to solve this problem by marking their sight settings for various ranges, but wary game won't always wait for them to make a field adjustment. There is, however, a rule of thumb that can be applied to any caliber, bullet weight or type of bullet. All you need do is determine the bullet velocity of your cartridge at 100 yards. Such information is often included in the manufacturer's ammunition catalog. If you don't have one, write for either the catalog or information. Here's how it works.

With slight variations, any cartridge

(Please turn to page 224)

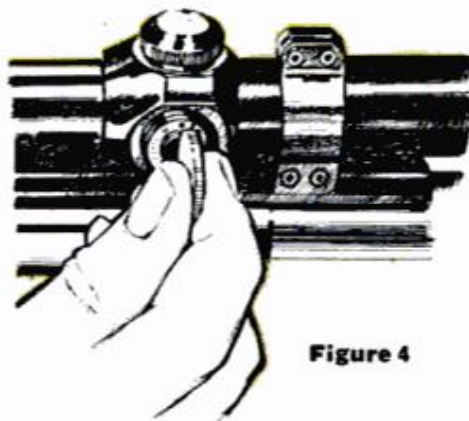


Figure 4

Take a look at a long lineup of functionally sized, stylish and attractively priced wagons—more than just the Simca, Volvo, Fiat and VW, below—that make a lot of sense

By ALEX MARKOVICH

ALL BUT TWO ARE IMPORTS. People who've never driven an imported station wagon may wonder why anybody would buy one. After all, most of them hold only four passengers, maybe five in a pinch—not nine, as do the biggest U.S. wagons. Four-by-eight plywood sheets? The imports will haul them in a diagonal position—if you don't mind having a third of your load hanging out the tailgate.

So why buy an imported wagon?

For one thing, they don't cost much more than imported sedans. Many of the models listed in our chart sell for under \$2500. The small wagons also save you money at the gas station. Expect to average well over 20 mpg with any of these models, including the two new small U.S. wagons—Hornet and Vega.

But perhaps the most appealing feature of these wagons is their small overall size. They'll fit inside garages already overflowing with bikes and garden tools. You can nose them into parking spots that full-size cars have to pass up.

They're handy for grocery shopping and other light-duty hauling. But most will also handle your weekend camping gear or nine or ten sacks of cement.

Although our chart lists 20 models, we actually test-drove 10. The German Audi, British Cortina, French Peugeot, Japanese

Subaru and Mazda, American Motors Hornet and Chevy Vega weren't available in time for our deadline. (The new Vegas are discussed in *The Minis Are Out to Rule the Road*, page 112.) And of the three Japanese Toyota wagons, we tested one: the Corona Mark II, Toyota's newest and mechanically most interesting model.

All our test cars have swing-up tailgates, and all are about equal in loading ease. If load capacity is your prime interest, compare load-area specifications in our chart. The brief road-test reports that follow will tell you what it's like to live with and drive each model.

SIMCA 1204

The French-made, Chrysler-owned Simca 1204 was fun to drive. But we had to make compensations: Our car showed only seven miles on its odometer when we took delivery. Even worse, we couldn't adjust the engine for proper idle (the carburetor later had to be replaced). Luckily, we also had a chance to drive a well-turned 1204 sedan, which showed us what the little Four is really capable of.

In spite of the ailing carb and a drastically accelerated break-in (300 miles), we managed 0-60 mph in 18.5 seconds, which is adequate if not exciting. Above 60, performance drags; our 50-70-mph run required a tedious 16.8 seconds. Fuel mile-



THOSE 'SENSIBLE'

age is exceptional; maintaining a 65-mph average on a long trip, we recorded 27.0 mpg. The optimistic speedometer was two mph off at 30, five mph off at 80 (which we attained on a downhill slope).

The Simca has independent, adjustable-for-height torsion-bar suspension front and rear. This setup gives excellent ride control over the worst bumps. In spite of its noticeable lean, the car is stable and predictable during the most violent maneuvers. We never noted an extreme transition from understeer to oversteer when letting up on the throttle in a hard corner, as we have in many other front-wheel-drive cars.

The disc-front, drum-rear brakes are powerful and fade-resistant, the rack-and-pinion steering is fast and precise. The four-speed, floor-mounted gearshift feels vague and spongy, but the well-synchronized gearbox allows the fastest shifts without protest.

The reclining front bucket seats are extremely comfortable. Legroom front and rear is just adequate for average-size people, but headroom is generous. The instrument panel is covered with strips of phony wood veneer which look better than they sound; the round gauges are well-placed for quick scanning. With the three-point belts (a real bundle of worms) fastened, reaching the radio or the window cranks is almost impossible.

DATSUN 510

Several sophisticated features usually found only on expensive imports are included in the Datsun 510. Among them are independent suspension front and rear and an overhead-cam Four.

Here again our test car came to us brand-new, and our tests were run after only 300 miles of break-in. Even so, the Datsun, with an optional automatic transmission, managed 0-60 in 16.3 seconds, 50-70 in 11.6. We couldn't shave these times by shifting manually.

Fuel economy on our 65-mph-average trip measured 24.4 mpg—and a broken-in engine should do even better. Our speedometer proved dead accurate from 30 mph on up.

The Datsun instrument panel is one of the handsomest and best-laid-out, regardless of price. It's glareproof and well-padded, and the round gauges are easy to read. Ball-socket vents swivel on either side to let you aim incoming air where you want it.

The skimpy front buckets were the only ones among our test cars not to adjust for rake. And the steering wheel is too close for comfort. Front and rear legroom is adequate, no more. But the seat belts are unusually convenient.

The Datsun handles predictably on smooth roads, but on bumpy corners the independent rear suspension feels like a live axle and the tail end of the car occasionally gets a bit out of shape. Steering is fairly fast, but transmits little road feel. Brakes (disc front, drum rear) are quite powerful and practically fade-free.

OPEL KADETT

The Opel Kadett has a small Four developing a scant 55 hp. But we had an optional larger engine that turned out 102 hp, also a smooth, crisp automatic transmission.

The engine was rough and noisy, but it



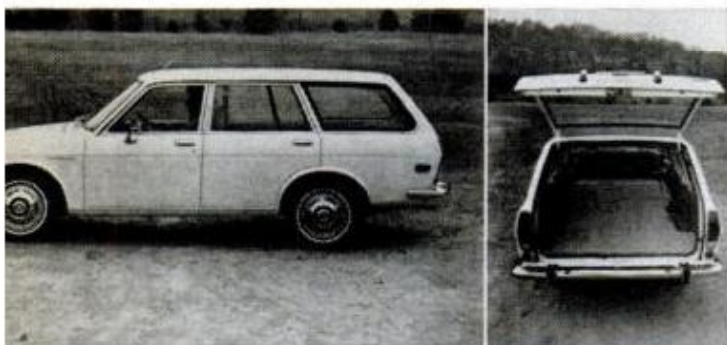
STATION WAGONS



VOLKSWAGEN SQUAREBACK is only wagon with front trunk. Louvers help cool engine under floor in rear



CITROËN D-21, largest and most expensive, has plush features; lacks carpet or mat in rear, however



DATSUN 510, sophisticated wagon for economy price, features an overhead-cam engine, good instruments



TOYOTA CORONA MARK II has luxurious interior with feel of domestic automobile; features ohc Four

FIAT 124 SPECIAL, with real sports-car feel, is most fun to drive, but instrument panel is nondescript



pushed the car to 60 mph in a quick 12.1 seconds, and from 50 to 70 in 8.1 seconds. Shifting manually failed to improve these times. On our 65-mph trip we recorded 24.9 mpg. Our speedometer read three mph fast from 30 mph on up.

The Opel is finished neatly inside and out. The instrument panel is attractive and laid out with the driver in mind. The front bucket seats, though comfortable, offer no side support, and legroom front and rear is just adequate. But the steering wheel is well-placed, almost at arm's length.

The Opel's ride is unimpressive. With just the driver aboard, it's harsh and bouncy. Adding three passengers and 350 pounds of sand changes the ride, but doesn't improve it. Handling is ho-hum on smooth roads and unpredictable in rough corners (rear-axle hop being the primary problem). But the disc-and-drum brakes are excellent in every respect.

FIAT 124 SPECIAL

If you want sports-car handling, consider the Fiat 124 Special. It gobbles up corners at the highest speeds; on rough roads the well-located live rear axle may hop, but it never gets badly out of hand.

Normal ride is firm and well-controlled, though with a little more pitching than we'd like. A full load, however, causes excessive bottoming of the suspension.

The plain-Jane instrument panel obviously is derived from a farm tractor. There's a beetle-browed, rectangular speedometer that's not too easy to read, and an immense, nonlocking glovebox with an ugly cable cutting right through its middle. But the Fiat also has those swiveling fresh-air ducts, full horn ring and near-perfect visibility in all directions.

The front bucket seats are comfortable, and legroom is okay front and rear. But rear headroom is cramped. The steering wheel, well away from the driver, invites an Italian-style, arms-straight, let-it-all-hang-out style of driving. Controls are well-placed except for the headlight dimmer stalk, which makes it easy to shut off the headlights accidentally.

The slick, fast four-speed floor shift can't be faulted. Steering is fast, pleasantly light, and responsive. And the four-wheel disc brakes stop the car right now. Our well-tuned engine covered 0-60 in 12.8 seconds, 50-70 in 7.9. The speedometer was just one mph fast at 30 and 40 and

two mph fast from 50 up. We netted 27.4 mpg on our mileage trip.

RENAULT 16

The Renault 16 stranded us early in our driving test: We ran out of gas, although the gauge didn't show "empty."

The Renault 16 "sedan-wagon" basically is a four-door sedan. But it has a unique tailgate that hinges open station-wagon style, and its rear seat can be folded into more different positions than you'd believe possible. For extra-large loads the rear seat can be removed (if you don't mind working up a sweat).

Those sensuously padded front and rear seats are the most comfortable we've ever settled into, bar none! And rear legroom is especially impressive. But the stalk-actuated horn takes some getting used to, and the foot-operated dimmer switch is confusingly close to the foot-operated windshield squirter.

Thanks largely to its front-wheel drive, the Renault feels stable at turnpike speeds, but soft springing and poor shock control make handling somewhat unpredictable in high-speed corners. We wished for an optional heavy-duty suspension.

Ride is comfortable over most road surfaces under lightly loaded conditions; a full load produces longer, floating ride motions that aren't objectionable.

Speedometer error ranged from two mph fast at 30 to three mph fast at 80. We managed 0-60 in 19.3 seconds; shifting manually, we got a still-lethargic 19.0. And 50-70 took 14.8 seconds. Fuel mileage on our 65-mph trip, however, averaged 29.9 mpg, the best we recorded.

TOYOTA CORONA MARK II

Seating comfort is the forte of the Toyota Corona Mark II. For its compact size, the car has a surprising amount of legroom front and rear. The front-seat rake adjustment makes it easy to find a comfortable driving position.

Under both light and heavy load the ride feels harsh over small irregularities and poorly controlled over large bumps. Handling generally is predictable, but cornering power is modest and rough corners start the live rear axle a-bouncing. Steering is slowish, heavy and none too sensitive. But the disc and drum brakes display very mild fade, fast recovery and excellent stability. Visibility is excellent.

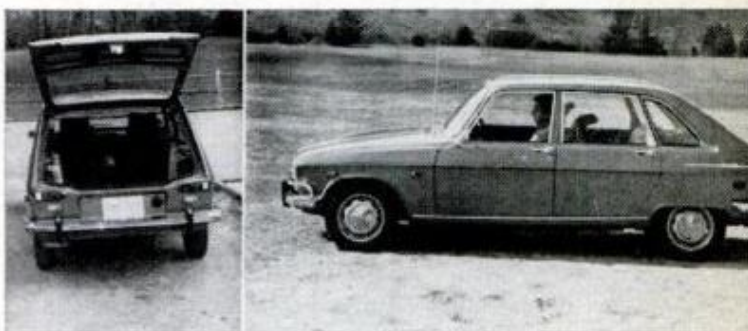
Our test car, equipped with the optional automatic transmission, reached 60 mph in



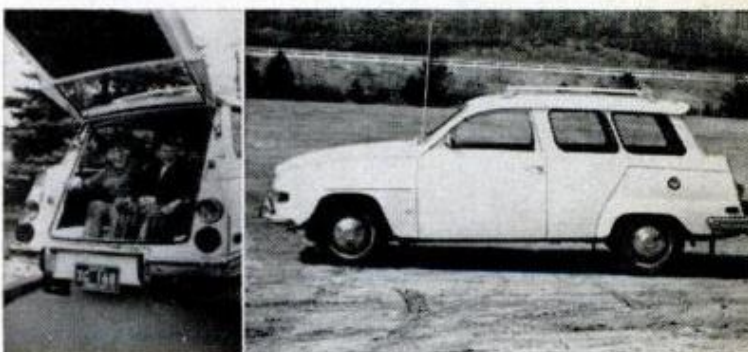
OPEL KADETT has fine lines, attractive instrument panel. Bucket seats only adequate, ride a bit bouncy



VOLVO 145 is solid, fast, extremely comfortable and luxurious. Steering is a bit slow; stick a bit stiff

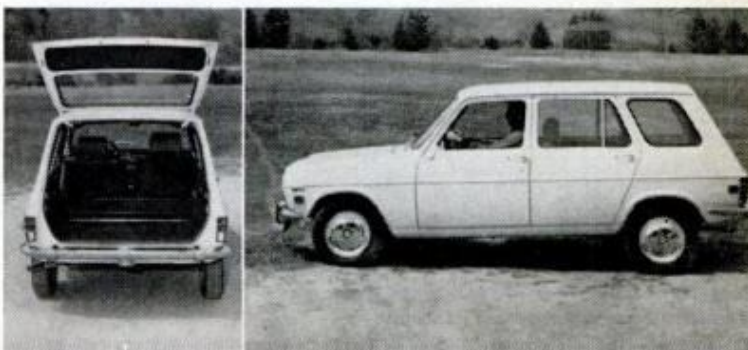


RENAULT 16 SEDAN-WAGON has versatile layout; rear seat can be folded in various ways or removed



SAAB WAGON has four-stroke V4 engine, front-wheel drive. Jump seat can be folded out of way

SIMCA 1204 has a transverse four-cylinder engine, front-wheel drive, adjustable torsion-bar suspension



SMALL STATION WAGONS—SPECIFICATIONS AND BASE PRICES

Model	Overall Length	Overall Width	Overall Height	Wheelbase	Engine Cu.-in. Displacement	Engine HP/RPM	Tailgate Opening, Max. Height/Width	Load Area Length (rear seat folded)	Load Area Length (rear seat up)	Load Area, Max. Floor Width	Load Area Maximum Height	Max. Load Space (cu. ft.)	Load Capacity (lbs.)	Base Dollar Price, East Coast P.O.E.	Warranty, Months/Mileage	Dealers in U.S.A.
AMC Sportabout	179.3	70.6	52.9	108.0	232 (6-cyl.)	145/4300	N.A.	N.A.	N.A.	N.A.	N.A.	58.3	N.A.	N.A.	N.A.	2400
Audi Super 90	173.8	64.0	57.2	98	107.5	100/5200	29.0/46.6	64.0	41.0	52.0	33.0	56.5	950	3245	24/24000	115
Chevrolet Vega	169.7	65.4	51.2	97	140.0	80/4400	26.1/42.1	67.4	N.A.	42.6	28.9	50.2	N.A.	N.A.	N.A.	6300
Citroen D-21	196.5	70.5	60.25	123.0	132.7	115/5750	42.25/41.75	84	48.5	38.25	39.5	69.0	1340	4900	12/unlim.	131
Cortina	168.0	63.8	54.8	98	97.5	71/5000	30.0/47.3	76.0	43.3	53.0	34.0	70.5	904	2304	12/12000	859
Datsun 510	163.2	61.4	56.5	95.3	87.3	96/5600	30.6/43.6	60.9	34.3	50.0	32.0	57.4	750	2226	12/12000	739
Fiat 124 Special	156.75	64.0	53.75	95.25	87.75	76/5400	33.0/44.0	58.0	38.0	50.0	33.5	59.0	949	2273	12/12000	560
Mazda 1200	145.0	58.3	55.3	88.9	71.3	64/6000	33.4/47.4	52.1	29.0	47.4	32.0	47.0	800	1930* (2-dr.)	12/12000	18
Mazda 1800	172.0	64.2	56.3	98.4	109.6	98/5500	32.0/51.0	63.0	35.0	51.0	33.4	59.0	1050	2450	12/12000	18
Opel Kadett	164.4	61.9	58.8	95.1	115.8	102/5400	28.9/48.0	61.9	38.5	49.0	32.5	55.6	963	2155	12/12000	2000
Peugeot 404	180.0	64.0	58.8	111.8	110.0	90/5500	22.0/43.0	75.0	51.0	40.5	37.0	81.2	1100	2995	12/unlim.	275
Renault 16	168.4	64.9	57.3	104.3	95.5	70/5200	37.0/47.0	72.5	38.5	49.0	41.0	42.0	900	2395	12/unlim.	400
Saab	168.3	62.2	58.6	98.3	91.4	73/5000	29.6/44.0	63.8	43.4	47.3	35.45	49.2	1150	2799	12/unlim.	375
Simca 1204	154.7	62.5	55.8	99.2	73.47	62/5800	35.0/45.0	67.5	34.5	42.0	35.75	41.0	1000	2145	12/12000	548
Subaru	152.8	58.3	55.7	95.2	66.4	62/6000	40.6/56.0	57.0	N.A.	47.5	N.A.	N.A.	N.A.	1899	6/6000	391
Toyota Corolla	154.3	58.7	55.1	90.0	71.1	73/5500	32.0/46.0	56.0	34.0	47.0	32.0	49.0	770	1876	12/12000	800
Toyota Mark II	171.5	63.2	56.1	98.8	113.4	108/5500	31.0/46.0	72.0	37.0	50.0	30.0	62.0	800	2400	12/12000	800
Toyota Crown	184.6	66.5	57.7	105.9	137.5	115/5200	32.0/43.0	78.0	43.0	47.0	32.0	68.0	900	3149	12/12000	800
Volkswagen Squareback	170.9	63.2	57.9	94.5	96.66	65/4600	27.5/48.0	66.0	42.75	48.0	31.0	42.4†	992	2499	24/24000	1000
Volvo 145	182.7	68.3	57.1	102.4	121.0	118/5800	31.5/46.0	74.0	44.5	52.4	33.0	67.0‡	1100	3495	6/unlim	360

* Two-door model; four-door, \$2030.

† Plus 8.1-cu.-ft. trunk in front

‡ Plus 3.5 cu. in. extra storage under floor

a creditable 14.2 seconds; shifting manually, we shaved another 0.6 second off this time. Our 50-70 runs averaged 8.9 seconds (8.7 shifting manually). Our 18.8-mpg trip mileage disappointed us, since our experience with other samples of this make convinces us that our test car wasn't properly tuned. We estimate about 23 mpg for a representative sample. Our speedometer was two mph fast at lower speeds, three mph fast at 60 and above.

The instrument panel is nicely laid out except for the rectangular speedometer (we're biased in favor of round ones). The headlight dimmer is conveniently combined with the directionals.

VOLKSWAGEN SQUAREBACK

The rear-mounted engine may usurp some rear load space in the Volkswagen Squareback, but a roomy front trunk

makes up for the loss. Normally you never feel that rear engine; the VW actually understeers right up to maximum cornering speeds, when it changes (fairly abruptly) to oversteer.

The car leans hard in the turns, and ride motions are long and abrupt. With a full load the ride actually improves slightly. The front bucket seats are comfortable, but the built-in headrests reduce rearward vision. Front legroom is skimpy, even for an average-size driver. Rear seating room is adequate for two.

The instrument panel styling is functional; round gauges offer good visibility.

Ventilation controls are complicated and hard to reach, and we'd prefer an old-style center horn button to a hard-to-find partial horn ring. The heater, usually a problem in air-cooled cars, is efficient, and a

rear-window defogger makes a useful addition.

Our car came equipped with the optional automatic transmission, which proved smooth and positive-shifting. Allowing the box to shift for itself netted a 0-60 time of 19.1 seconds; manual shifting brought this down to 18.8. Our 50-70 runs took a leisurely 16.8 or 15.8 seconds, depending on whether the transmission was left alone or shifted by hand. Trip fuel mileage averaged a decent 23.2 mpg. The speedometer read two mph high throughout most of its range.

Steering in the VW is fast, but heavy, even at speed. The disc and drum brakes do their job well in every respect.

SAAB

That old free-wheeling device—necessary to prevent oil starvation in Saab's old two-cycle engine—has been retained on the newer V4-powered Saab. We wish it hadn't been.

This diabolical mechanism disengages the engine from the transmission whenever you let up on the accelerator. Sure, this saves gas by allowing you to coast with the engine idling. And sure, it lets you upshift without using the clutch, if that turns you on. But the lack of engine braking made us feel queazy, especially when cornering. Also, coasting puts greater demands on the disc and drum brakes which, happily, are up to the job. The Saab brakes, though not the most powerful, are directionally stable and fade-resistant. Incidentally, the free-wheeling can be locked out with a lever under the instrument panel—and that's what we did.

As is true with most front-wheel-drive cars, the Saab's handling is stable at high speeds, even in strong crosswinds. On a corner the front end plows strongly unless you let up on the accelerator; then the front end abruptly tucks into an oversteering condition. Such behavior may frighten the novice driver, but it's great fun once you get used to it. Steering is heavy, particularly when accelerating in a corner; but it's precise and fairly fast. Ride is firm and reasonably comfortable for a car of this size; even under full load it remains acceptable.

The column-mounted four-speed shift lever is sloppy, but the transmission synchronizers do their job well. Our 0-60 times averaged 17.3 seconds, and 50-70 took 12 seconds flat. Fuel mileage, 29.1 mpg, was a close second to the Renault's. Speedometer error ranged from plus 1.5 mph at 30 to plus four mph at 80.

The interior made us feel claustrophobic; the windshield slants back sharply, and the high cowl and window sills give passengers the impression of sitting in a bathtub. But actually, visibility all around is fine.

The instrument panel is neither modern nor

(Please turn to page 216)



SUBARU STAR has horizontally opposed, four-cylinder, water-cooled engine, top speed of 90



AUDI SUPER 90 is clean, smartly styled, has front-wheel drive from water-cooled Four



CHEVROLET VEGA is long-awaited domestic wagon of compact and handsome proportions



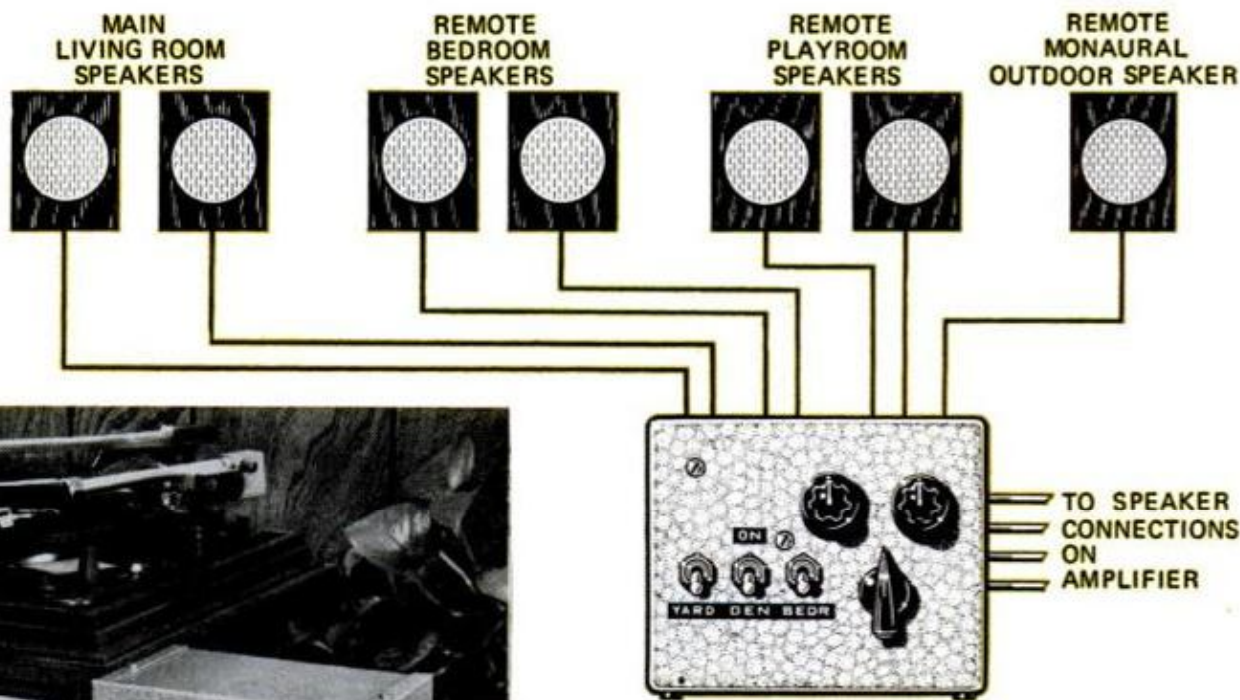
PEUGEOT 404 has a 1.8-liter engine, dual carburetion, ZF automatic transmission option

CORTINA from Ford of Britain has a 1600-cc engine with 71 hp, economy close to 30 mpg



Switch Your Stereo Speakers

This easily built selector automatically maintains a proper impedance load as you turn speakers on and off. It lets you choose three stereo pairs and one monaural extension



A HANDY COMPANION to a hi-fi set, this master selector makes it easy to switch speakers on and off without changing the load on the circuit. It handles up to three pairs of stereo speakers and one monaural extension and also offers individual volume control on main speakers. It makes no difference which or how many speakers are on at a time—the load is always kept the same automatically

By **WALTER G. SALM**

Photos by Robert D. Borst

SOONER OR LATER, most hi-fi owners dream of adding extra speakers throughout the house—a second stereo pair in a playroom or den and maybe another set in the bedroom. The trouble is, most amplifiers provide for hooking up, at most, only one or two sets of speakers.

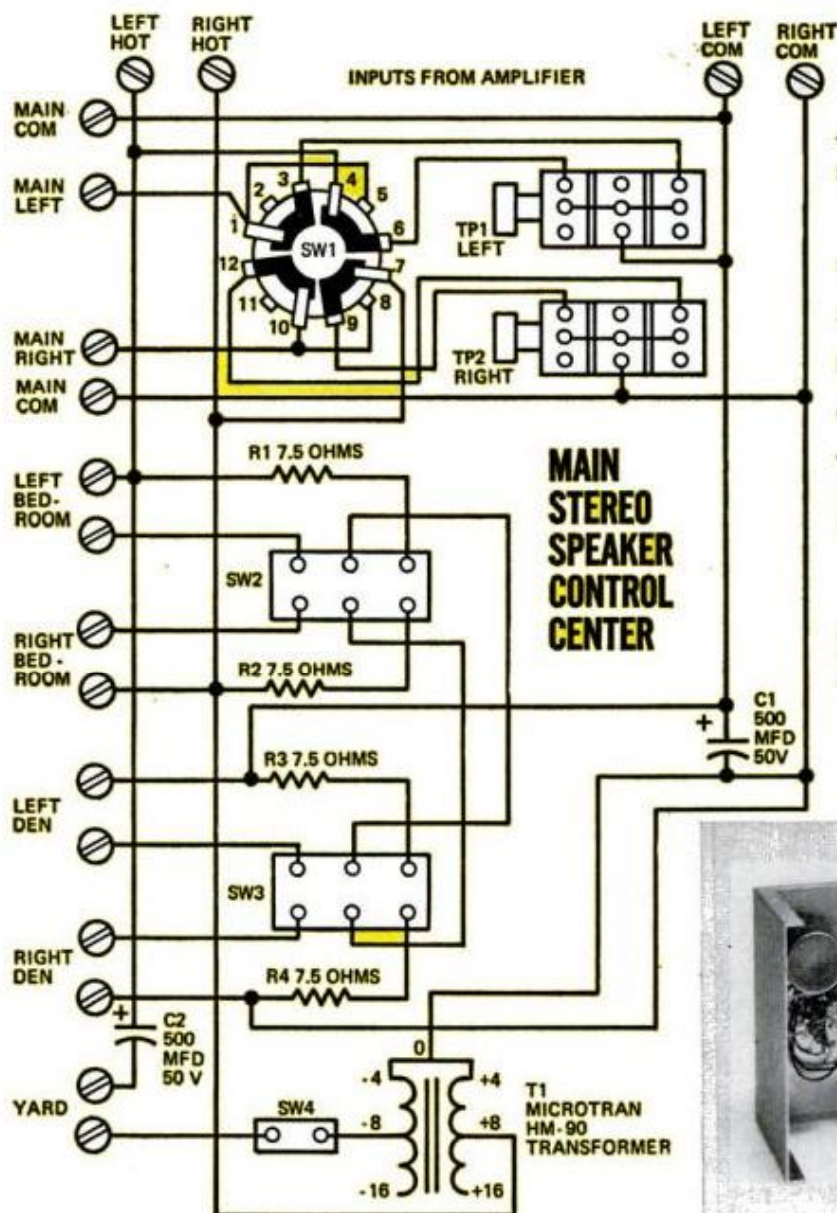
If you simply attach additional speakers to the same terminals, wiring them in parallel, you decrease the resistance in the circuit and create a serious impedance mismatch. This drastically reduces the amplifier's effective power, and, on transistor models, can cause an overload that may damage the set or blow the speaker fuses. Most of today's amplifiers are lim-

ited to a safe impedance range of 4 to 8 ohms. If total speaker resistance falls much below 4 ohms, you're in for trouble.

The handy control shown here lets you switch on up to three pairs of stereo speakers, plus a fourth, monaural speaker, without affecting the impedance match to the amplifier. It does this with a clever combination of series-parallel wiring and dummy loading resistors to keep the total impedance the same, no matter how many speakers are switched on or off.

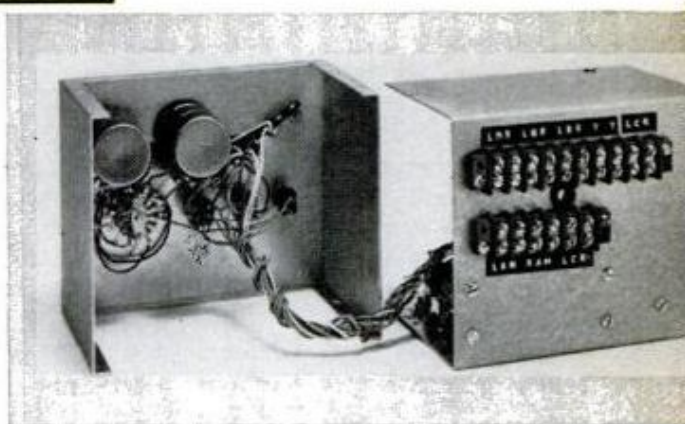
Here's how the system works: Wiring two 8-ohm speakers in parallel cuts their resistance in half to 4 ohms. The formula for determining this is to multiply the two

With This Self-Balancing Control



PARTS LIST

- TP1, TP2—8-ohm T-pads (46F3116)
 SW1—4-pole, 2-position rotary wafer switch (56A4306) or use alternate 4-pole, double-throw miniature toggle switch (56A3204)
 SW2, SW3—D.p.d.t. miniature toggle switches (56A3202)
 SW4—S.p.s.t. miniature toggle switch (56A3201)
 R1, R2, R3, R4—7.5-ohm, 20-w. wire-wound resistors (45F7196C)
 C1, C2—500-mfd., 50-v. electrolytic capacitors (43A9269)
 T1—Microtran HM-90 transformer
 Case—6x5x4" minibox (42A7623)
 Misc.—4-lug terminal strips (package of 10, 47A4335), 8-terminal barrier strip, 10-terminal barrier strip, 3/8" rubber grommet, hookup wire, mounting hardware
 (Part numbers in parentheses from Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680.)



WIRING DIAGRAM shows how loading resistors are switched into circuit as speakers are turned off to maintain a constant impedance. Switches and T-

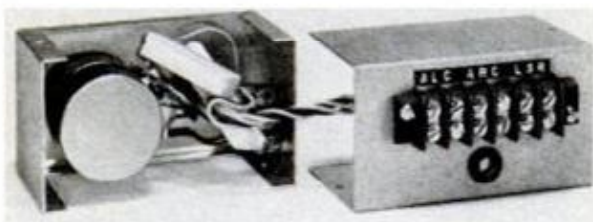
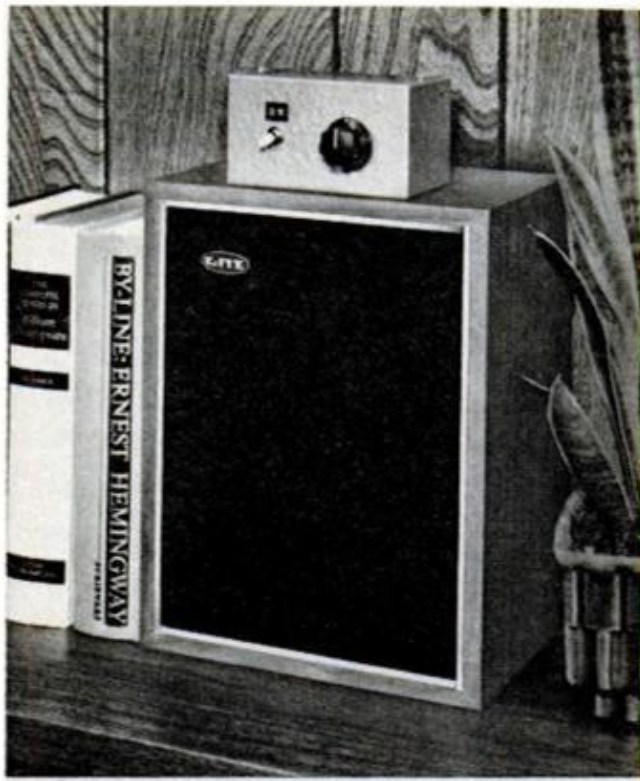
resistances together, then divide the product by the sum of the resistances. Thus, you multiply 8 times 8, divide the product, 64, by the sum, 16, and get an impedance of 4 ohms. This is within the safe limit, but when you add a third 8-ohm speaker in parallel, you multiply 4 times 8, divide the product, 32, by the sum, 12, and get 2.67 ohms—well below the danger point.

Now if you connect two 8-ohm speakers in series instead of parallel, you double their resistance, producing an impedance of 16 ohms. But you can't wire all of your speakers in series or the total would get too high. The trick is to arrange some in

pads are mounted on inside of front panel, as shown in photo at right, above. Other components are wired between lug-type terminal strips on rear panel series and some in parallel in such a way that their total impedance falls within the safe range.

This is what the control does. The two remote pairs of stereo speakers are wired in series, then this combination is wired in parallel with the main living room speakers. The result is a 16-ohm load for the series speakers added in parallel to the 8-ohm load for the main speakers. You multiply 8 times 16, divide the product, 128, by the sum, 24, and get a total impedance of 5.3 ohms—well within the allowable range.

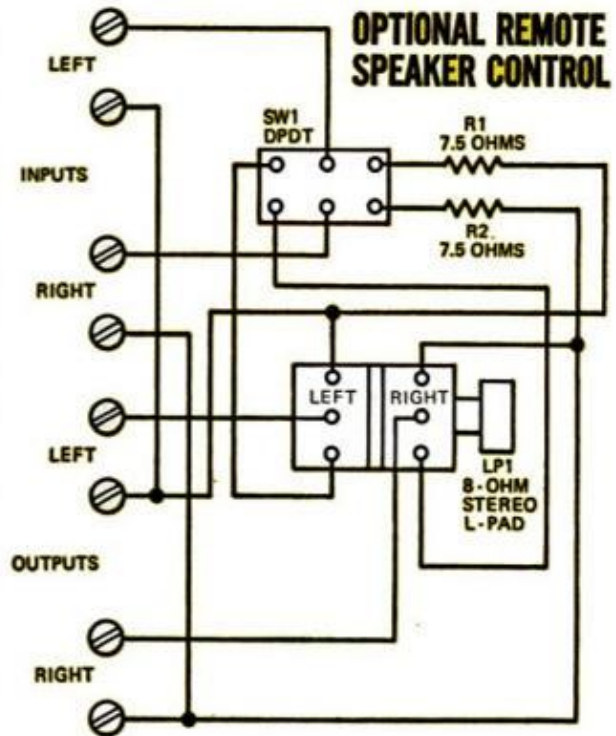
This is fine if all your speakers are



REMOTE CONTROL is not part of basic circuit, but can be added if you want to switch speakers on and off at each location independently of the main control. It uses a stereo L-pad to vary the volume

playing at once, but obviously you'll want to select only certain ones at a time. The control automatically provides for this, too. As each pair of remote speakers is turned off, its switch cuts in a pair of loading resistors of the equivalent value. Thus, the speakers always present the same total impedance to the amplifier, no matter whether they're playing or not.

The main speakers are wired through a switch to two T-pads that function as volume controls. To get sufficient volume from your remote speakers, it's sometimes necessary to turn up your main speakers louder than you want for comfortable listening. The T-pads let you reduce the volume on your main speakers while keeping the remote ones at an adequate level. The switch is a two-position, four-pole rotary. In one position, the T-pads are in the circuit; in the other, they're switched out and the main volume control



PARTS LIST

LP1—8-ohm stereo L-pad (46D3097)
SW1—D.p.d.t. miniature toggle switch (56A3202)
R1, R2—7.5-ohm, 20-w. wire-wound resistors (45F7196C)
Case—2¼x2¼x4" minibox (42A7619)
Misc.—4-lug terminal strip, 8-terminal barrier strip, 3/8" rubber grommet, hookup wire (Part numbers in parentheses from Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680.)

simultaneously on paired speakers. It also incorporates loading resistors so the circuit will remain balanced if speakers are switched off remotely while they're still turned on at the main control

on the amplifier takes over. You can cut out the T-pads whenever you're using only your main speakers.

If you want only your remote speakers on, turn the T-pads down to the point where your main speakers can't be heard. This, in effect, turns them off without removing their resistance load from the circuit. If you prefer, you can substitute a four-pole, double-throw toggle switch for the rotary type, but this is usually more expensive and harder to find. The other switches shown are all miniature toggles, but standard toggles of the same pole arrangement would do just as well.

The extra monaural speaker is added in case you want a single extension for use outdoors on a porch or patio. The monaural signal is derived by using a matrixing transformer, a Microtran HM-90 type, bridged across the right and left stereo channels. Capacitors isolate the two

channels so they will not become grounded together. This is necessary because many of today's transistor amplifiers do not have a common ground and the two channels must be kept separated.

If you don't need the monaural extension, you can eliminate the transformer and the two capacitors. In this case, be sure also to omit the connection that bridges the right and left common bus wires together at capacitor C1 as the two commons must remain isolated if the capacitors aren't used. If your amplifier does have a common ground, you needn't worry about this isolation and you can connect your single ground lead to both the right and left common input terminals on the control.

When you shop for the loading resistors, you'll discover that there are no wire-wound types at exactly 8 ohms to match your speakers' impedance. The nearest that are commonly available are 7.5 ohms, but this is close enough. Heavy-duty wire-wound resistors of 20 to 25 watts capacity are necessary because the simple carbon type will burn out quickly under power surges.

In addition to the master selector, it's often handy to be able to control your speakers from each location. For this, an optional remote control is shown that incorporates a stereo L-pad, a pair of 7.5-ohm loading resistors and a double-pole, double-throw switch. The L-pad serves as a volume control and has two sections ganged on one shaft so it adjusts the level of both stereo speakers simultaneously. The switch works in the same way as those in the main selector—in one position, the speakers are on; in the other, the speakers are cut out and the loading resistors are switched in. This way, the circuit is kept balanced even if you turn off your speakers at the remote control while they're still turned on at the main control.

Connections are made on the back of both the main selector and the remote control by means of barrier-type terminal strips. The main control requires 18 connections so you'll need one 10-terminal strip and one 8-terminal type. The remote control requires eight connections, but you'll note that the inputs and outputs are electrically common on one side of each channel. Each of these pairs can be connected together on one terminal if you

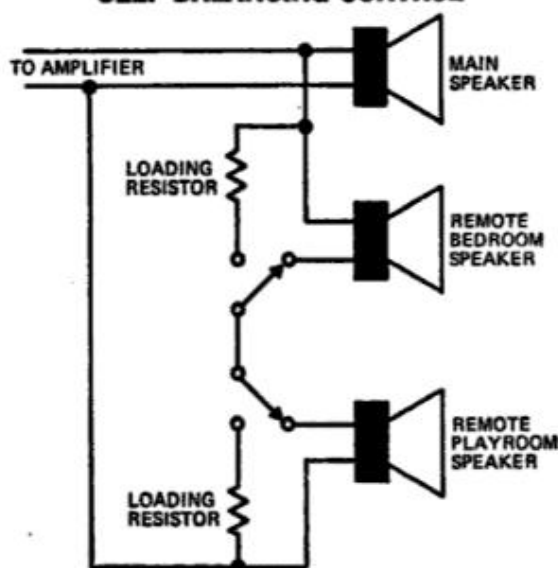
wish, reducing the total number of terminals to six. However, it's probably easier to keep track of the wiring if you set up separate terminals, as shown in the diagram, using an 8-terminal strip.

Except for the matrixing transformer, all parts can be obtained from Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680. The Microtran HM-90 transformer is available from Arrow Electronics, 900 Broadhollow Rd., Farmingdale, L. I., N.Y.

Once your speakers are hooked up, it's a good idea to check to see if they're properly phased. Switch your amplifier to the monaural mode or play a monaural record so both channels are mixed together. Crank up the bass control so you're getting a lot of deep, throaty low frequencies. Now stand in front of the speakers between them and listen carefully. If they're properly phased, the sound should be rich and full-bodied. If it seems weak and flat, reverse the connections to one speaker (it doesn't matter which one, but only do it to one of the two).

Try reversing the connections several times until you can be sure of a noticeable difference. The hookup that gives the best sound will be the one that indicates correct phasing. Do this for each pair of stereo speakers separately. ★★★

PRINCIPLE OF SELF-BALANCING CONTROL



BASIC THEORY of self-balancing circuit is shown in simplified diagram above. As each speaker is turned off, a loading resistor is switched into the circuit to maintain a constant impedance load. Remote speakers are wired in series with each other, then in parallel with main speaker to keep impedance from falling too low. Diagram shows only one stereo channel. Other channel is identically wired

Now: Home TV Films in



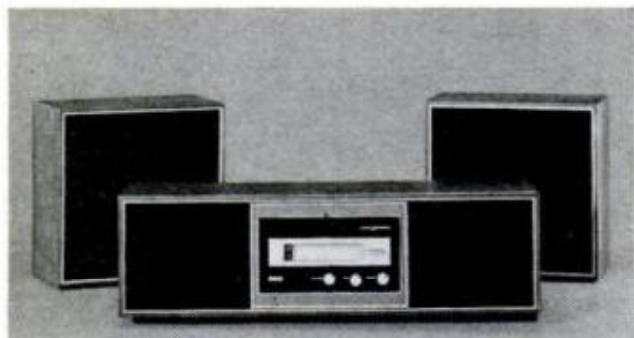
SLIP A REEL OF FILM into a small player about the size of a phonograph and you can watch movies in full color right on your TV screen. Based on the EVR (Electronic Video Recording) process developed by CBS, the player connects to your TV's antenna terminals and works like a miniature TV transmitter. It feeds electronic signals into the set just as if they were broadcast over the air. The pictures appear in color on color sets and in black-and-white on noncolor sets.

Unlike magnetically recorded video tape—too costly at present for home viewing in color—the new EVR system uses ordinary movie film. The film is divided into three tracks—one for sound, one for visual images in black-and-white, and one for a series of squiggles representing coded information on

4-Channel



Stereo From Cartridge Tapes



NEW 4-CHANNEL PLAYER has two built-in front speakers and two remote rear speakers. You can also attach two more front speakers to replace the built-in ones if you want wider stereo separation

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FOUR-CHANNEL STEREO, an exciting new concept in hi-fi listening, is here at last in a convenient, relatively inexpensive system for use in any home. Developed by RCA, it provides 4-channel sound from ordinary 8-track cartridge tapes and will sell for under \$200—considerably less than previous quadrasonic systems based on large open-reel tapes.

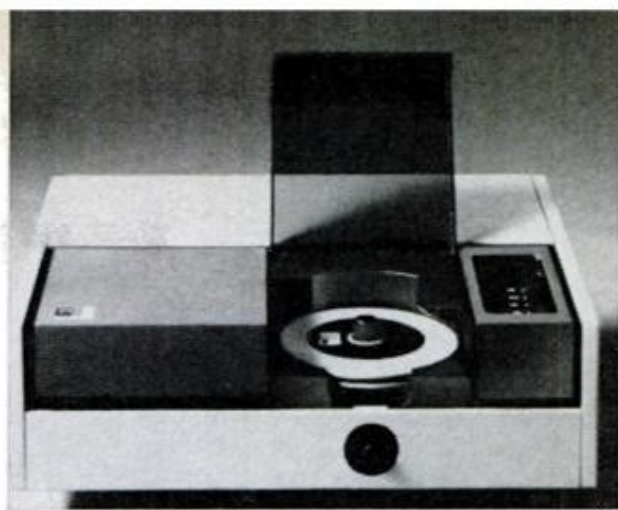
The three-piece system consists of a main unit containing a cartridge tape player and a pair of built-in speakers plus two separate plug-in speakers. The built-

POPULAR MECHANICS

Full Color

what colors to add to each picture. In the player, the images are electronically scanned and converted into TV signals along with the color information and the sound track. These are transmitted to the TV set and the picture is recreated on the screen in full color.

Each 7-inch film reel holds 25 minutes of program material. To assure that there will be plenty of films for home viewing, 20th Century-Fox plans to release popular movies for use in the EVR system after they have appeared in theaters. Other companies are producing special programs like travelogues, sports events, historical documentaries and instructional hobby films. The players will be manufactured for CBS by Motorola and will sell initially for \$795. Future, more simplified models are expected to cost less as production increases. ★★★



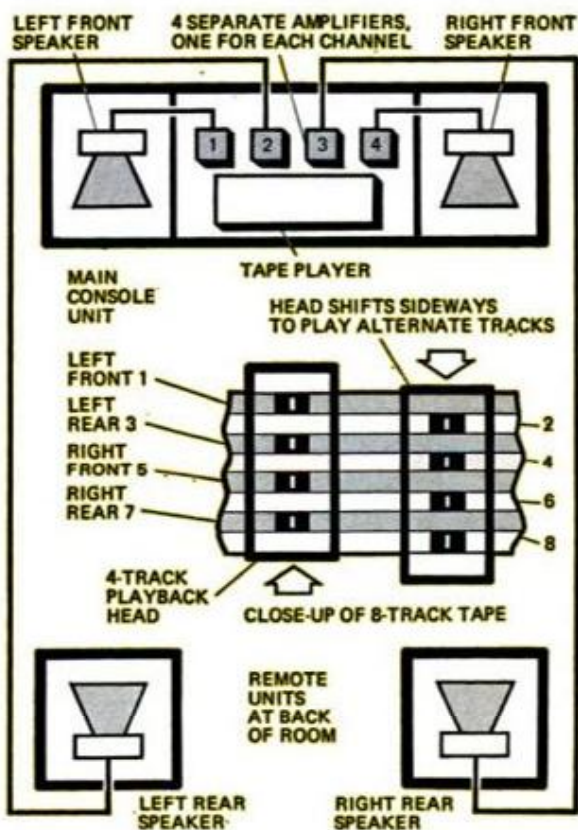
CLOSE-UP OF COLOR PLAYER shows lift-up plastic lid and spindle that holds the reel of film. Reel is simply slipped onto spindle, like a record on a phonograph, and threads automatically into the mechanism. At end of program, film is rewound onto reel and removed for storage. It can be stopped at any point for single-frame viewing or backed up. Plastic reel, shown below, is 7 inches in diameter



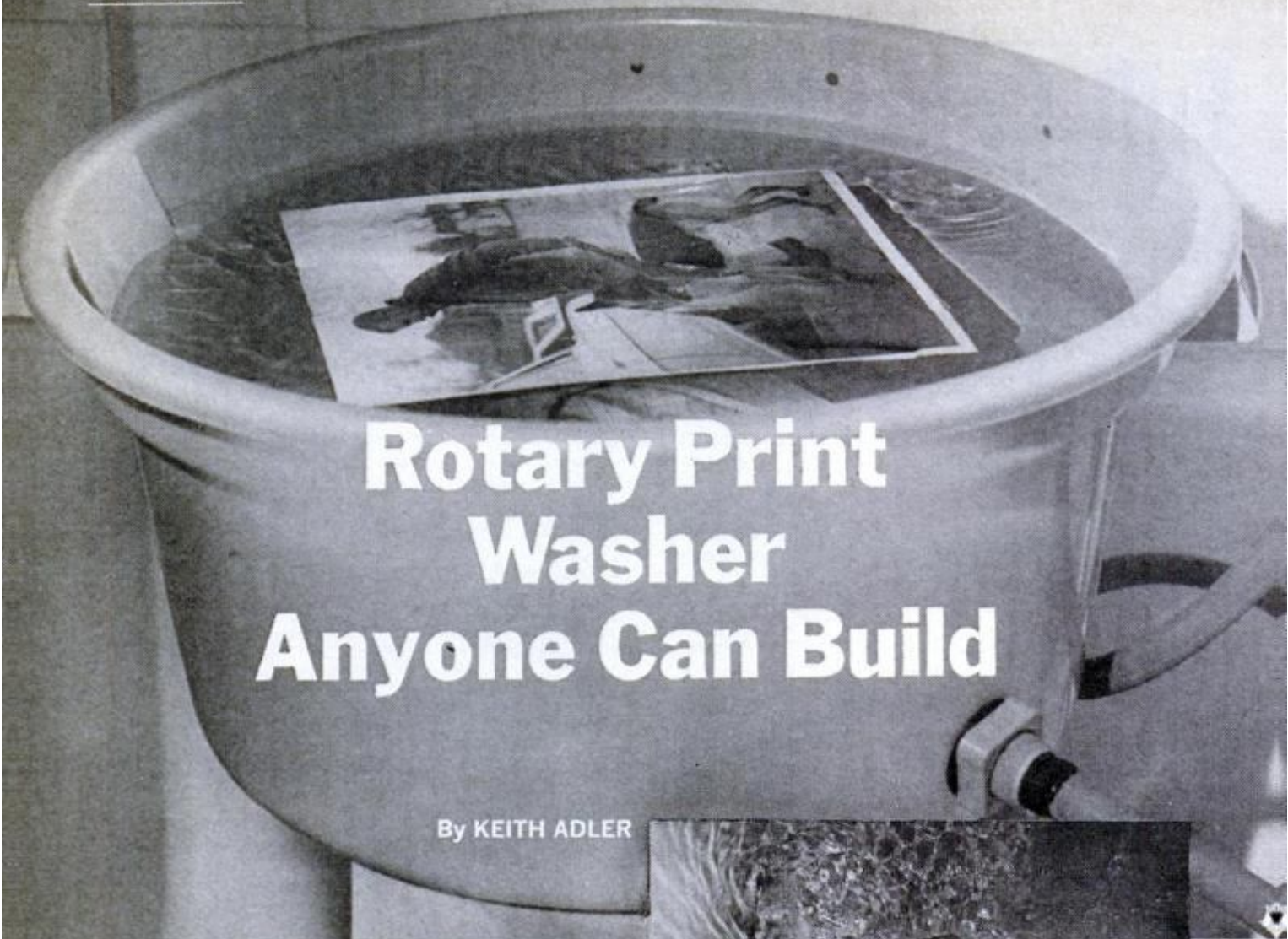
in speakers produce conventional 2-channel stereo. The two remote speakers are placed at the rear of your listening area to add a rich, reverberant background effect. The result is a spacious, room-filling sound similar to live music heard in a huge concert hall.

The tapes are identical to 8-track cartridges used in car players except that four channels are recorded simultaneously instead of the usual two. A 4-track playback head feeds the signals to four separate amplifiers, each connected to one of the four speakers. The head shifts sideways, playing tracks 1, 3, 5 and 7 in one position and tracks 2, 4, 6 and 8 in the other position. This alternate-track arrangement provides two sets of musical selections on each tape and also enables the machine to play conventional 2-channel cartridges interchangeably.

Recording companies are already producing 4-channel tapes and expect to have an extensive collection available soon. Motorola is planning to introduce a 4-channel car tape player, similar to the RCA home system, that will also play the new cartridges. ★★★



WALL-TO-WALL SOUND: Two built-in speakers at front and two added speakers at rear give rich, room-filling effect. Diagram at center shows how tape head shifts to play alternate sets of tracks



Rotary Print Washer Anyone Can Build

By KEITH ADLER

A plastic laundry tub and some hose fittings can give you a professional-type, swirling-action washing tank for \$5 worth of parts.

ROTARY PRINT WASHERS are too expensive for most home darkrooms, but you can make one like this from a plastic washtub. Water is forced in through a right-angle inlet pipe, creating a circular flow to keep your prints swirling and tumbling for a good washing action. Dirty water drains off at the top.

A \$3 plastic bulkhead fitting, sold at plumbing shops for use with plastic pipe, is the key to making a neat inlet. Cut a hole in the side of the tub near the bottom and clamp the bulkhead over it. Locate the threaded end of the bulkhead on the outside and screw in a $\frac{3}{8}$ -in. reducing adapter to take $\frac{3}{8}$ -in. rubber hose. On



the inside, cement in a plastic elbow using epoxy or similar adhesive.

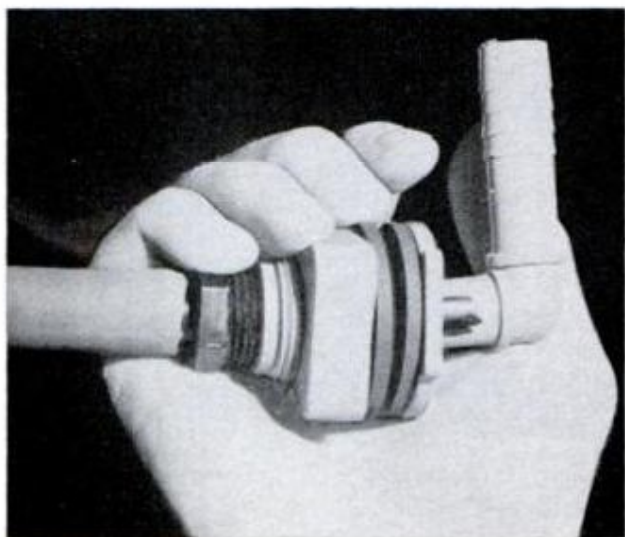
Slip rubber tubing over the outside fitting and run it to any nearby source of water. I connect my washer to a bathroom shower by removing the shower head and using the adapter shown on the opposite page. You can hook up to a threaded faucet with a garden-hose adapter or to an unthreaded faucet with a rubber laundry connector.

Drill $\frac{1}{4}$ -in. drain holes around the tub's rim. The washer's agitation can be varied by adjusting the angle of the inlet. Pointing the end upward increases turbulence and downward decreases it. ★★★

PHOTO HINTS



PLASTIC BULKHEAD FITTING makes it easy to feed water into the washtub. Reducing adapter is screwed into outer half for attaching $\frac{3}{8}$ -in. hose, and the plastic elbow is cemented into the fitting's inner half



COMPLETED INLET shows elbow on inside of bulkhead fitting and rubber hose attached to outside. Bulkhead is now taken apart and clamped together on either side of the hole in the plastic washtub

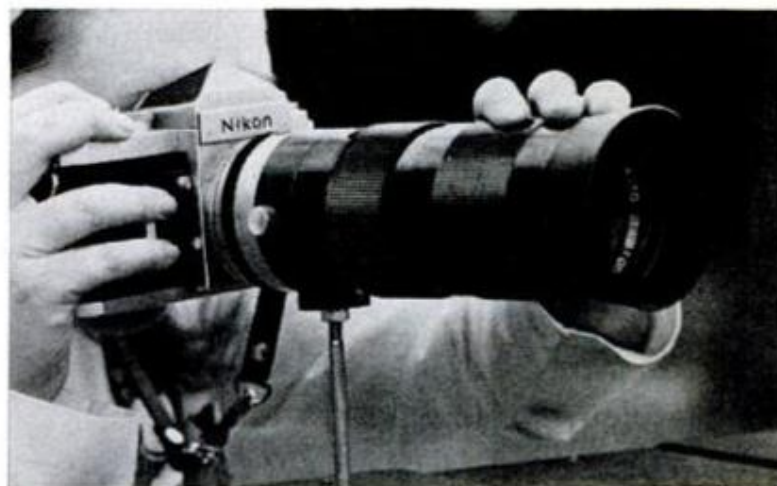


WASHER CAN BE FED from a bathroom shower with an arrangement like this. Shower head is removed and a pipe coupling screwed on. Reducing adapter for $\frac{3}{8}$ -in. hose then lets you run tubing to tub

SEPTEMBER 1970



AN ORDINARY SCREWDRIVER with a $\frac{1}{4}$ -in. shank makes a perfect replacement for a lost or damaged tripod handle. Pick an inexpensive variety-store type since its metal is not as hard as that in higher-quality drivers and will be easier to work. Hacksaw off the blade tip and thread the end to match the threads in the tripod head. It's sometimes necessary to grind a shoulder near the end to serve as a stop before threading.—Arthur L. Ramos



A HANDY MINIPOD for steadying long telephoto lenses can be made from a standard $\frac{1}{4}$ -in. bolt 4 or 5 inches long. Screw the bolt into the tripod socket found under the barrel on many long lenses. Run a nut up tight against the barrel to prevent any looseness. With the lens resting on the minipod, your left hand is free to concentrate on focusing. The bolt can also be used as a pistol grip for steadier hand-held shooting.—James Tallon

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HOW TO SOLVE



JIGGLING a loose or defective ignition switch may put enough life back into it to get engine restarted

A logical, step-by-step approach to the possible causes of a stalled engine makes it easy to get back on the road and on your way again

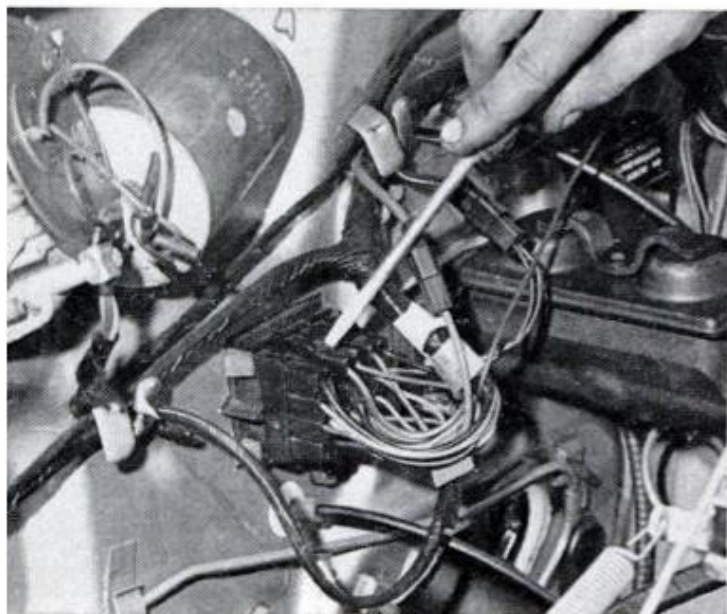
HAVING A CAR STALL is no fun, especially when it strands you in the boondocks. But straight-line thinking from the minute the engine quits will help you cope with the situation if it happens to you.

Aside from an empty gas tank and a few other problems (bad fuel pump and bad coil are the primary ones), roadside repairs are easy to make. A good troubleshooter knows that the most likely causes of stalling are in the fuel or ignition systems, and wastes no time before investigating the major trouble spots. Let's look at a hypothetical situation and see just how it's done.

Suppose you're driving along a stretch of freeway that generally has little traffic and even fewer service areas. At this moment, you and the cars behind you are zipping along when your engine suddenly quits.

Getting safely off the road is your first consideration. If your car is equipped with emergency warning flashers, as all late models must be, push the button to let those behind know that you are in trouble. If this signal isn't available, wave off other cars by putting on your turn signal and motioning with your hand (arm out, palm facing to the rear) that you are stopping. Put the transmission into neutral to give yourself maximum maneuvering movement, and, with light taps on the brake pedal, smoothly glide off the road onto the right-hand shoulder. Try to stay off the left-hand median; it's a more dangerous spot. Hopefully you will have some warning device (flares or light) that you

SUDDEN STALL



THE BULKHEAD CONNECTOR located on the firewall of today's cars looks like this. Make sure all the ignition wires coming into it are pushed on tight

CORRODED BATTERY TERMINALS could be your problem. Scrape clean with penknife or battery tool. Wipe off battery posts and connect terminals tightly



can place well aft of the car to warn approaching motorists.

Okay, go to work. Are you out of gas? Start hiking.

If fuel is okay, consider how the engine stalled. Did it sputter and jerk before it died? The trouble is probably a fuel failure. Did it just cut out? That signifies ignition trouble.

SEPTEMBER 1970

Before getting under the hood, what about climatic conditions? If the weather is hot, the problem could be vapor lock. If you have a jug of cold water, pour it on the fuel pump and fuel line. This will cause vapor to liquify and allow gas to flow again. Otherwise you will have to sit for half an hour or so until the engine cools down to the point where the vapor dissipates by itself.

Is it winter? Perhaps a sliver of ice is blocking fuel. Try the same method as for summer, this time pouring hot water or hot coffee over the carburetor and fuel line. If you don't have a hot liquid with you, you will have to try to clear ice by removing the fuel filter, clearing the needle valve, or blowing out the fuel line, which we'll explain below.

Did you splash through a deep puddle? Ignition parts could have gotten wet. Wipe off the distributor cap, coil and sparkplugs.

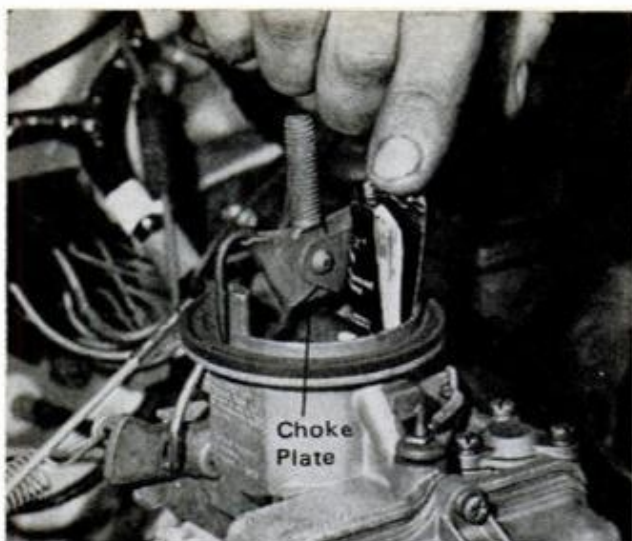
Another thing you should do immediately is jiggle the ignition switch under the dash. The switch may be defective, and shaking it could put enough life back into it to get the engine started.

Another place an ignition failure often occurs is at the bulkhead connector on the firewall, where ignition wires connect. One of the connections may have worked loose and just needs to be pushed back in.

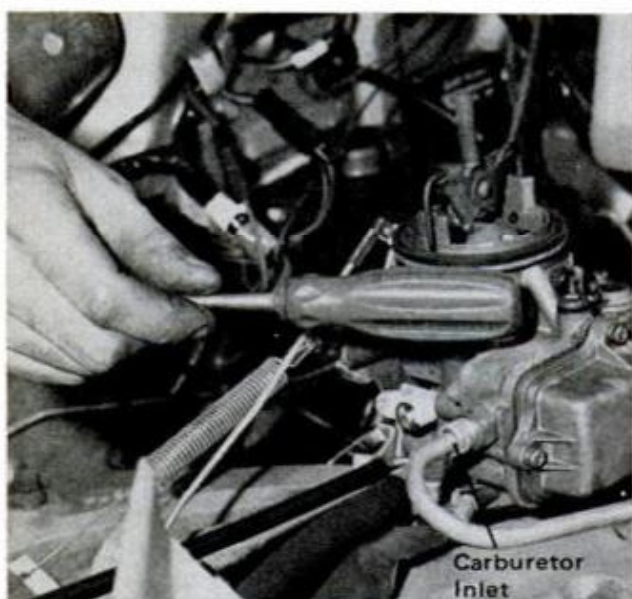
One other place to check is the battery cables. If terminals have worked loose from battery posts, tighten them. If they are badly corroded, take them off the posts and scrape them clean. A regular battery tool is good to have and costs only \$1.50.

If the way the engine died suggests a fuel-system problem, remove the carburetor air cleaner. Is the choke plate closed? Maybe a malfunctioning choke control piston caused the plate to shut, and the engine has flooded. Wedge the plate open with a block of wood or a book of matches folded in half.

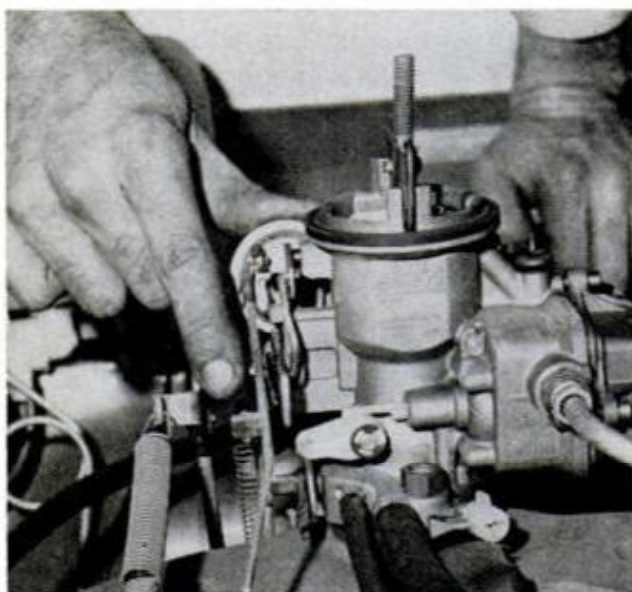
Although it rarely happens, the filter in the carburetor air cleaner may be so clogged with dirt that it cut off air to the carburetor, causing the engine to flood. In



KEEP FAULTY CHOKE PLATE open by wedging an emergency device between choke plate and carburetor



TO FREE NEEDLE VALVE of dirt, tap carburetor inlet. Remove fuel line here to reach the internal fuel filter



CHECK TO SEE if gas is getting to cylinders by operating throttle as you look down the carburetor throat

this case, throw away the air cleaner and run the car without it until you can get a new one at a service area.

Another cause of engine flooding can be a piece of dirt (or ice) wedged between the needle valve and seat. Tap the carburetor bowl with a screwdriver handle to try to loosen the dirt.

If the engine has flooded, you will have to clear the cylinders before it will restart. With the accelerator pedal to the floor, crank the starter, allowing the influx of air to deflood the engine.

If flooding is not the problem, maybe lack of fuel is. To see if gas is getting to the carburetor, look into the carburetor throat as you open and close the throttle manually.

No fuel? Disconnect the fuel line from the carburetor side of the fuel pump. Crank the engine for a moment. If gas comes out, the blockage is between this spot and the carburetor throat, probably in the fuel filter (either an external type located on the fuel pump-to-carburetor fuel line or an internal type in the carburetor inlet).

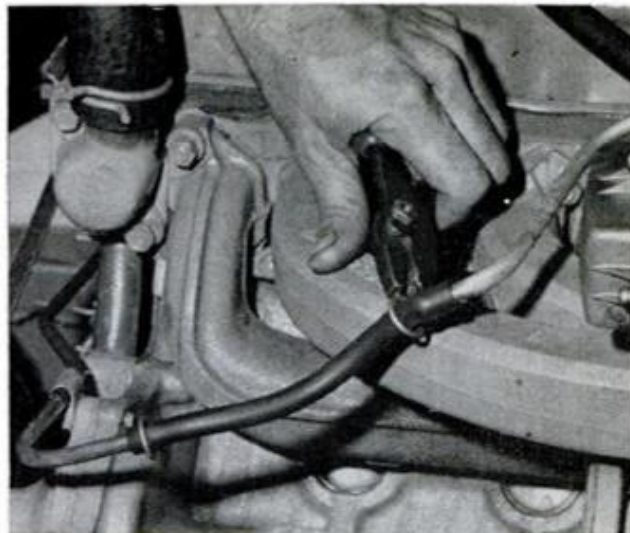
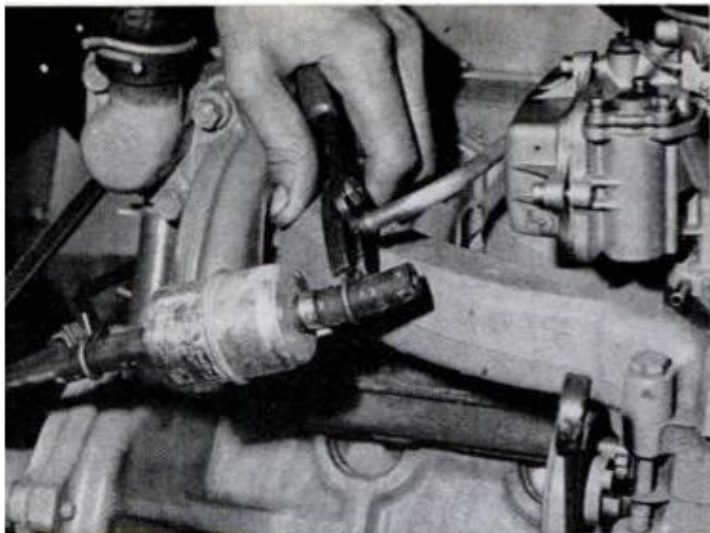
If you have an external filter, take it off and replace it with a length of 5/16-inch hose. If you have an internal filter, remove it from the carburetor inlet and hook the fuel line back up. In either case, you can run the engine without a fuel filter until you get to a service station, but don't forget to install a new filter as soon as possible.

Rarely will the fuel pump-to-carburetor fuel line get clogged, but if there is no other explanation for lack of fuel at the carburetor, remove the line and blow it out by mouth.

If you get no gas at the outlet side of the fuel pump, make sure the fuel line coming to the pump from the gas tank is tight. If an air-sucking loose connection is not the trouble, the fuel pump has no doubt gone bad.

Is an ignition failure indicated? Remove a sparkplug cable, insert a screwdriver into the boot so it contacts the terminal, hold the screwdriver about 1/4 inch from ground and crank the engine. If spark jumps, the ignition system is okay.

Plugs bad? Not likely under these circumstances, since it is almost impossible for all plugs to go out simultaneously and cause a moving car to stall. If there is no spark, however, make sure all electrical



CLOGGED FUEL FILTER will stop an engine dead. A length of $\frac{3}{16}$ -inch hose will serve as substitute bypass to get car started. If original filter was attached by holders, hose must be held in place by clamps

connections are tight. Push all sparkplug cables firmly onto plugs. Do the same for all cable terminals at the distributor cap. Pay particular attention to the cable from the coil tower to the distributor tower. If this one comes loose, it will stop you dead in your tracks. Tighten up on the primary wire between the coil and the distributor. This wire is usually connected at the distributor points so you will have to remove the distributor cap.

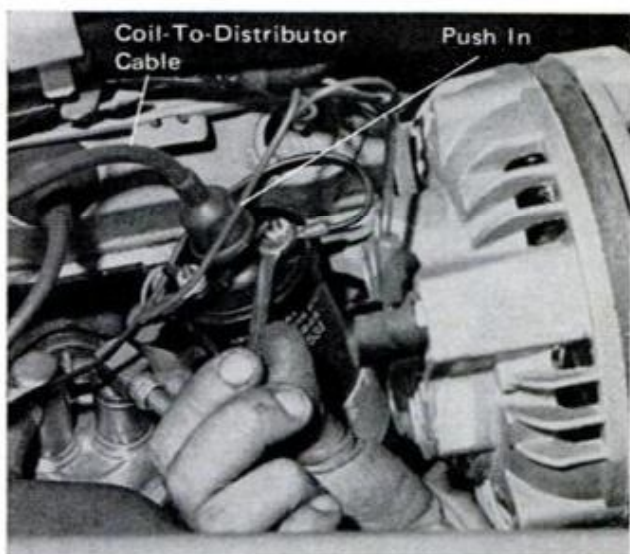
Also make sure the wire on the ignition switch side of the coil hasn't worked loose and that the connections at the ballast resistor are in place. (The ballast resistor, if you have one, is a white ceramic resistor on the firewall.)

If none of this gets you going, the distributor points may be fouled. Clean them off with an ignition point file if you have one. If not, give the points a pass or two with the striking part of a book of matches.

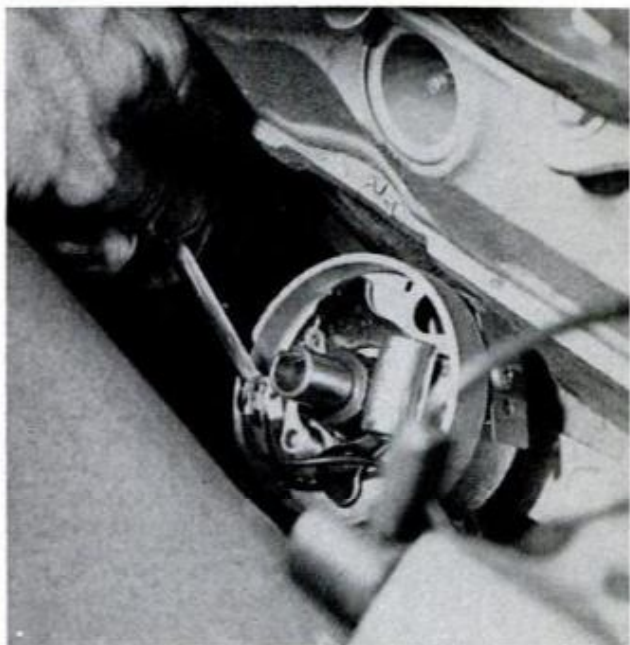
Finally, it could boil down to either a bad condenser or coil. In either case, there isn't much you can do unless you are carrying spares.

To find out which is at fault, disconnect the condenser and place it so it isn't grounded on the distributor plate, turn on the ignition key and open and close the points with a screwdriver. If a spark jumps the point gap, the condenser is bad. If there's no spark, the coil is the probable bottleneck.

There is one other possibility, although it's not too likely—a rotor spring clip that suddenly breaks off. You can check this when the distributor is open. A new rotor is the only help. ★★★



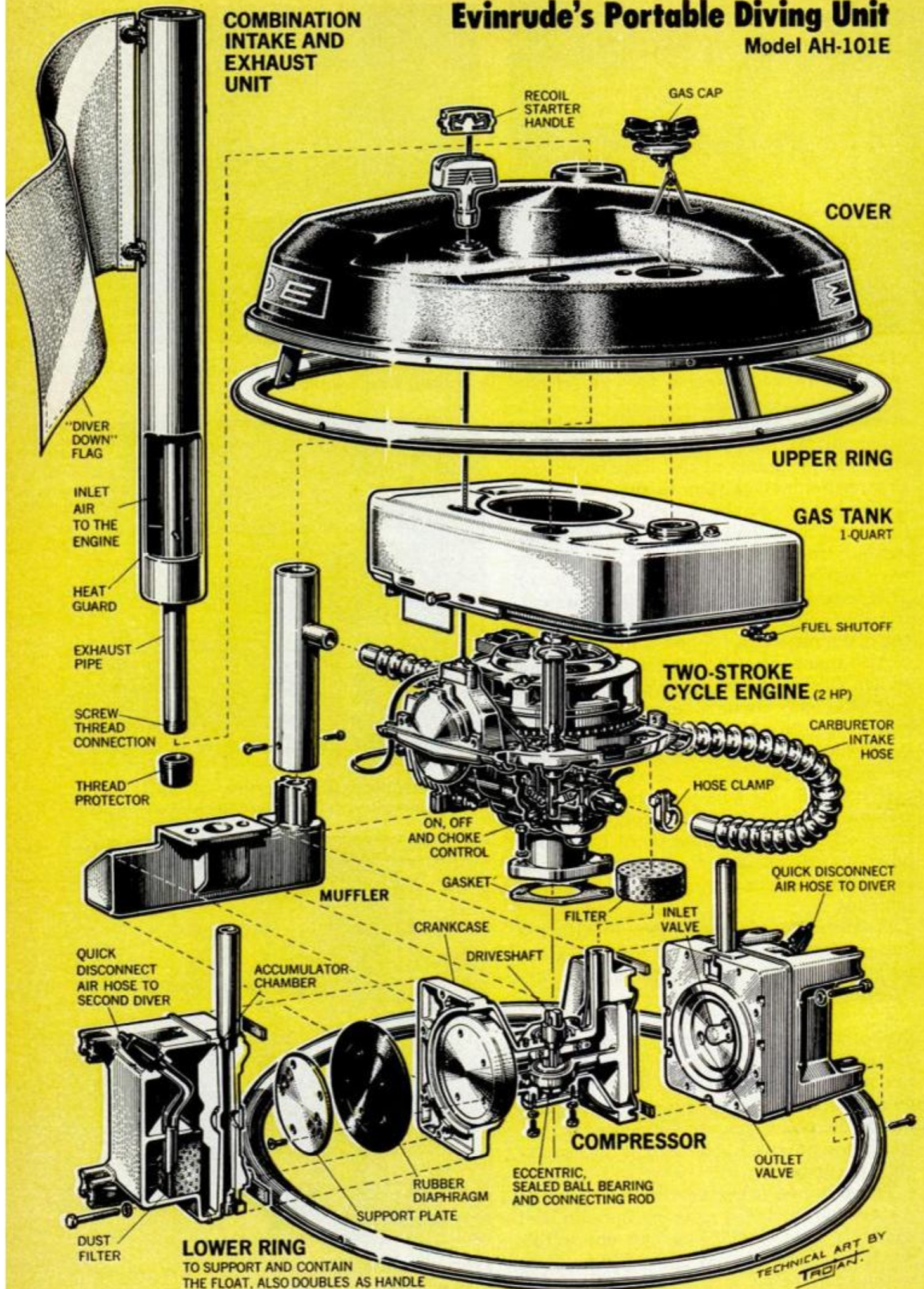
LOOSE ELECTRICAL CONNECTION may cause stall. Check connections, including coil-to-distributor cable



REMOVE DISTRIBUTOR CAP to make sure primary wire, usually connected at distributor points, is tight

Evinrude's Portable Diving Unit

Model AH-101E



LOWER RING
TO SUPPORT AND CONTAIN THE FLOAT, ALSO DOUBLES AS HANDLE

TECHNICAL ART BY
TRIGAN

OUTDOOR RECREATION

Aquanaut Makes Diving Easy

By DAN FALES

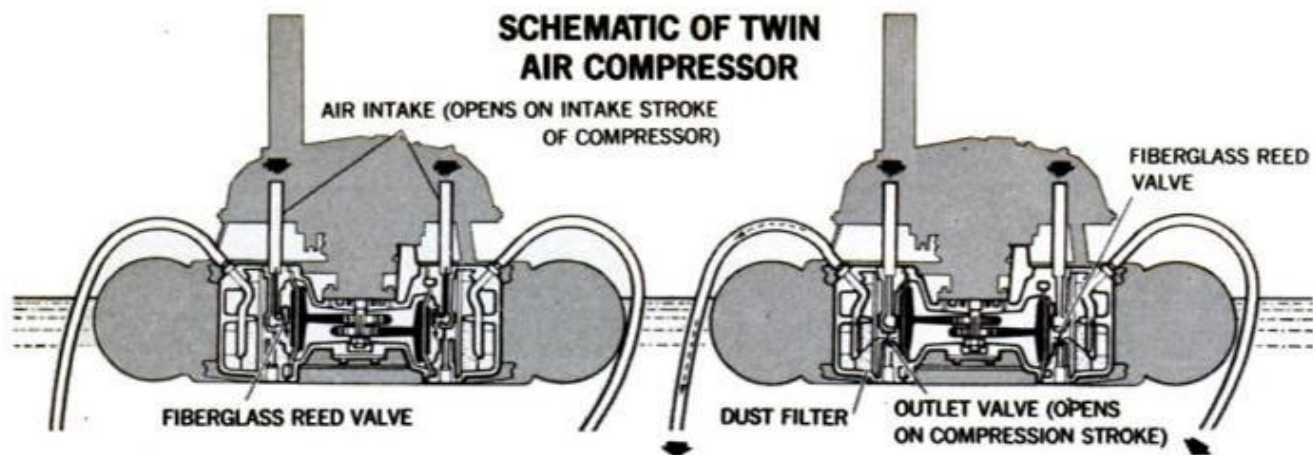


Now you can get into sport diving with this simple device



IF YOU HAVE NEVER CRUISED at the bottom of a state park, it's high time you tried. And it takes absolutely no experience. Just strap on a face mask, crank up a little two-cycle compressor and head for the bottom of John Pennekamp Coral Reef State Park in the Florida Keys. There are no tanks to harness on your back, no hours of costly lessons to learn how to use the equipment—there's just the freedom of exploring the undersea world.

This freedom is available through use of Evinrude's ingenious "Aquanaut." It's a floating air compressor operated by a two-hp motor. The whole 40-pound unit rides on a life-preserver ring on the sur-



face. Two air hoses lead from the compressor and attach to individual harnesses. Each hose is a different color so that a diver can keep track of his line. Hose length is limited to 25 feet—for a good reason.

Any scuba diver knows that if he swims below 30 feet he must figure on decompression time during his ascent. If a diver doesn't go below that 30-foot level he doesn't have to decompress. So the hose length is your limiting factor in determining your dive depth.

There's another reason for eliminating the need to decompress. When under water you always hear the drone of the two-cycle motor running above. During my tests, I suddenly noticed the drone from topside had stopped. This happened at the same time I became aware of a distinct lack of air in my face mask. It was an anxious moment and I surfaced immediately. What had happened?

The motor had simply run out of gas, a common occurrence that happens about every 20 minutes. All you need to correct this insecure feeling is climb aboard your boat, refill Aquanaut's one-quart tank with a mixture of one part outboard motor oil to 24 parts of regular automotive gasoline. Then, with the tank full, pull the starter cord, refit your face mask and dive back into the water. You can repeat this operation all day long.

Though there's little chance of anyone getting into trouble, it's always best to dive with a buddy. That's the reason for the two air hoses.

Even with the hoses dangling from the compressor, everything is so arranged that you can swim underwater while gently tugging the surface unit behind like a buoy.

Actually, this is a buoy with a diving flag flying from the exhaust pipe. But remember not to get too far from your boat. It's tough to swim a long distance on the surface after spending much time below. Also, currents can play tricks on you by moving you farther from your boat than you realize.

I can see where this unit would be great fun at resorts, camps, summer homes and aboard cruising boats. It's good for your guests if they haven't done much underwater swimming or do not have any equipment with them. The Aquanaut is great for shallow-water diving, but if you are inclined to go deeper, or if you wish to join a group of adventurous wreck divers or treasure hunters, it's not for you. What you want then is the sophisticated equipment used by the varsity: tanks, regulators, depth gauges and underwater watches.

Actually, for the price of the Aquanaut you can get a good scuba rig. The Aquanaut costs \$259; for an expenditure of about \$300 you can do very well in the scuba department.

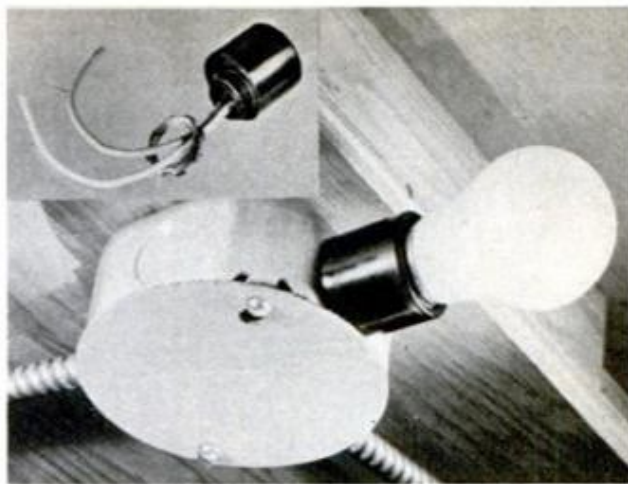
But if you are like me and find the 30-foot level quite nice, thank you, then the Aquanaut is for you and a buddy. However, I do wish the maker would develop a harness with straps that didn't rub the skin off my sides, and also develop a face mask that doesn't leak around the fleshy cheek area. Still, these are only minor complaints.

The Aquanaut is an easy-to-manage device for getting two people at a time into the beautiful underwater world. And they can do this without the rigamarole required in scuba diving. Given that design reason, you'll find that the Aquanaut is perfect. ★ ★ ★

HINTS FROM READERS

Junction-box receptacle

To improve the lighting over my workbench, I found that it isn't necessary to go to the trouble of installing an additional outlet box. Instead, I used a nylon knock-out socket-fuse holder. Having a junction box at about the right location, I simply pried out a knockout and installed the holder as shown.—*Joseph Braunstein*



Lengthen life of fiberglass mix

If you make a double container from two different-size containers, you can use the device to keep mixed fiberglass and hardener from setting up too fast. Fill the larger can half full with a slush-mix of ice and water, then, after mixing the fiberglass in the smaller can, set it into the ice water. I've found this works even at high temperatures.—*Ivan Mowry*



Bandsaw wheel replacement

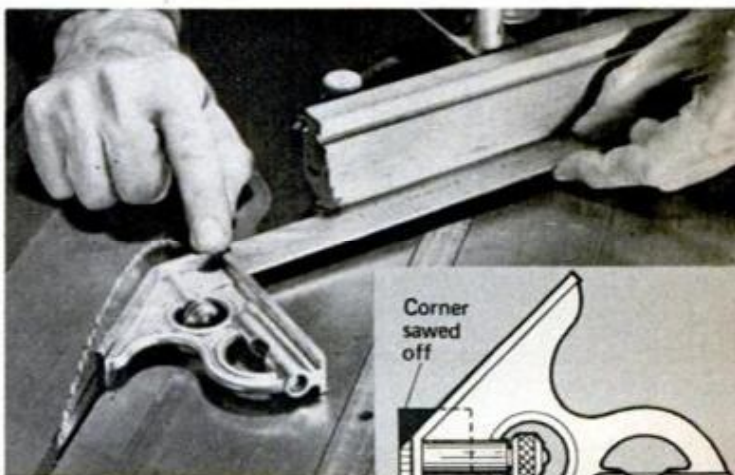
When the rubber facing on my bandsaw wheels deteriorated to the point that the blade slipped, I made "new" ones by cutting large bands from an old truck inner tube. After stretching them around the wheels, I started the motor and trimmed the excess by holding a linoleum knife against wheel's edge.—*Wilbur R. Gradin*



Small parts keeper

You can keep small parts, such as those you have on hand when doing electrical work, from rolling off a stepladder shelf if you do this stunt. It's nothing more than a strip of wide adhesive tape applied around the edge. It makes a simple and effective fence and, of course, can be easily removed when it's no longer needed.

—*William Swallow*



Modified combination square

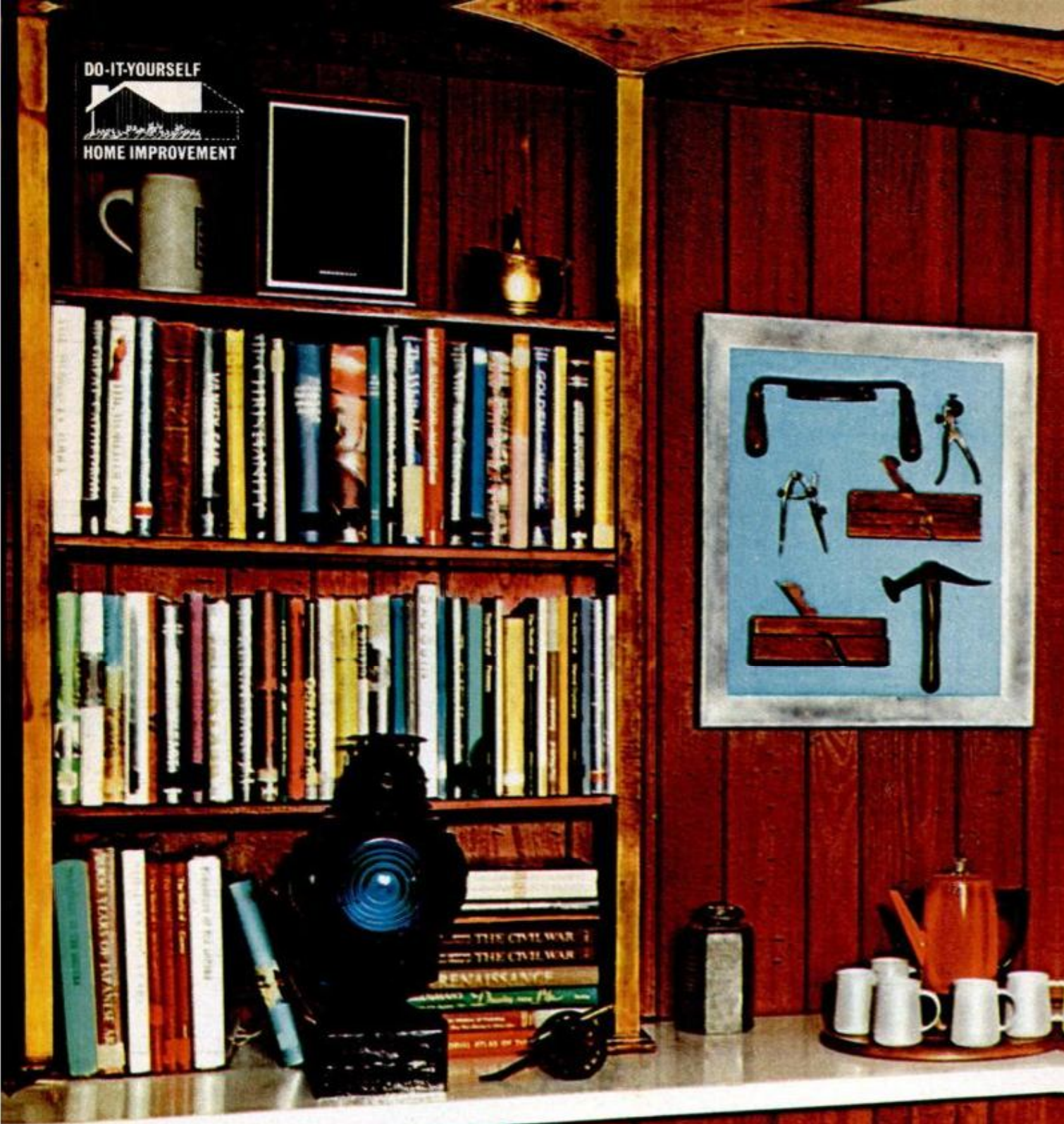
By making a simple change on my combination square, I've greatly increased the tool's versatility. All I did was saw off the corner of the blade—45° by about 5/8 in.—so that I can use the tool to accurately set my bench-saw miter gauge to the blade. An added bonus is that the square can also be used to check 135° angles.

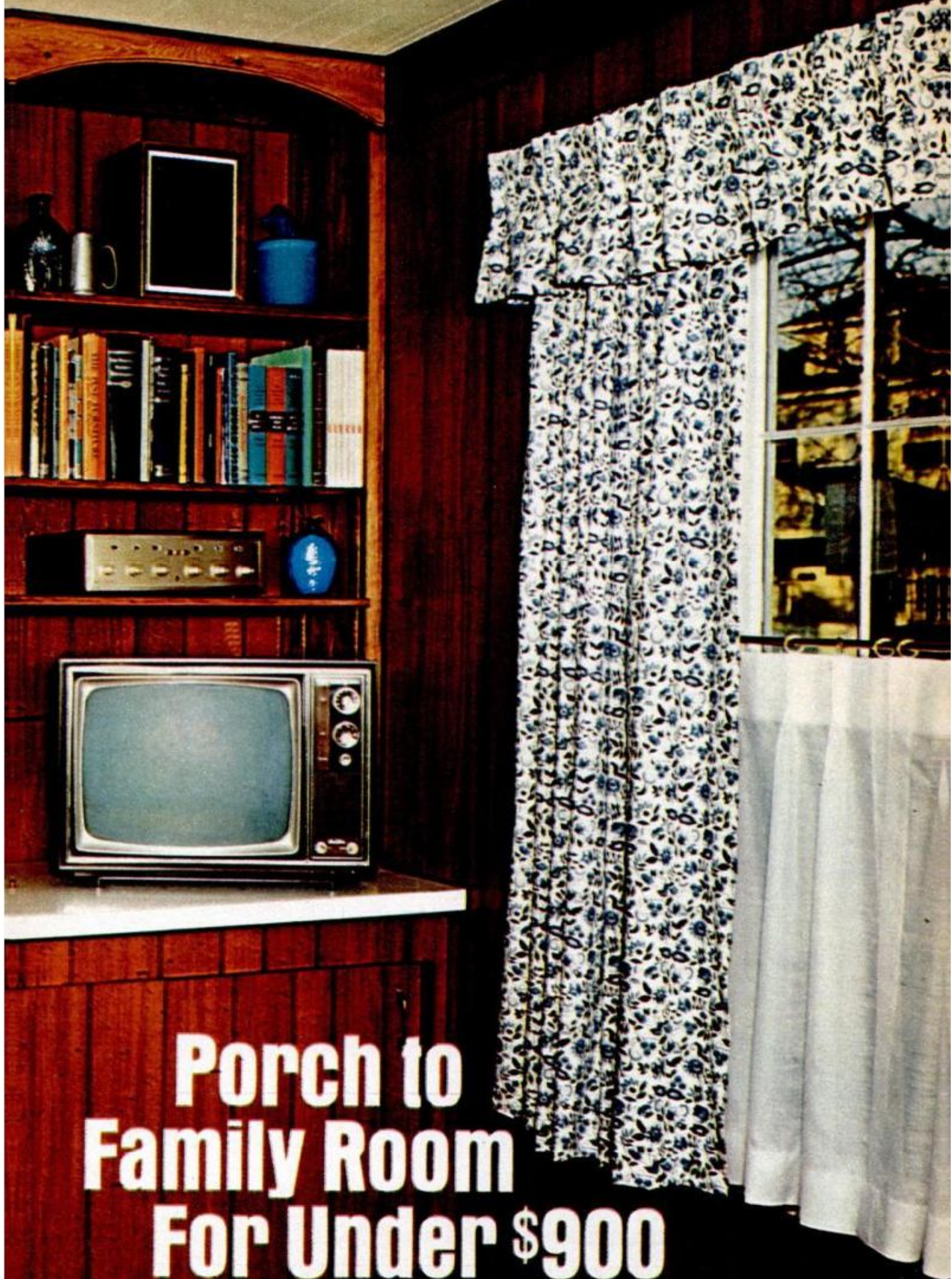
—*Robert F. Finch*

DO-IT-YOURSELF




HOME IMPROVEMENT





Porch to Family Room For Under \$900

PLEASE TURN PAGE 

Материал, защищенный авторским правом

More room for better living may already be well begun in an area now used only as a porch

By HARRY WICKS, Workshop Editor

Color Photo by Bill Aller, Styling by Robert Lotgren

THERE ARE REAL ADVANTAGES in buying an older home but there are also some points on the minus side. The biggest liability, as far as my wife and I were concerned, was a front sun porch that seemed more like a greenhouse than a room. It had nine windows and a pair of French doors. This made it just about impossible to arrange furniture sensibly and get full use of the room.

The room required a lot of curtain and window-washing, plus twice-a-year storm and screen-changing chores. This—and our real need for a family room—prompted the project you see on these pages. By doing it myself, I was able to keep total construction costs to about

\$810. I'd guess that in my area (Long Island) the same job by a contractor would have run close to \$2500.

Windows. The project was started by closing in the windows as shown. The double-mullion window installed in front is sized to satisfy FHA requirements—5 percent of floor space for ventilation, 10 percent for light. Vinyl clad on the exterior, the windows won't need painting for at least 10 years. And the muntins are removable. When the glass needs washing, it's a simple four-pane job. The windows come finished on the exterior; you, of course, supply the interior trim.

(Please turn to page 210)



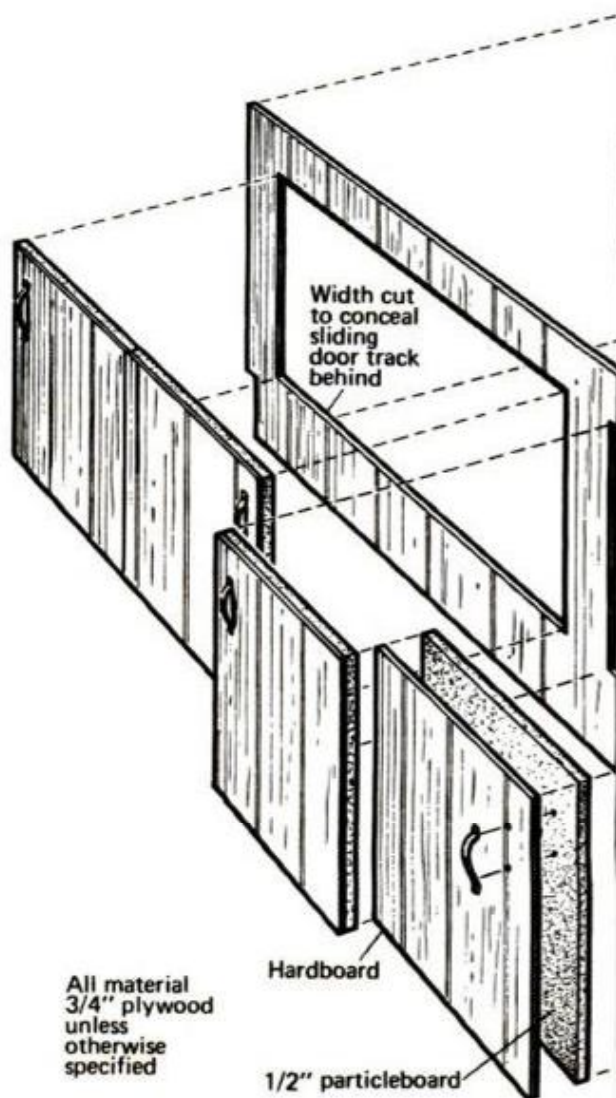
BEFORE: Over-windowed porch on front of older home was of little use—lots of work inside and out



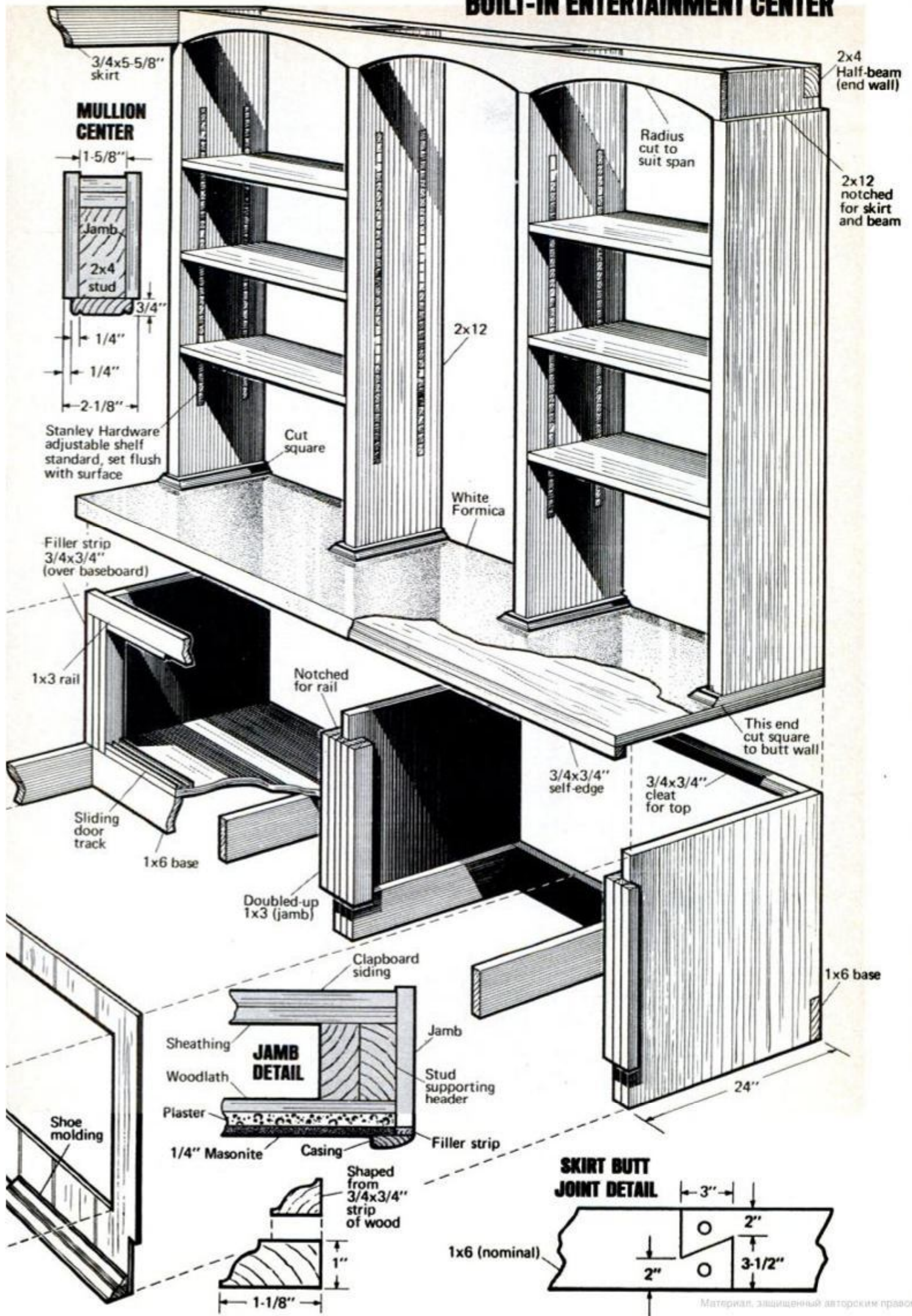
AFTER: Double window meets FHA minimum requirements; rebuilt room functions for everyday living

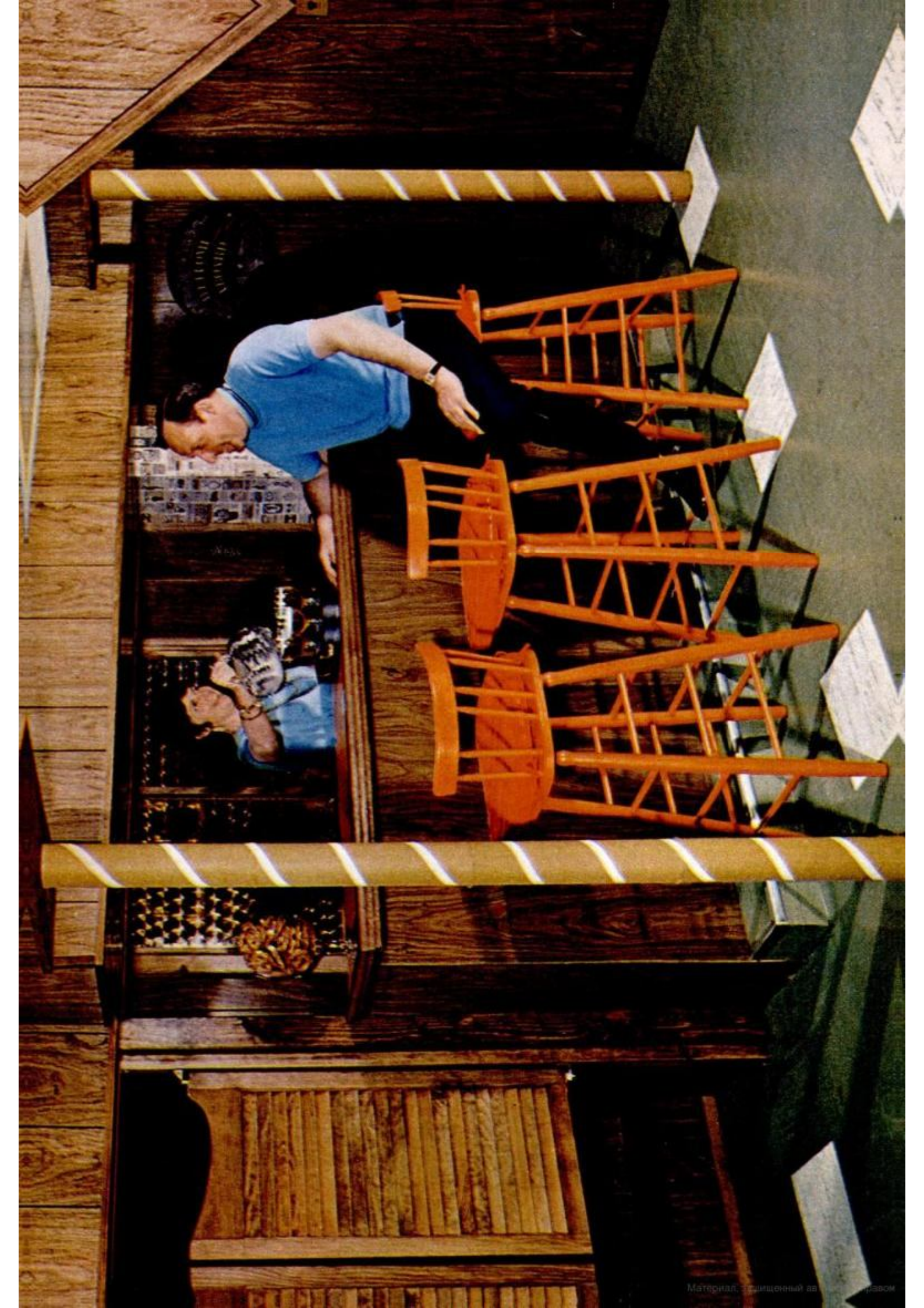
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Technical Art by Fred L. Wolff



BUILT-IN ENTERTAINMENT CENTER







A Handsome Space-Saving Bar

With the bar located under low-hanging, boxed-in heat pipes, this finished basement uses 'wasted' floor space to best advantage.

By HARRY WICKS, Workshop Editor

Color Photo by Bill Aller. Styling by Robert Lofgren

WHEN YOU DECIDE to refinish your basement, the first, and wisest, step you can take is to draw up a floor plan. On it, besides the overall room dimensions, indicate floor-to-ceiling height, locations of pipes hanging from joists, meters, electric panels and any other apparatus that might require an access panel.

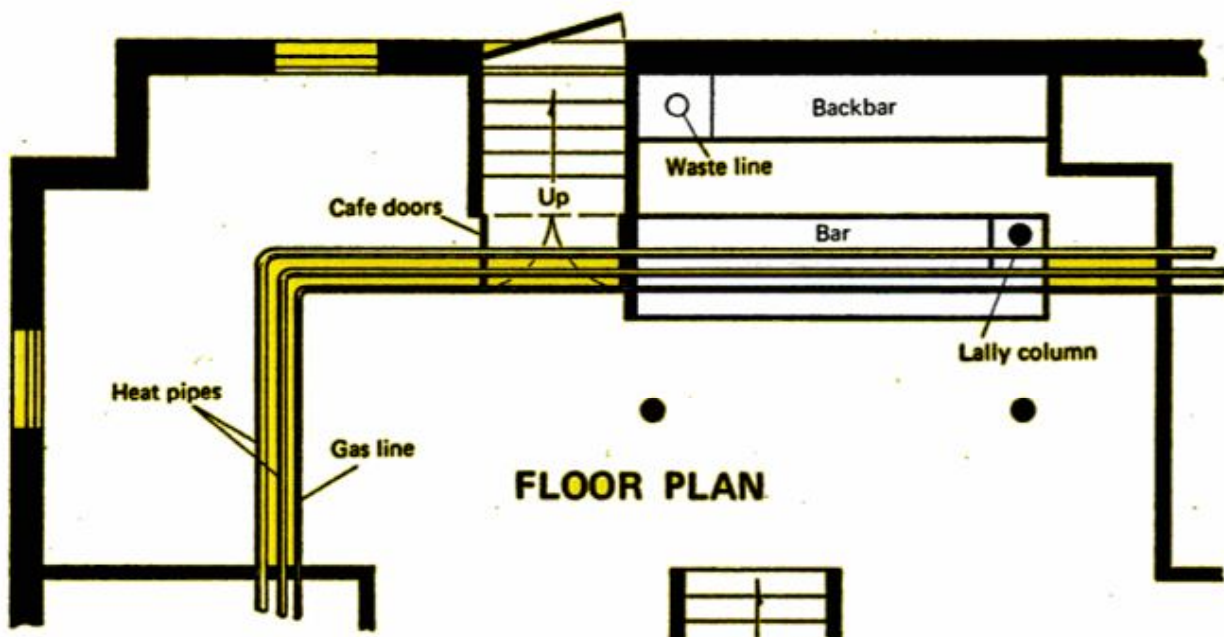
The Eugene P. Southers of Bellerose, N.Y. approached their basement project in just such a manner. Then, armed with this information, they determined how the entire room would be treated logically and attractively. Since they do considerable entertaining (and the family includes six active youngsters) they felt there was a need for a "wet" bar (a bar with a sink).

There's no arguing that a bar takes an inordinate amount of floor space. So, where to place it is of considerable con-

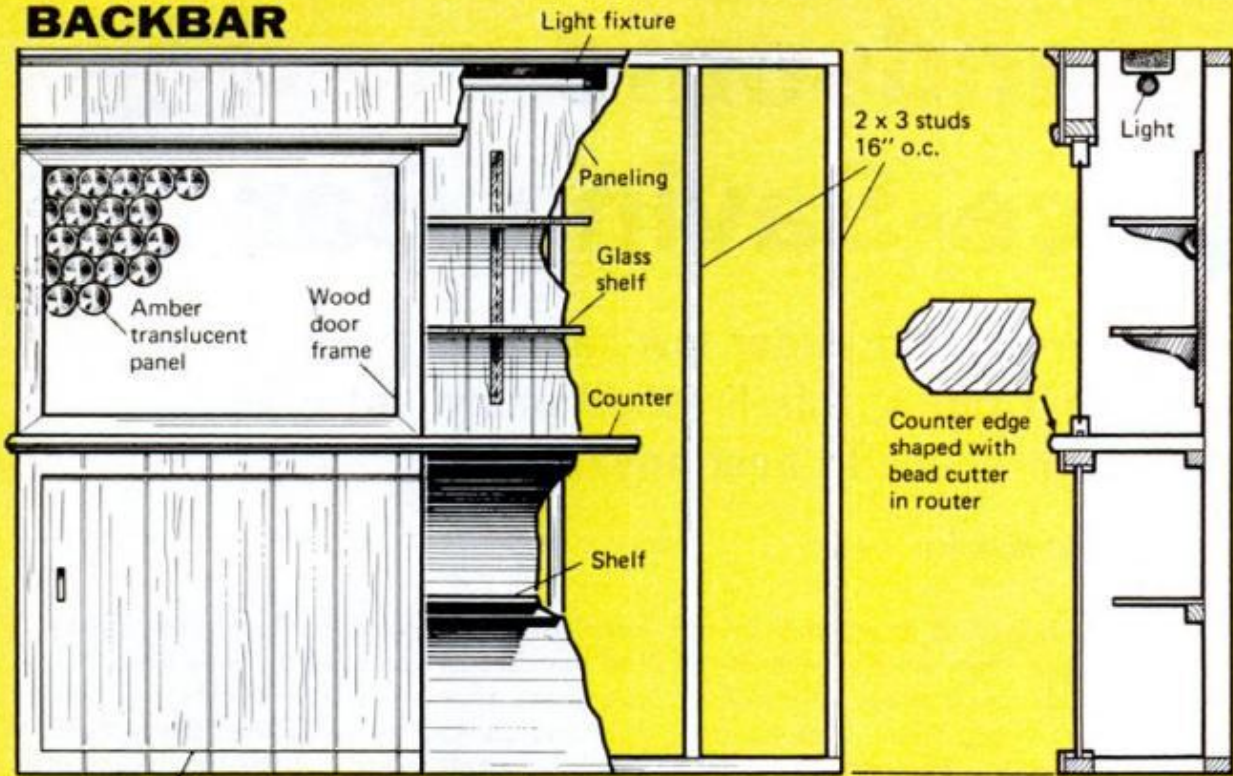
cern. In their layout (below) they located the bar directly beneath several low-hanging heat pipes. (There is also a water line and shutoff valve in the cluster hanging below the joists but for clarity's sake, they are not shown in the art.) This location is space that would otherwise have been wasted because of the drop ceiling. As can be seen in the drawings, there is plenty of headroom for the bartender behind the bar.

The bar is built to architectural standards. The dimensions shown give a comfortable working area, and you will notice that most of them are variable. The variables, of course, are for customizing the bar to suit the person who will use it.

The sink was no problem because in this house the drain-waste line exits from the cellar floor. But if your line is hung



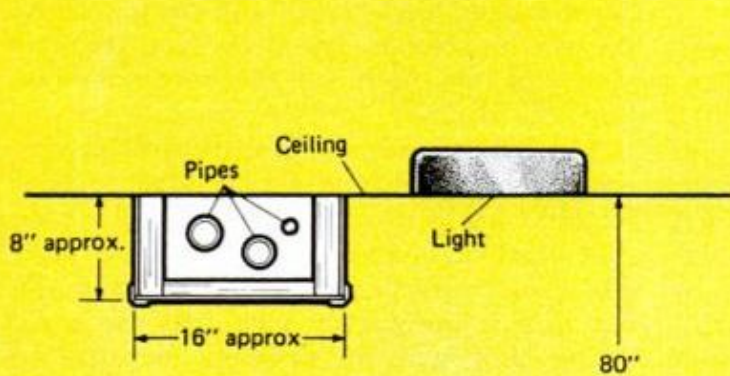
BACKBAR



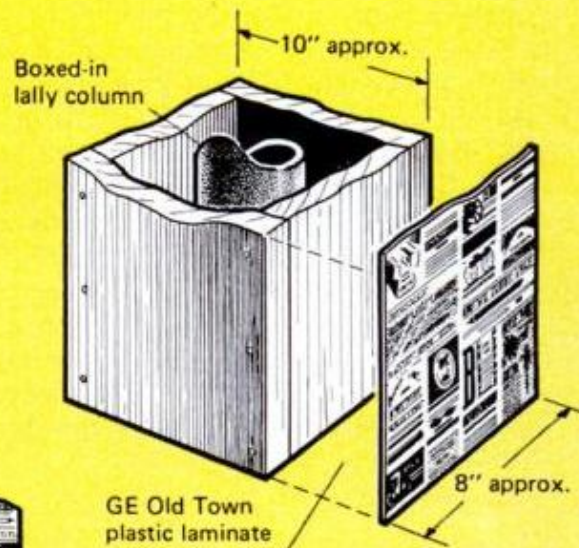
Sliding door, 1/4" paneling over 1/2" particleboard

ELEVATION

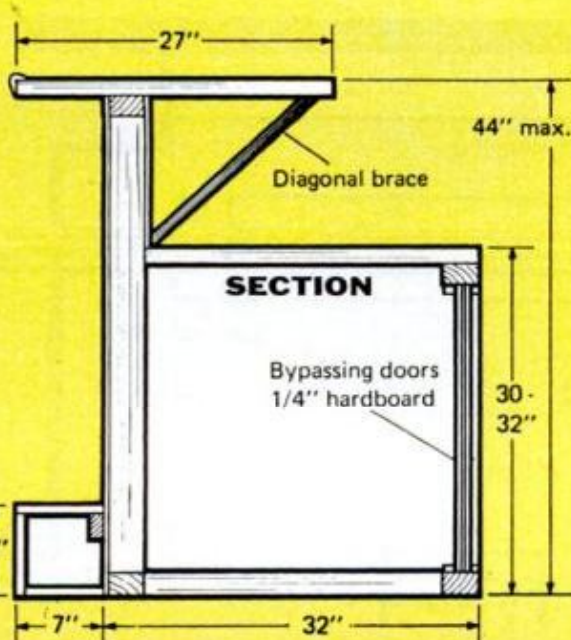
SECTION



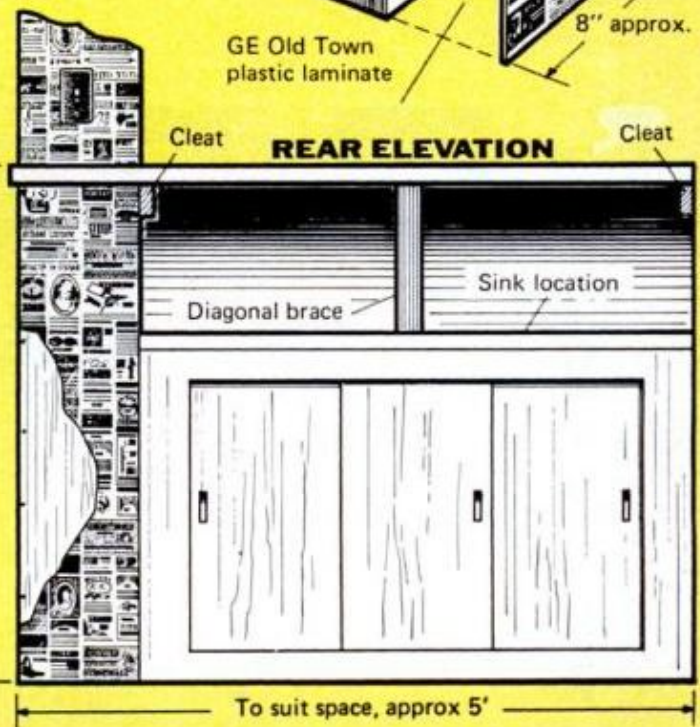
BAR



GE Old Town plastic laminate



SECTION



REAR ELEVATION

To suit space, approx 5'

from the joists, you can install a pump to handle water discharge.

As a matter of convenience and to reduce maintenance, Souther used plastic laminate on the work-counter surface behind the bar. And he went all the way by installing a laminated backsplash. In the final analysis, his decision was a sound one.

The lally column at one end of the bar was slightly out of plumb; thus, as can be seen in the drawings, it took considerable material to box it in. And the look was not good. So it was decided to make a strong point out of a weak one by making it decorative. Since the bar top was laminated with Formica's Persimmon (suede finish), the laminate applied to the boxed-in lally was selected to heighten the festive air that a party room should have. GE's Textolite Oldtown 6000 pattern was the choice.

Another factor in selecting this particular location for the bar was the "nook" that existed in the foundation wall. It was a natural for a back bar. Fitted below with sliding doors that can be locked with a standard sliding-door lock, the space behind provides storage for party potables and the like.

For appearance's sake, the deck (the counter separating the upper and lower sections of the cabinet) was made of 5/4-in. (nominal) stock. The top and bottom edges were shaped with a bead cutter in the router to create an architectural shadowline. The deck was stained to match the paneling and treated with two coats of semigloss varnish.

To help eliminate the dark, cavelike look that is common in many finished basements, the upper part of the cabinet was fitted with a pair of sliding doors made of translucent, amber panels of "bottle" design. Then, with a light installed overhead and glass used for shelving, the effect is much the same as if it were a first-floor window.

Though not obvious in the photo on page 160, there is an access panel fitted under the dropped ceiling for quick access to that water shutoff valve mentioned earlier. Souther chose to use the type illustrated on page 155, Dec. '69 *PM*. All in all, his planning paid off; the room provides an area for the youngsters, another for adult gatherings and the handsome bar to serve as a focal point. ★★★

SEPTEMBER 1970

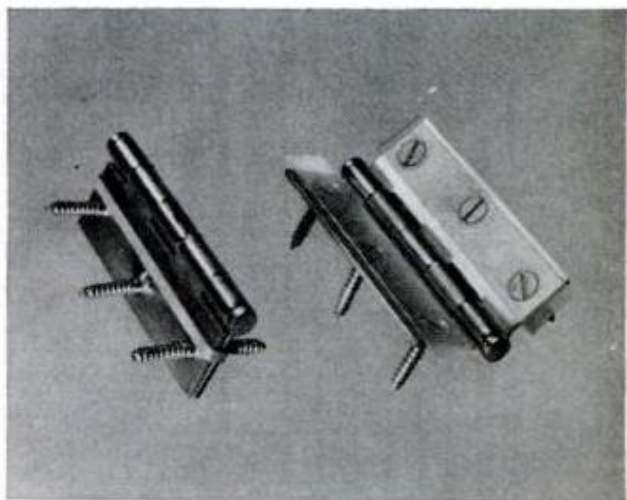
HINTS FROM READERS



Eyeglass case 'toolbox'

An ordinary eyeglass case provides a fine container for drill bits and other small workshop tools or parts. The cases are felt-lined and have a strong spring hinge that keeps the cover tightly closed. If you decide to use several cases for small-parts storage, label each of them for quick identification of the contents.

—Edward L. Fisher



Store screws with hinges

Often when you store hinges for future use, the screws get mislaid. To be sure that you will have a complete set of screws for each hinge, here are two ways for storing the screws right with the hinge. One way is to insert the screws, close the hinge leaves and clamp them with a rubber band. The second method is to merely stick a strip of cellulose or masking tape over the screwheads and leaves.

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Pretty, Use-Full Walls

**There's no reason to let walls just stand there.
Make them see-throughs with a storage-space bonus**

AS YOUR FAMILY GROWS, so does the accumulation of personal possessions. It becomes increasingly clear that the more square feet of living space in your home you can utilize efficiently, the greater your family comfort will be. A logical, and frequently the most economical, place to turn to for desperately needed storage space is a wall. The three wall ideas shown on these pages, in addition to satisfying particular family storage needs, have something else in common: Each is well-designed and adds to the looks and the value of the home.

The long see-through wall shown above

is framed to give a deck (or counter) at a height of approximately 36 in. The deck and post enclosures are of nominal 1-in. clear pine. The cabinet on the living room side was paneled; on the opposite side narrow pine shelves were installed to hold a collection of knickknacks.

Above the deck, large dowels (closet poles) were installed to give the illusion of greater room height and size. Thus, several advantages were gained by converting a flat, run-of-the-mill wall into a customized "room divider."

The unit shown at the top of the facing page was designed by a pro. The

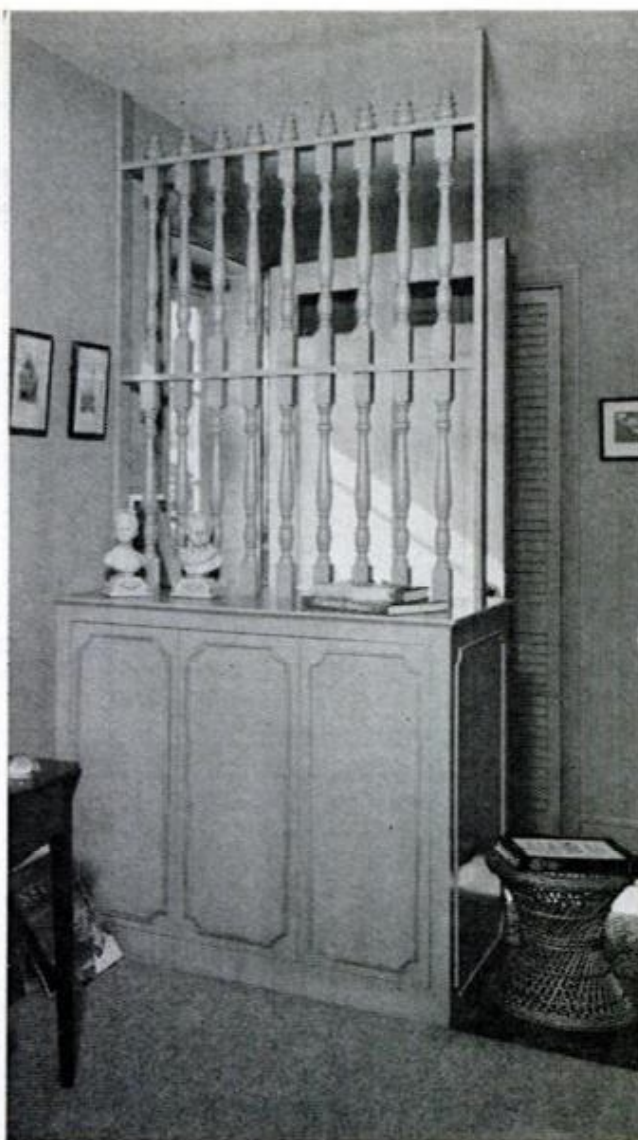
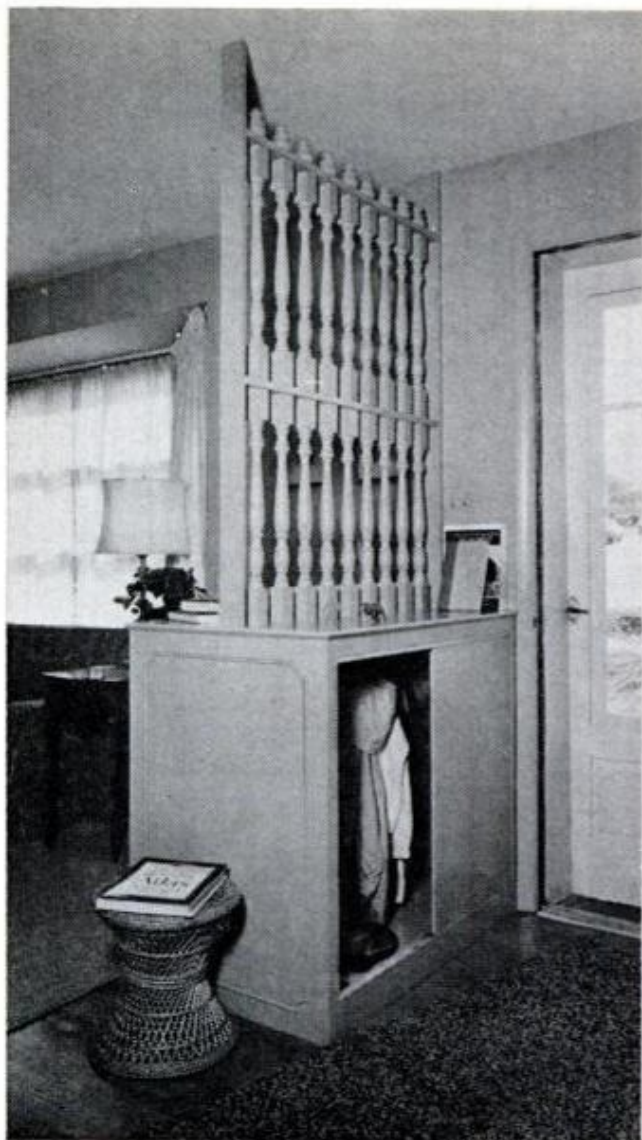


PHOTO BY MARK BLAIR

ENTRY WALL, viewed above from both sides, provides storage area for stereo components, closet for children's wardrobe and attractive foyer at the front door. This handsome divider was created by Top Recker, A.I.D.

homeowners required a built-in that could be used for stereo equipment and a convenient closet for their children to store boots, mittens and so forth. Additionally, they wanted it placed near the front entrance to create an entry way. The design accomplishes all three aims.

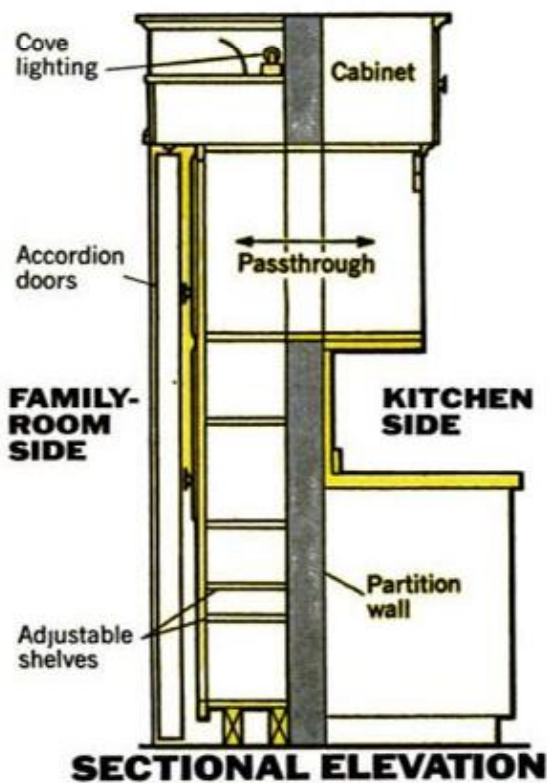
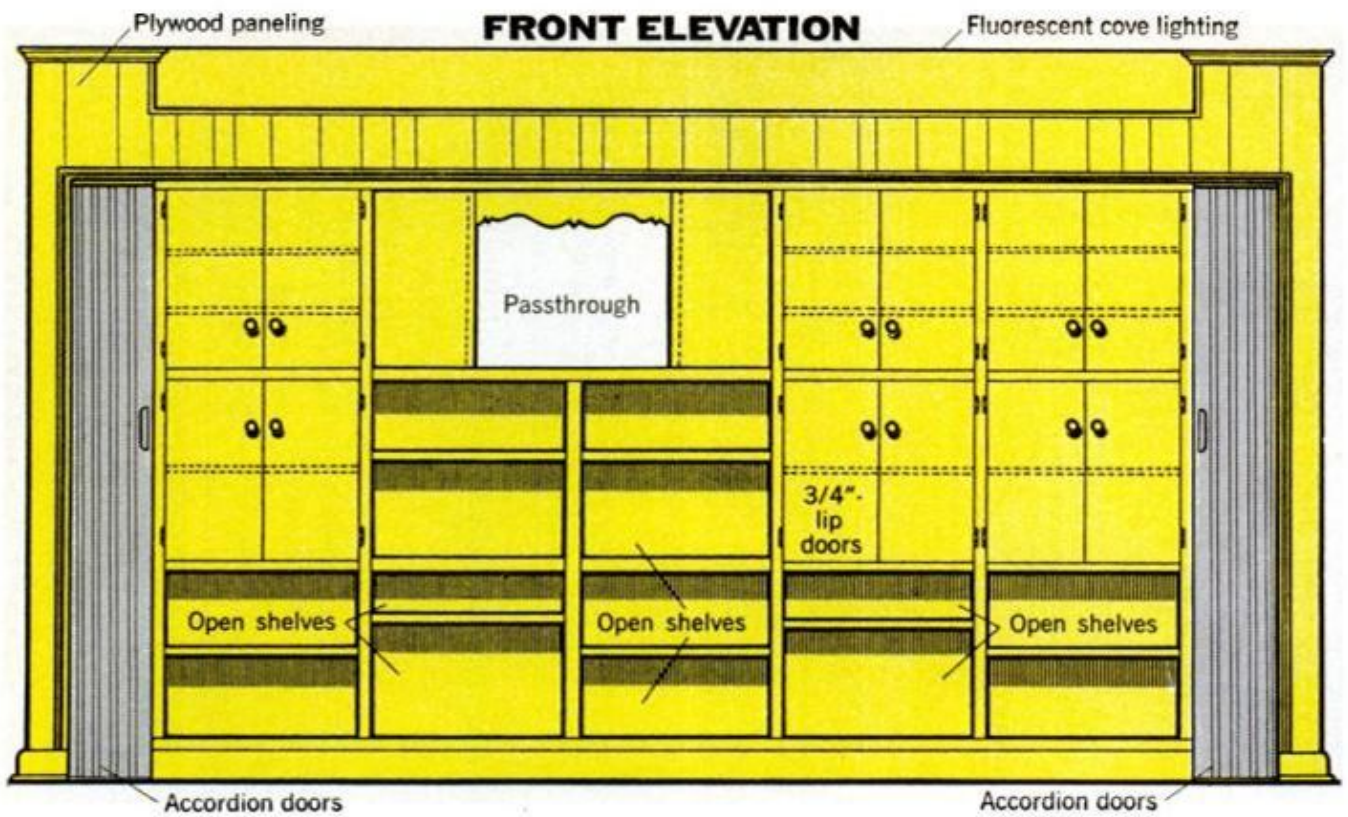
The cabinet is 27 in. wide, 39 in. high and 42 in. long. In turn, it is topped by a double-deck set of 18 hand-turned balusters (nine per row). The folding doors on the living-room side are trimmed with factory-made moldings for a decorator touch and fitted with friction catches for easy access. The interior shelves are removable; thus, should storage needs ever change, there is a built-in flexibility to meet them.

The children's side of the cabinet, by the front door, is fitted with sliding doors for quick use. Inside, there is an accor-

dion-type wood hanger with peg hooks for small-fry clothes plus the storage for boots and the like. To match the existing decor in the room, the entire cabinet-divider unit was painted a Wedgwood blue shade.

The third unit shown was designed expressly to handle the storage needs in a playroom next to a kitchen. It's a built-in along a wall, 15 feet long, that has been divided into five equal sections. Each of the five youngsters in the family, from toddler to teen-ager, has his own personal storage area.

Horizontal members are spaced so as to create 13 sections (plus a pass-through to the kitchen for snack serving). Six of the sections are fitted with doors to protect the older children's more valuable games and possessions from the little ones' inquisitive hands. The remaining lower



FULL-DEPTH WALL gives that ample storage so much appreciated by a large family. Accordion doors hide it all when desired

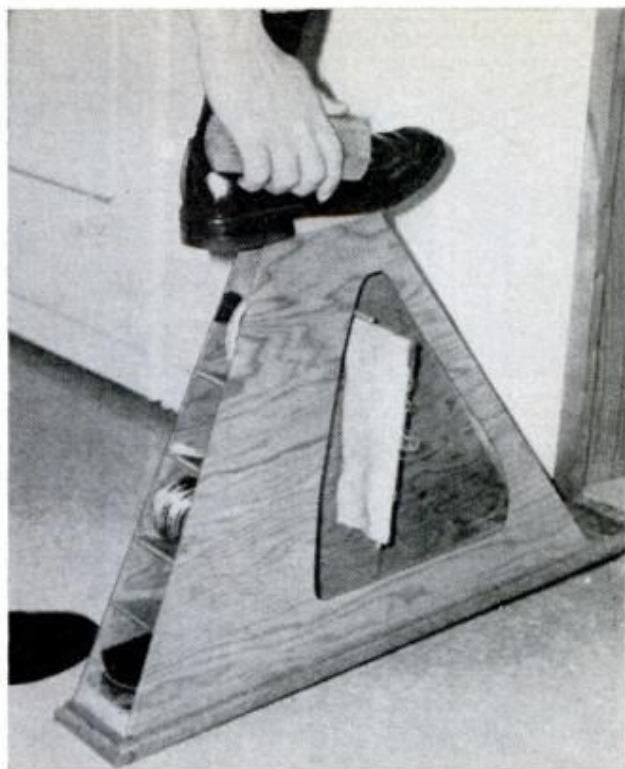
sections are fitted with 18-in. adjustable shelves.

The unit shown was constructed entirely of $\frac{3}{4}$ -in. plywood (except for cleats, nailers and the like). To withstand abuse, the unit was finished, inside and out, with a primer and semigloss paint.

To hide the unavoidable clutter of toys that always seems to be present on the toddler's open shelves, accordion doors were installed in front. Then, when the

room is used for adult parties, the paraphernalia behind can be quickly removed from view.

If the wall is to be used primarily by adults or teen-agers, the face of the unit could be built of cabinet-grade plywood and stained for a natural finish. Another method would be to treat the facing with either $\frac{1}{2}$ -in. plywood or particleboard, and then glue and nail prefinished paneling over. ★★★



Narrow cabinet space in laundry saved from going to waste

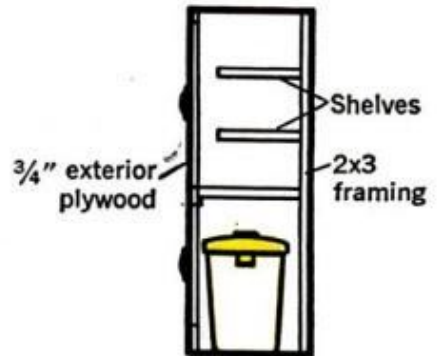
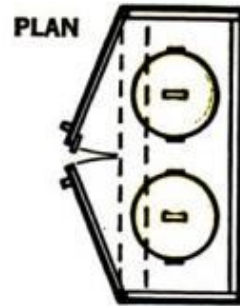
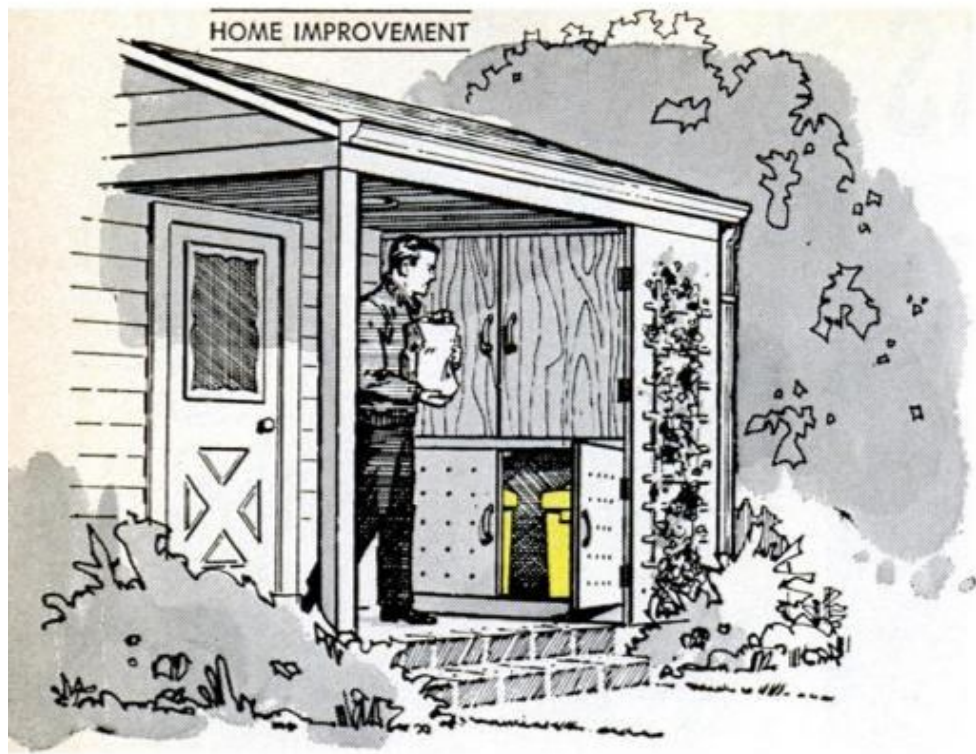
If you are planning to build new, or remodel existing, cabinets in your laundry area, here's one good way to make use of that leftover narrow space that always seems to exist. It's a built-in storage unit that holds all of your shoe-shining needs—polish, rags and brushes. The one shown occupies a scant 4 in. of space and is installed with hinges so that it swings down to provide a comfortable footrest for shin-

ing your shoes. For sturdiness, build the entire unit of $\frac{3}{4}$ -in. plywood. And, since the unit will be exposed to almost daily use, make certain it is well put together; use an ample amount of glue and brads. If you put prefinished factory-made cabinets in the laundry you can take the completed stand to a local cabinet shop (along with a drawer front) in order to match the cabinet finish.—*R.S. Tupper*

Back of basement partition can be handsome, too

Generally, when a basement or recreation room is remodeled, the side of the wall in the unfinished area is left untreated. Though that space may be used for nothing more than seasonal storage, it can still be made attractive with a minimum investment of time and money. Our solution was to first stain the framing members a dark brown and then apply a coat of white paint to the back of the paneling. The result is a resemblance to the half-timber English Tudor style. For color accent, we then applied several travel posters between studs with wallpaper paste. For easy cleaning, the paper was coated with shellac.—*Edward G. Gold*





SIDE ELEVATION

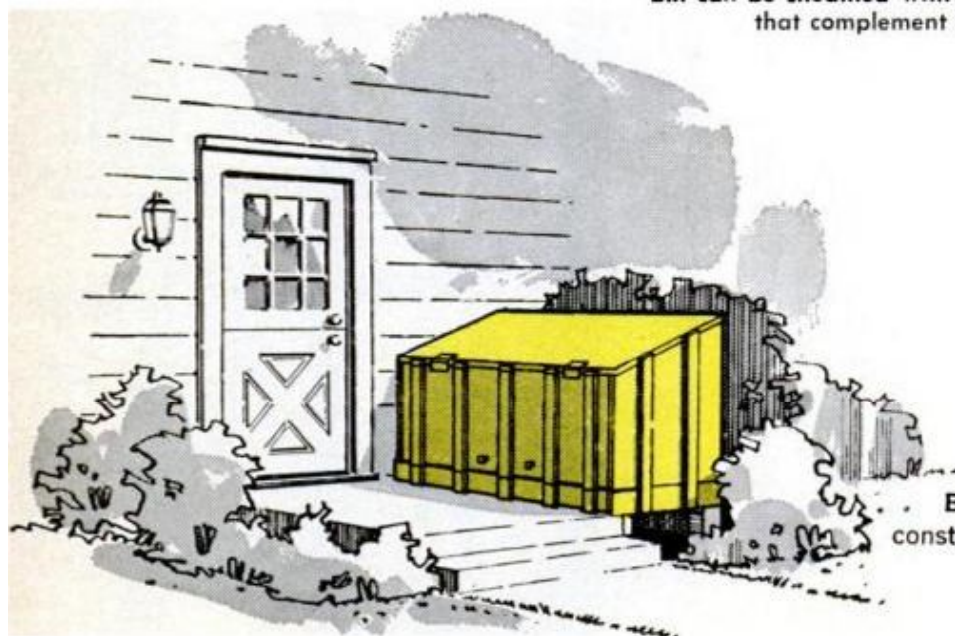
ROOF OVERHANG on a rear porch makes the latter an ideal spot for a trash-can hide-away. Doors to the trash-can space are of perforated hard-board, provide ventilation. Space above can be used for seasonal storage after installation of several adjustable shelves

FOUR WAYS TO HIDE

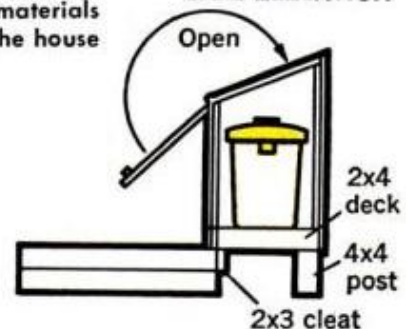
WHAT CAN BE DONE to hide that back-yard eyesore—the cluster of needed, but unaesthetic, trash cans—from view? We asked Gerald Geerlings, A.I.A. to tackle the problem. It's interesting to note that all four of his practical solutions have two good design ideas in common:

● **Location:** Each is convenient to the service entrance, keeping trash-hauling steps at a minimum.

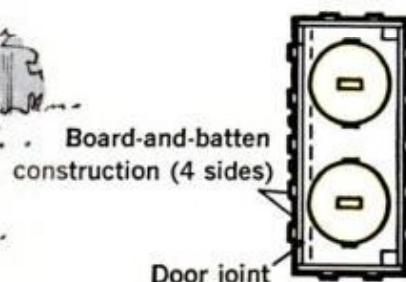
ROOFLESS PORCH can also be used for small structure, but top of enclosure should be pitched to provide positive water runoff. Though board and batten construction is shown here, exterior of bin can be sheathed with materials that complement the house



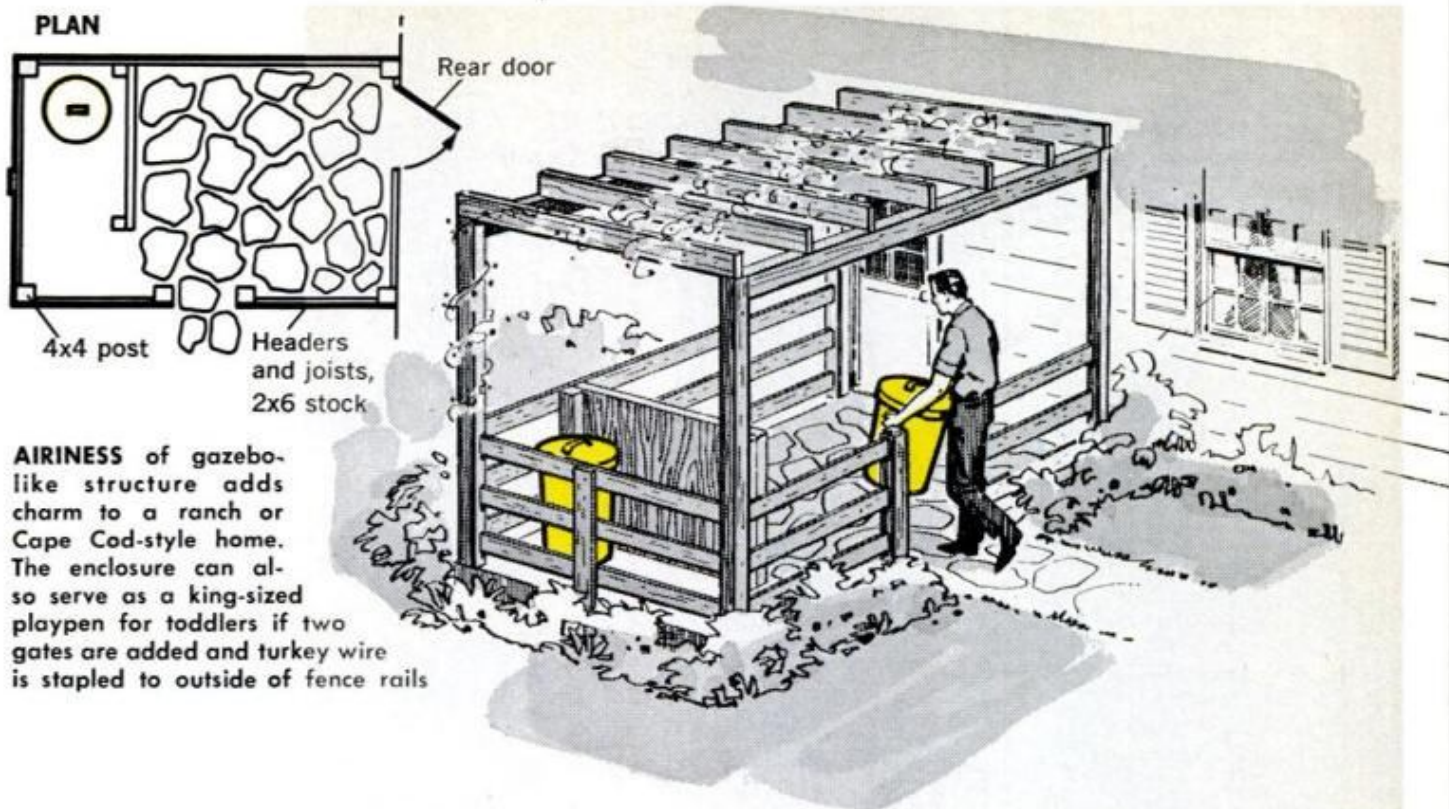
SIDE ELEVATION



PLAN



POPULAR MECHANICS



AIRINESS of gazebo-like structure adds charm to a ranch or Cape Cod-style home. The enclosure can also serve as a king-sized playpen for toddlers if two gates are added and turkey wire is stapled to outside of fence rails

TRASH CANS

A portfolio of good ideas for keeping those unsightly necessities concealed, yet very accessible for everyday use

- **Design flexibility:** Each allows for a custom exterior that suits the house design. Though the four types shown are attached to the house, they can be built as free-standing units if property lines and location make this solution more desirable. Bearing corner posts are of cedar, treated with wood preservative, plywood is exterior grade and if you add wood members such as battens, redwood is recommended. Use galvanized nails or brass screws for all assembly to avoid beauty-marring rust stains on the paint finish.—*Harry Wicks, Workshop Editor*



IF GARBAGE ROUTE in your locale includes a back-yard pickup, this built-in should keep collector happy. To ease hinge strain, drop door used by the collector can be equipped with two sturdy chains

Benches You'll Want to Build for Your Deck

HAIL, HAIL the gang's all here for the cookout, but where do they park when their legs get weary?

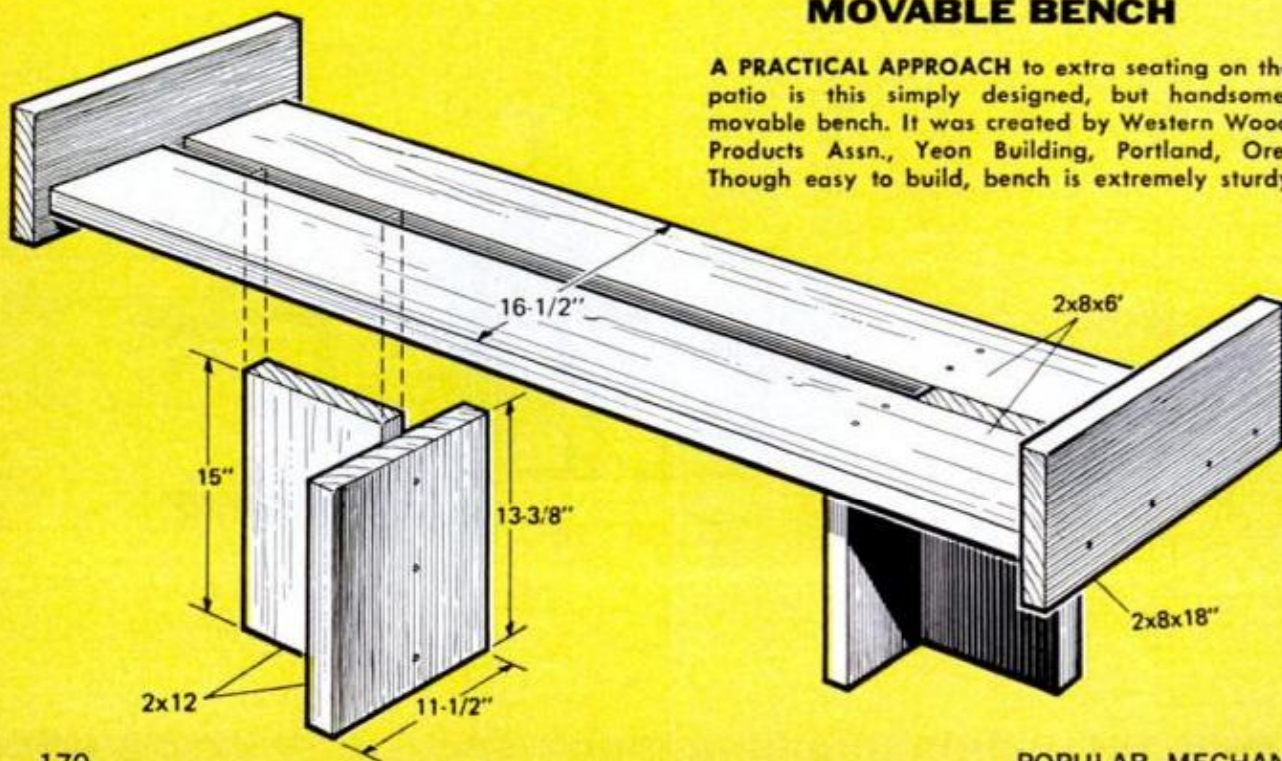
From spring through fall, outdoor entertaining is a real part of the American scene. But when there's a big party group in your back yard, you may have a problem finding seats for everybody.

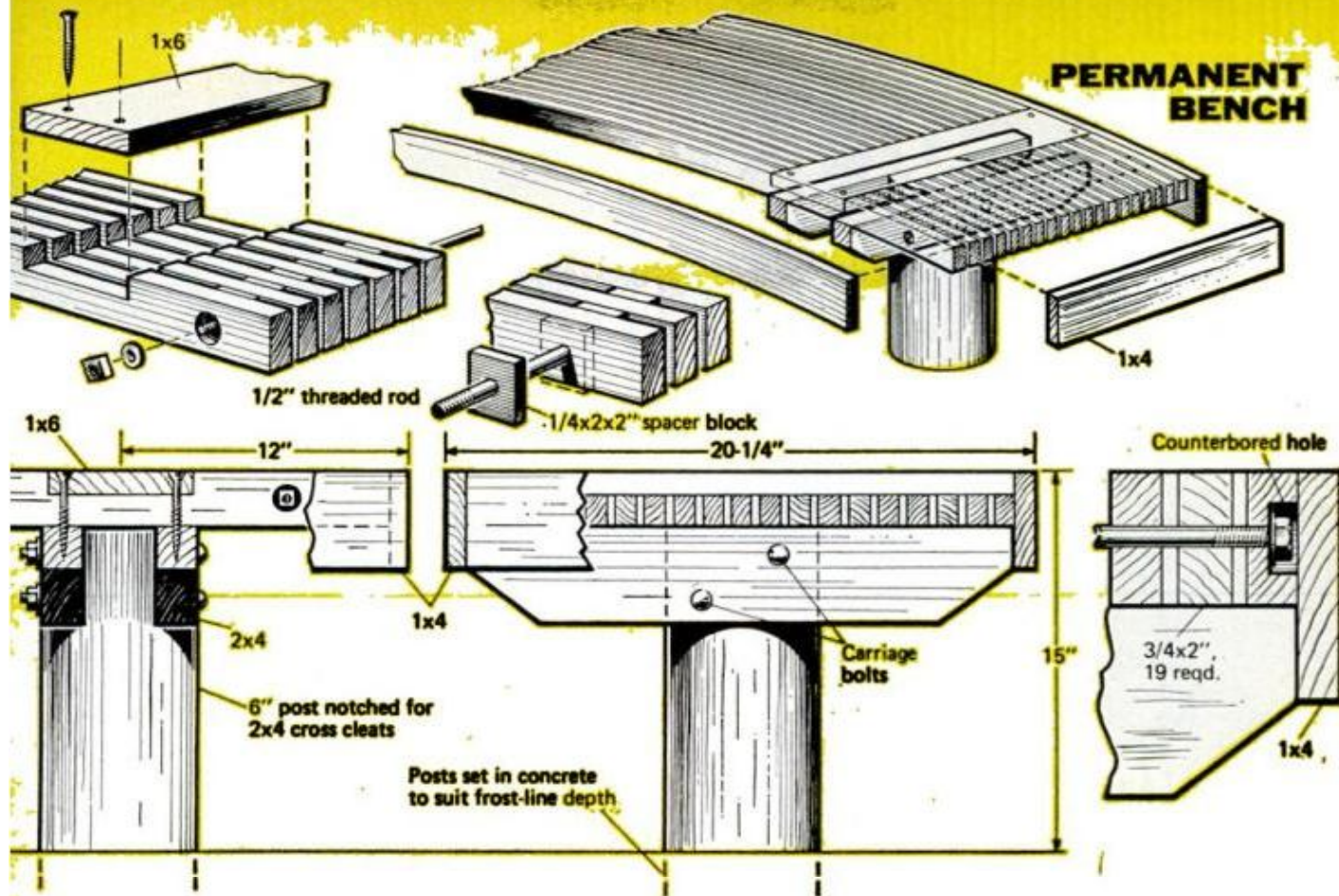
If you are a bit short in back-yard seat-

ing, you may want to build one or both of the beauties shown on these two pages. These benches are very good-looking, sturdy and, best of all, they will last for years. The movable bench (on this page) is constructed of eight standard-size pieces of fir. Thus, it is simply a hammer-and-saw project. You just cut the pieces to length and assemble them.

MOVABLE BENCH

A PRACTICAL APPROACH to extra seating on the patio is this simply designed, but handsome, movable bench. It was created by Western Wood Products Assn., Yeon Building, Portland, Ore. Though easy to build, bench is extremely sturdy





The curved bench shown below is a little more involved to build and is generously dimensioned, but, if your patio is modestly scaled, simply adjust the bench's length proportionately to suit. This bench is permanently installed and is fastened to posts which in turn are embedded in concrete. Designed for the California Redwood Assn., 617 Montgomery St., San

Francisco, Calif., by landscape architect John Staley, the bench, like the privacy screen, is of redwood. Notice how gaps between slats are assured by use of spacers where the threaded rod goes through. These gaps are necessary—they permit water to drain.

For a finish, sand and then apply two coats of clear exterior sealer. ★★★





PLASTIC PIPING

Makes You an 'Instant Plumber'

It's rigid, lightweight, heat-toughened and, best of all, easy to fabricate and install

By RICHARD DAY

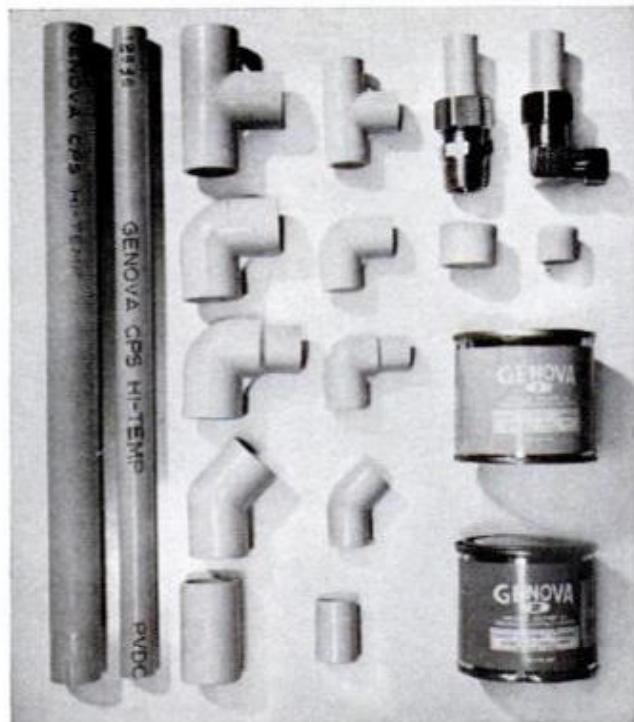
THE BEST THING that's happened to plumbing since it moved indoors is CPVC. If your local plumbing code doesn't prohibit its use, this recently available pipe is the best for do-it-yourself plumbers when remodeling or installing new plumbing. Just about every fitting you could want is available, and the solvent-welded joints quickly harden as strong as the pipe itself.

CPVC was developed from PVC (polyvinyl chloride), which has a long history of success in cold-water and drain-wastewater runs, but which softens too much when heated and doesn't withstand house hot-water pressures. Chemists found that by hypoing another chlorine atom into the PVC formulation they could get added resistance to heat-softening. They first called the improved vinyl *polyvinyl dichloride* (PVDC), reflecting that extra atom. But recently its name was changed to CPVC.

Some advantages of CPVC pipe:

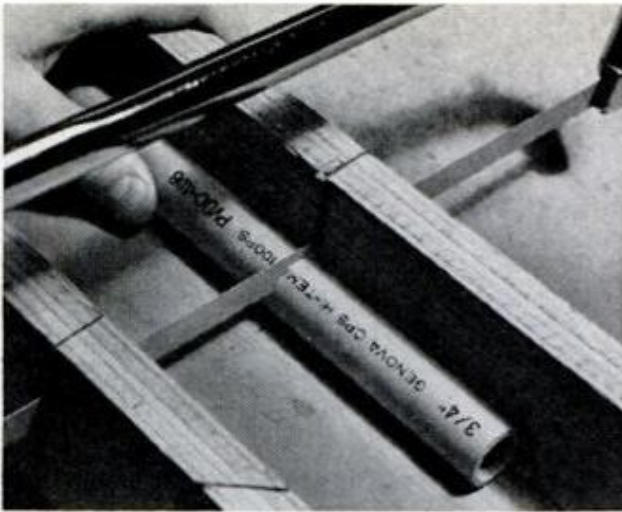
- It can be cut with any saw.
- Its heat-insulating qualities reduce

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PIPES AND FITTINGS (left to right, top to bottom): $\frac{3}{4}$ and $\frac{1}{2}$ -in. pipe, $\frac{1}{2}$ and $\frac{3}{4}$ -in. tees, 90° elbows and street ells, 45° elbows and couplings, two types of transition fittings for connecting other kinds of pipe, two cap sizes and No. 1 and No. 2 solvents for joining

POPULAR MECHANICS



USE MITERBOX and a hacksaw or wood saw to cut plastic pipe, or use a conventional tubing cutter

sweating of cold-water pipes and heat loss from hot-water pipes.

- Its smooth inside walls give little friction to water flow.
- It does not corrode inside or out. Bi-metallic corrosion has no effect on it and scale does not build up in it.
- It is resistant to rodent and termite attack, will not support combustion, has no odor or taste to impart to the water, and resists denting.

CPVC pipe and fittings are available in two colors from one manufacturer. There is no difference in the pipe other than the color, but this allows you to color-code your lines—green for cold water, orange for hot—if you wish, for instant identification.

As with anything, there is a drawback. CPVC is touchy about high temperature and pressure in *combination*. It is rated to withstand 180° F. at a working pressure of 100 pounds p.s.i., so you must install and maintain your plumbing system to stay below these maximums. This will be no problem if you follow the tips given later.

One other thing: You *can't* use plastic pipe for an electrical ground.

The pipe comes in 1/2 and 3/4-in. diameters. Use 3/4-in. pipe for main hot and cold runs, 1/2-in. for branch runs to fixtures.

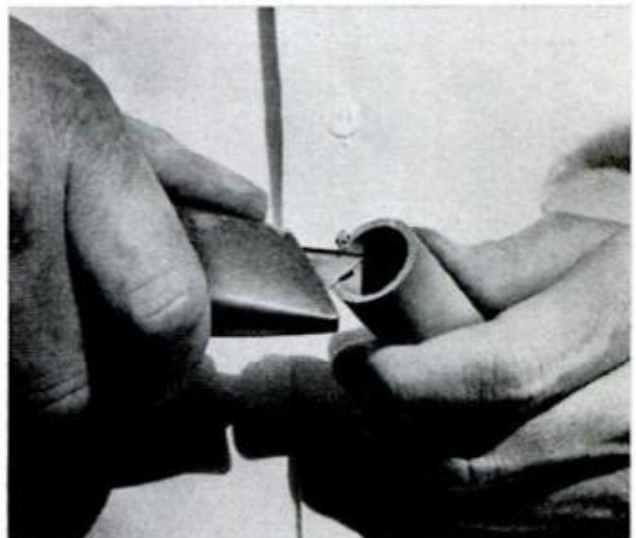
The greatest thing I found about plastic pipe is the speed and ease of working it. Tools are minimum. For cutting it, I prefer a hacksaw. And you'll need a knife, sandpaper or tapered reamer for removing burrs left inside the pipe after sawing. You should have two cheap 3/8-in. coarse-bristle brushes for applying the



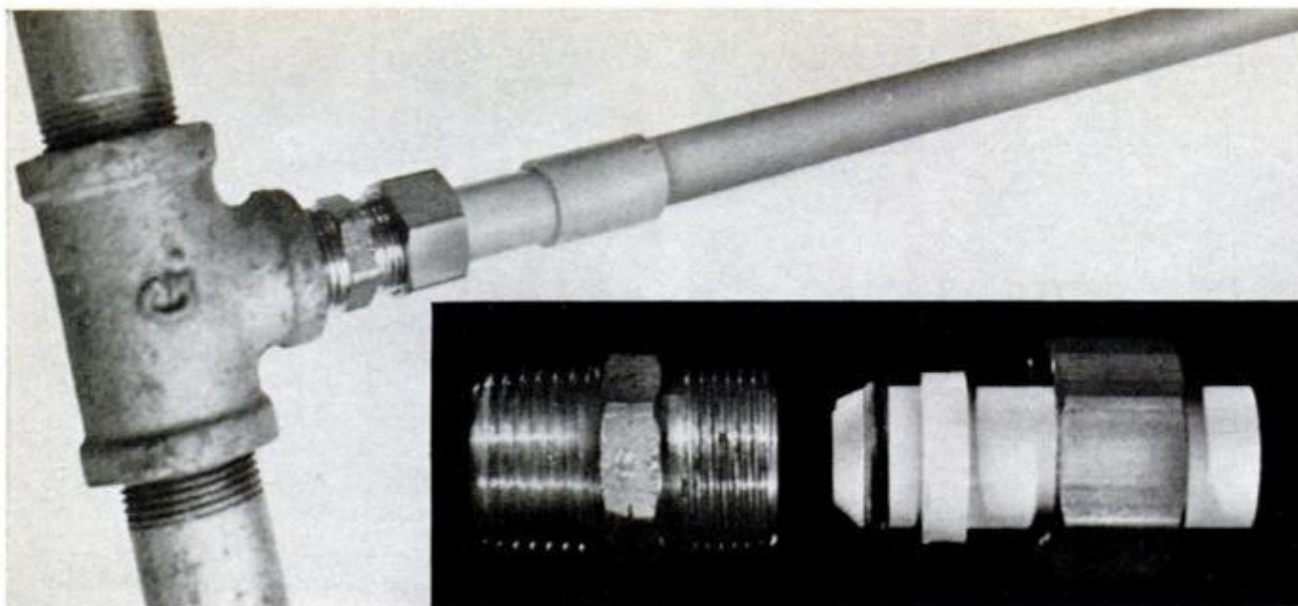
BRUSH SOLVENT No. 1, then solvent No. 2 on the end of the pipe and on the inside of the fitting



WITHIN A MINUTE of starting to dope the joint, insert the pipe into the fitting with a slight turn



ANY BURRS or rough spots should be removed with a knife, file or sandpaper before you make joint



TRANSITION ADAPTER with gasketed plastic bayonet acts as a union to let you connect section of plastic pipe to other types of pipe. To make a joint with steel (above), the adapter is solvent-welded to the coupling

joint-welding solvents. You will also need a rule for measuring, a pencil for marking the pipes and a hammer for fastening pipe straps.

Fabricating plastic pipe: If you cut the pipe with a saw, you can get square cuts by using a miterbox, although this isn't necessary. After cutting, remove the burr around the inside edge of the pipe. When you cut a pipe, be sure to allow for what is called *make-up*; that's the amount the pipe ends slide into each fitting. Allow as much in extra length as the pipe diameter; for instance, $\frac{1}{2}$ -in. pipe should be cut a half-inch longer on each end, $\frac{3}{4}$ -in. pipe needs $\frac{3}{4}$ -in. per end for make-up.

Now check the pipe in the fitting before you go any further. CPVC pipes and fittings are designed for an *interference fit*; that is, they should be tight enough to touch when the pipe is one-third to two-thirds of the way into the fitting. If they are too loose, the joint might not seal tightly.

It's a good practice when fabricating plastic pipe to dry-assemble the whole system, or at least a sizable part of it, before welding any joints. This way you'll know whether you have all the parts and if everything fits.

Joints to be solvent-welded should be clean and free of oil or grease. Solvent-welded joints in CPVC pipe are made by using the two liquids shown. Get these where you buy the pipe. No. 1 is a cleaner, No. 2 a solvent. Never get them mixed and always use separate brushes for application. The ideal brush size is half as wide

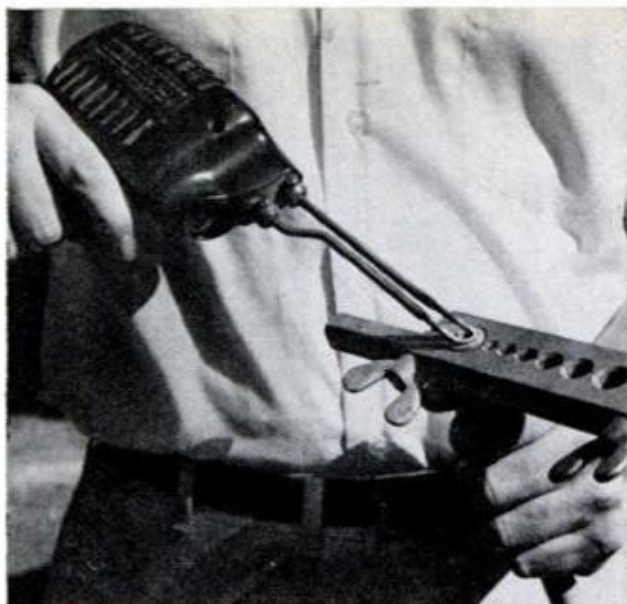
as the diameter of the pipe you're working on. Shelf life of the solvents is limited to several months. If they thicken or discolor, throw them out and get fresh stock. Work in a ventilated area and avoid breathing the vapors.

To make a joint, first brush No. 1 cleaner on the end of the pipe to socket depth and on the inside of the fitting socket. Apply enough No. 1 to cut the shiny skin of both the pipe and the fitting. A definite lightening in color should be apparent. Follow immediately by flowing No. 2 solvent onto both, giving the pipe a liberal coat and the fitting a light one. Coat the surface completely but don't brush out either of the solvents. You'll get best results by brushing in the direction of the pipe at a temperature above 40° F.

Do one joint at a time, and don't dally. Push pipe and fitting together until the pipe bottoms against the fitting's flange. Quickly give a quarter turn to distribute the dissolved plastic and align the fitting. You don't have much time until the joint becomes immovable, so align it fast. Then leave it to set. It is ready for pressure within a few minutes. A good joint will have a bead of softened plastic (fillet) all around the fitting.

Once assembled, a fitting cannot be removed and used again. If you should goof on a joint, don't give up. Saw the bad fitting off and use a coupling and short length of new pipe to replace the ill-fated joint.

Pressure-test any plumbing job before



SUREST METHOD for successful flaring of plastic piping is to heat the end first with a soldering gun



FLARING is frequently useful in water-heater hook-ups; connection is made using standard flare nut

you close-in the piping, while repairs are still easy. To pressure-test the system, plug or cap all openings and turn on the water. Examine each fitting carefully for leaks. Check again after four hours. A leaky joint is rare. If you do find one, cut out the bad joint and replace it with short lengths of pipe and couplings, all solvent-welded. Some joints will have to be installed without twisting. You can do it successfully if you're careful to get full distribution of solvent.

Make all your capped stub-outs (leads to faucets and other fixtures) from wall or floor long enough to permit cutting off the caps and hooking up fixtures to them later.

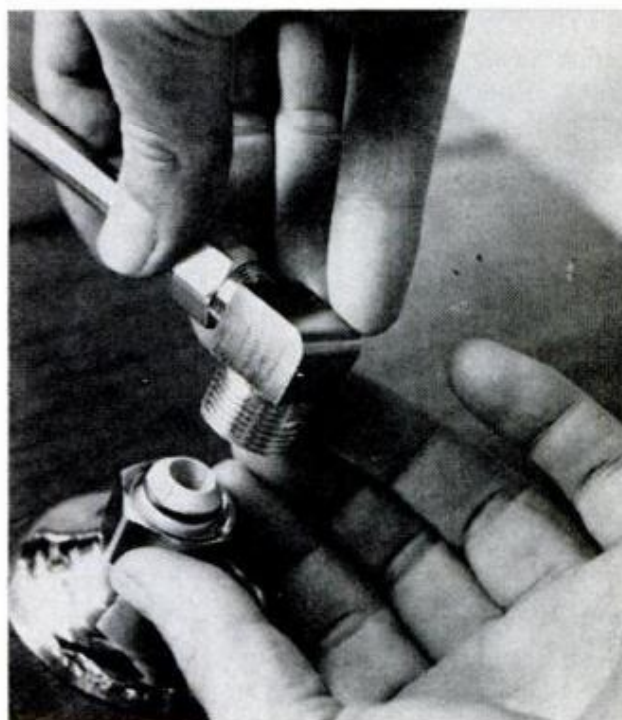
Adapting to other pipes. Fittings come in both pipe sizes. You can get elbows, tees, wyes, couplings, reducers, caps and adapters for connecting to pipes other than plastic.

When adding to existing plumbing, and at every fixture and at the water heater, softener and other plumbing appliances, you'll find it necessary to connect plastic piping into steel or copper pipe or into threaded fittings. Using a CPVC transition adapter makes this a simple chore. The adapter has a gasketed plastic bayonet that solvent-welds to the plastic pipe system and assembles finger-tight to a leakproof permanent joint with the non-plastic system.

The transition adapter can serve as a union, connection to a fixture stop valve, connection to a fixture compression union

(Please turn to page 192)

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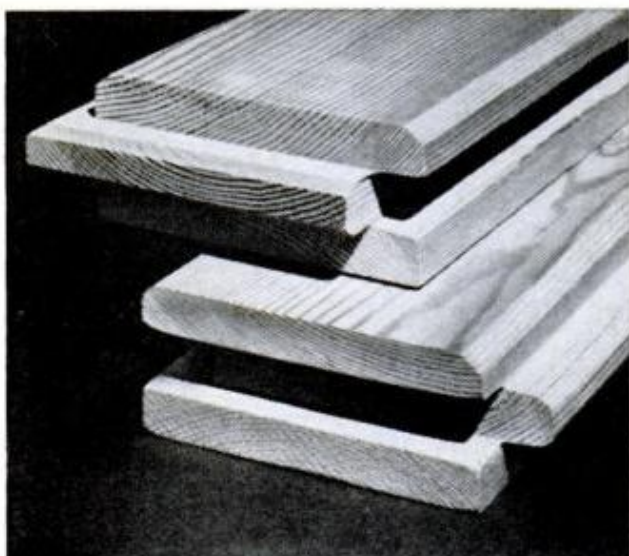
TRANSITION ADAPTER is solvent-welded to wall stub-out; angle compression fitting is then attached



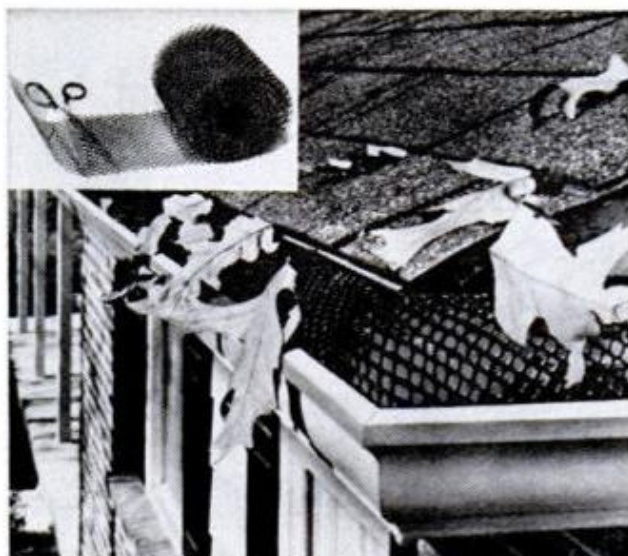
USE SMOOTH PLASTIC HANGERS to hang pipe. This type lets pipe slide without damage as it expands

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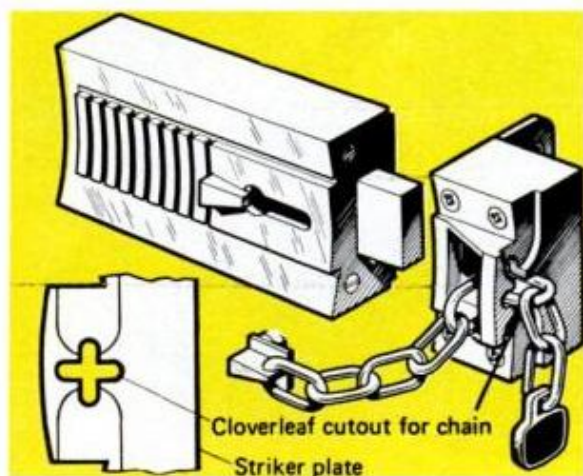
New Products for



LAMINATED DECKING is manufactured with a face layer of ponderosa pine, Engelmann spruce, Douglas fir or larch bonded to two layers of softwood. It's said to maintain a relatively constant moisture content to reduce chance of cupping. Boise-Cascade, Box 7727, Boise, Idaho 83707.

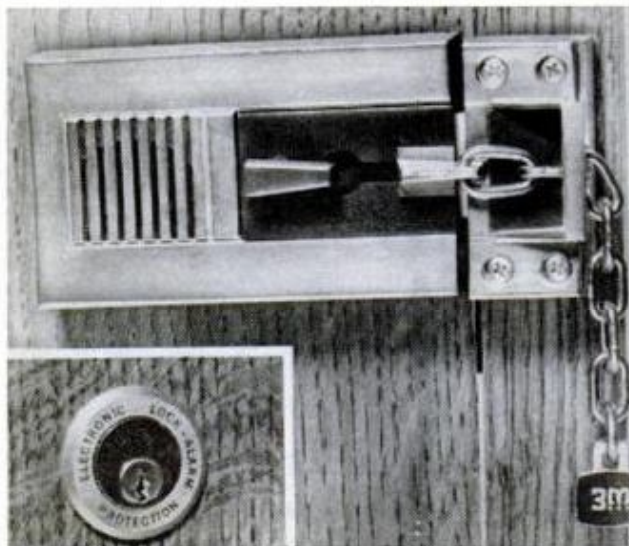


NONRUSTING PLASTIC GUTTER GUARD labeled Vexar installs quickly because you simply insert one edge under the shingles and tuck the other edge into the front slot on the gutter. In 25-ft. rolls, plastic material can be cut with scissors, will not rust. DuPont, 3301 N. Market St., Wilmington, Del. 19802.

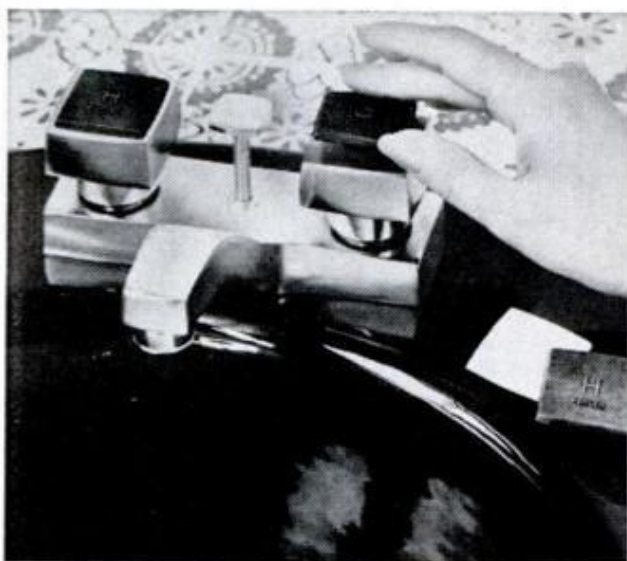


LATEST IN LOCKS introduced by 3M Co., St. Paul, Minn., is made for use on all nonglass doors. The Lock Alarm consists of a dead-bolt lock and chain coupled to a highly sensitive, battery-powered, solid-state electronic alarm. In operation, the bolt is moved conventionally by a knob or key. Price: \$79.95.

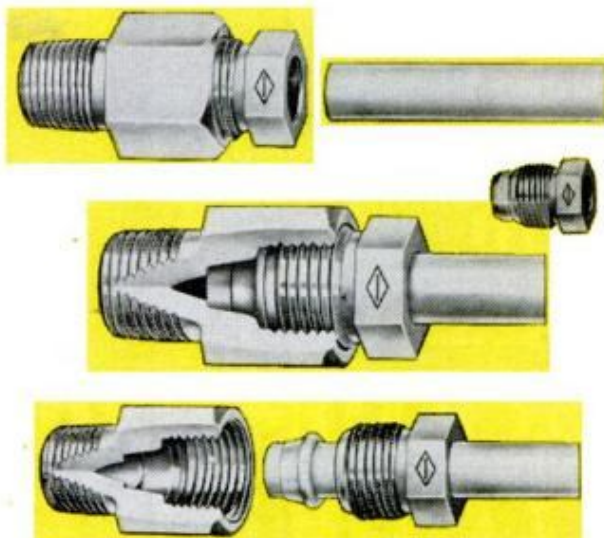
DESIGNED FOR USE on masonry surfaces above or below grade, Kwal-Chek is a self-contained waterproofing compound designed to stand up to 4.5 p.s.i. hydrostatic pressure. It will cover 75 to 100 sq. ft. per gallon depending on masonry porosity. Kwal Paints, Inc., 800 Water St., Denver, Colo. 80217.



Home Improvement

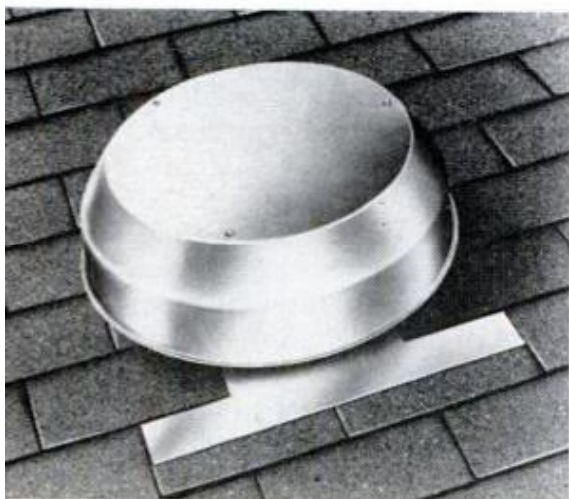
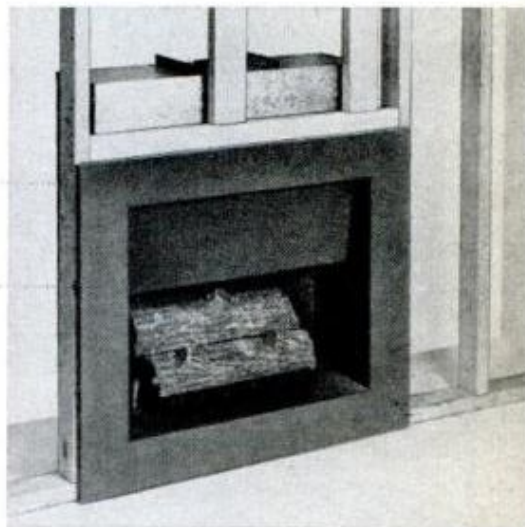
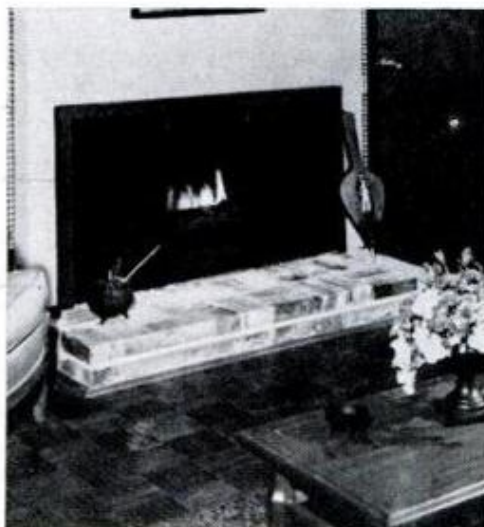


ADD A TOUCH of decorator color to your bathroom with Alterna lavatory and bathtub fittings. Inserts with embossed H or C come in teak, walnut, ebony and white to mix or match with fittings of brushed chrome and gold electroplate. At plumbing supply dealers. Kohler Co., Kohler, Wis. 53044.



NEW TUBE FITTINGS are claimed to be easier to install than flare or compression-type fittings. To make a joint, push tube into the fitting and tighten the nut. The sleeve shears off and attaches to the tube in the assembly. For information, write Imperial-Eastman, 6300 W. Howard St., Chicago, Ill. 60648.

GAS-FIRED FIREPLACE boasts a 28-in. opening and a remote-control pushbutton operation. Unit, only 13 in. deep, is installed behind built-up wall (far right), vented with standard 5-in., type-B gas vent or existing approved flue. Labeled Gasilator GF-28, it's sold by building supply dealers and department stores. For the nearest source, write Majestic Co., Huntington, Ind. 46750.



KEEP YOUR COOL by sucking hot attic air out with this exterior-mounted roof fan with thermostat designed for flat or pitched roofs. Nutone, Madison and Red Bank, Cincinnati, Ohio 45227.

YOU CAN PRODUCE exposed aggregate patio blocks using a chemically treated paper set in the mold. After concrete sets, simply brush or spray off excess. Jewel-Tex Corp., 55 Skyline Dr., Plainview, N.Y. 11893, makes it.





HOW TO MAKE A BLACKTOP DRIVE LOOK LIKE NEW



EXAMINE DRIVEWAY, then fill large holes with stone and complete patching with a suitable patching mix



SMALL CRACKS and holes can be treated with a crack filler. Let the cracks cure for at least one week

ASPHALT DRIVEWAYS require periodic care to extend their life, save costly repairs and improve their appearance. Even a new driveway should be covered with a tar-emulsion driveway coating and sealer after it has aged one to three months (to allow all solvents to evaporate). This protects it from oxidation, seals hairline cracks and keeps it from softening as a result of gasoline and oil that may drip on it. And, happily, it's a do-it-yourself job.

All the necessary materials for maintenance of an average home driveway can be purchased for around \$20 to \$35. They should include the compound to fill in driveway cracks; smoothing paste to prepare the surface for application of the coating-sealer (if the driveway is rougher than desired); two or three five-gallon cans of coating (usually enough for an average driveway), and a two-way applicator tool, which is a combination brush and squeegee. All the materials used on the job shown were purchased from Sears, Roebuck.

Check the labels when you buy to make sure you're getting tar-emulsion coating and sealer; some labels don't specify. Sears claims that a coating with tar-emulsion properties will not dissolve when the dried film is wiped with a rag soaked in gasoline, kerosene or paint thinner. That test, hopefully, your driveway will not have to endure.—*Harry Wicks, Workshop Editor*



IF YOUR DRIVEWAY SURFACE looks this good it is ready for a final sealing with Sears Tar Emulsion



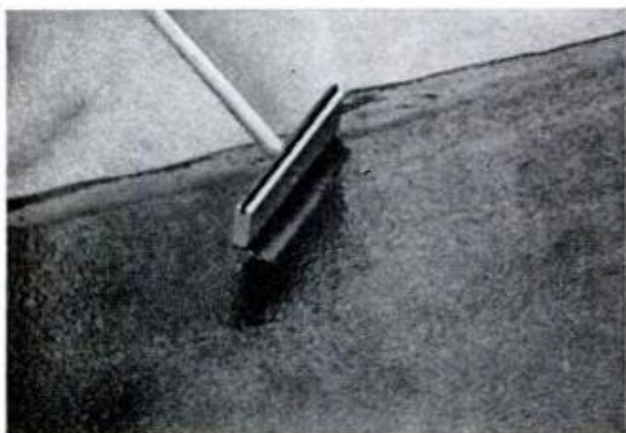
SWEEP OUT PUDDLES and low spots. If available, use jet of air to blow dirt and water out of cracks



SMOOTHING PASTE is poured on damp surface in continuous ribbons to cover area about 20 to 40 sq. ft.



USING APPLICATOR sold for the purpose, spread the ribbons with firm pressure to get uniform coverage



DO NOT APPLY the paste too thickly, never over $\frac{1}{4}$ in. For big depressions, two coats are better than one



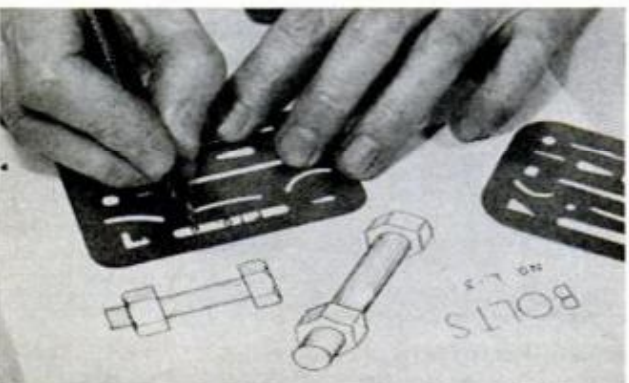
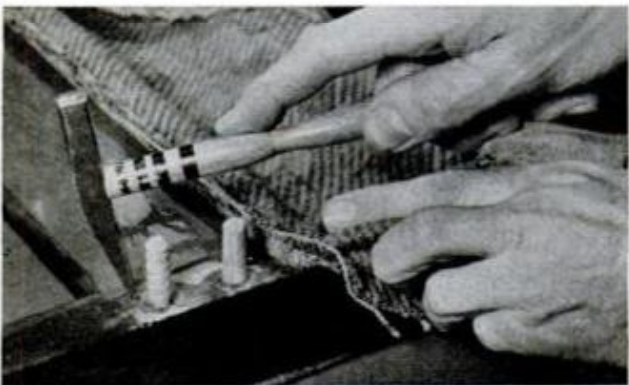
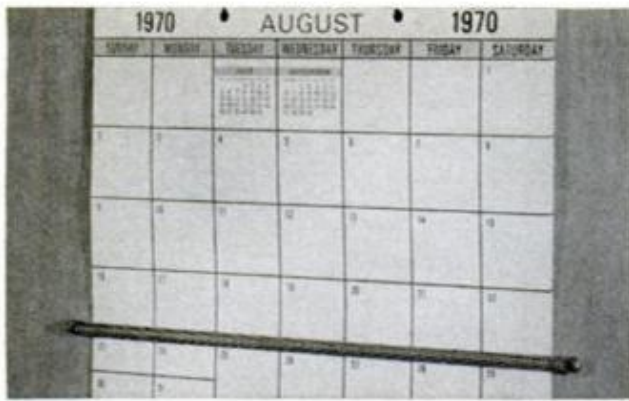
IF NECESSARY, smoothing paste can be mixed with just enough water to obtain good flow consistency



WHEN COLOR changes from brown to black, drive can be walked upon. On rough areas, apply a second coat
SEPTEMBER 1970



APPLY THE FINAL coat to give a smooth surface, but don't get it so smooth that it's slippery when wet



HINTS FROM READERS

Year-round 'spring' for calendar

I have a large wall calendar in my shop which flutters annoyingly whenever the door is opened. To eliminate this, I stretched a screen-door spring across the lower portion of the calendar and fastened it to the wall at both ends with screws. Now the pages stay put, yet it is still easy to change the page each month.

—Clarence N. Breitenfeldt

Painter's mitt saves cleanup

When you're painting small articles, such as drawer knobs, a mitt made from cardboard holds the work steady while keeping the paint off your hands. Bend, but do not crease, the cardboard and attach the knobs with screws, as shown. Position the fingers between screws and wear the sleeve like a glove. Leave parts on the mitt until completely dry.

—A. J. Stephenson

Hammer serves as gluing aid

A tack hammer with one end shaped much like the cutting end of a cold chisel provides an effective method of removing thick deposits of old glue from any old furniture you might be repairing. Use the hammer like a metal-chipping hammer (or miniature adz) then finish cleaning the glued area with a conventional wood scraper.—B. W. Ervin

Fast way to cut plastic foam

Next time you have a project that involves using a plastic foam such as Styrofoam, try my trick for cutting the stuff. I've found that a serrated kitchen knife or fine-toothed hacksaw blade—ground to a bevel on both sides—works perfectly. For soft foam, blade thickness doesn't seem to matter, but for rigid foams a thin blade is best.—David W. May

Eraser-shield lettering guide

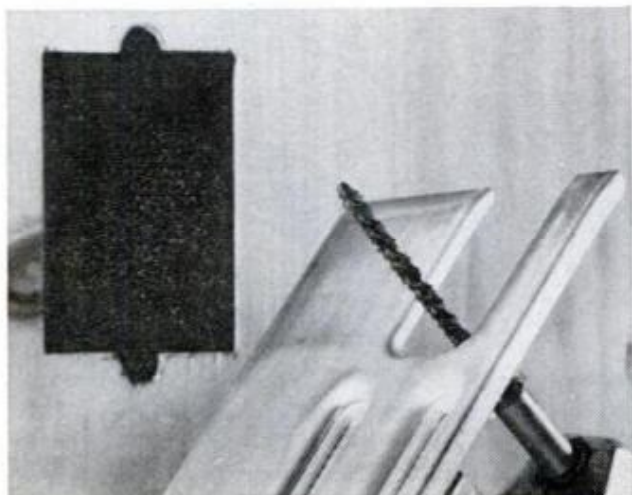
An erasing shield can be used as an aid when you do small-size lettering with a pencil or ballpoint pen. Guide openings make it easy to keep the letter height uniform with the tops and bottoms of the various characters. Photo shows shield being used to do small lettering to supplement large lettering done with another scale.—Walter Burton

New tools you should know about



PORTABLE CUTOFF TABLE and miterbox can be set up in minutes as an on-the-job workshop for production building. Designed to accept any full-shoe portable circular saw, Trim-A-Table features a built-in precision tape measure and an adjustable sliding butt stop with quick lock that can be used anywhere along the back fence. Light in weight, table can be folded and carried by one man. Cost: \$110. Van Mark Products Corp., 18235 Weaver, Detroit, Mich. 48228.

JET BATH FOR PAINT ROLLERS does a thorough cleaning job in two minutes. Designed to accommodate seven and nine-inch rollers, it rinses latex paint out of the roller by spinning it with nine 30° angle jets. It will also clean out oil-base paint after the roller has been dipped in emulsion. The power source is your laundry-tub faucet or outside hose bib. RinSpin is made of styrene plastic, self-cleaning and comes with a satisfaction or money-back guarantee. \$2.95 postpaid. For information, write Busch Enterprises, Dept. M, 1622 Polk St., Minneapolis, Minn. 55413.



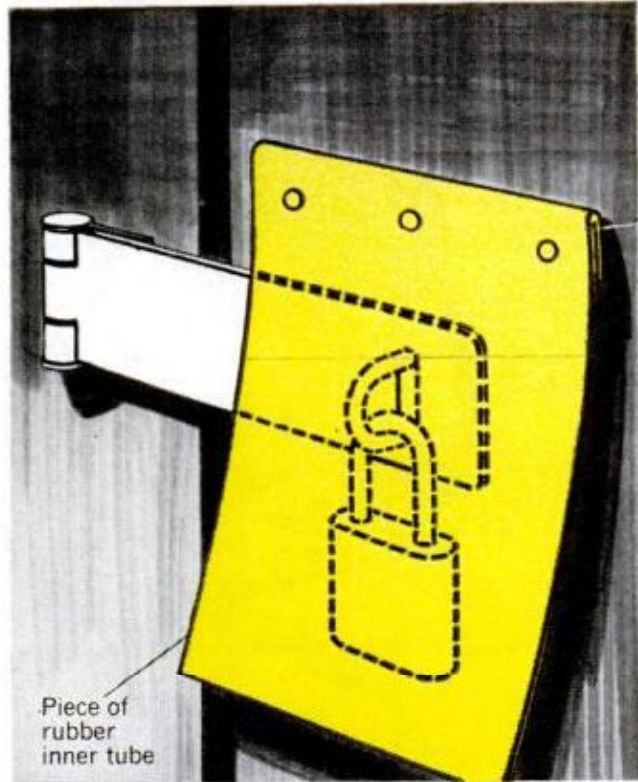
TIGHT TURNS and small-radii scrollwork are easily cut in wood or plasterboard with a Stickle-Dickle because the blade diameter is only 3/16 in. Manufactured by Coastal Abrasive & Tool Co., Box 337, Trumbull, Conn. 06611, the blade fits most popular sabre saws and gives an exceptionally smooth finish cut that requires little or no sanding. At hardware and department stores.



SOLVING



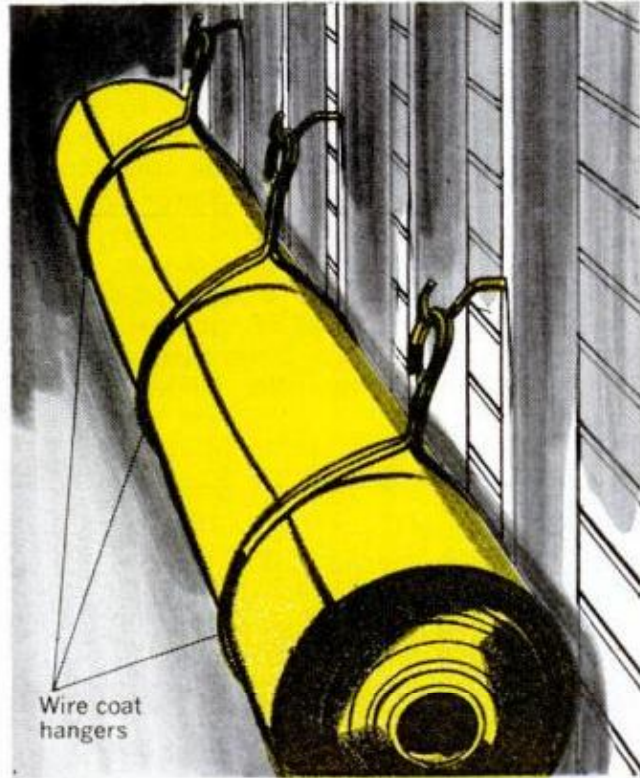
THE BEST METHOD for wiping a paintbrush that I've found is to halve an old cover and use it while painting. Bonus: The rim stays even cleaner than one that is punched with several holes.—*Walter Griffin*



PROTECT AN OUTSIDE PADLOCK from foul weather by covering it with a small section cut from an old inner tube. Make the flap so that it is about 2 in. wider than the lock it covers.—*Blanche Campbell*



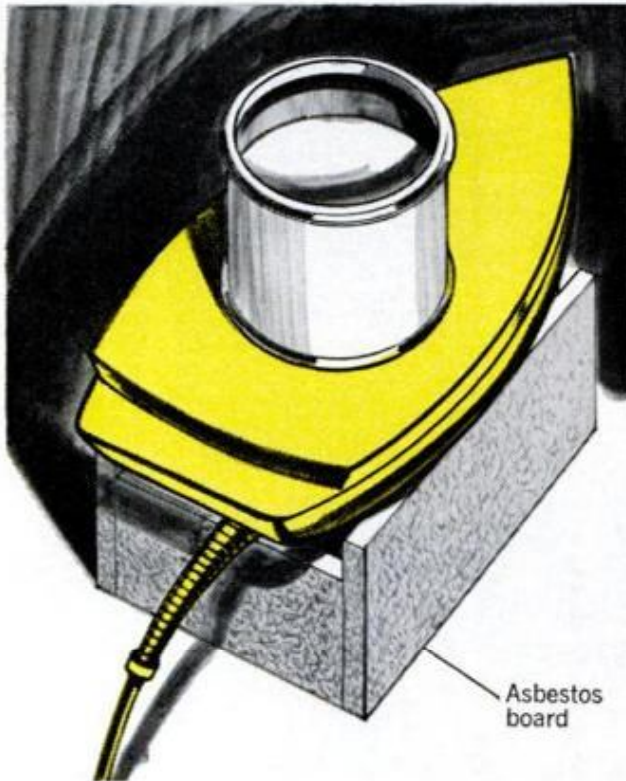
MOUNT SNAPSHOTS in an album without glue-on corners by slitting hold-down corners with this simple tool. Make it of a short piece of thin wood with two razor blades bolted to one end.—*William Swallow*



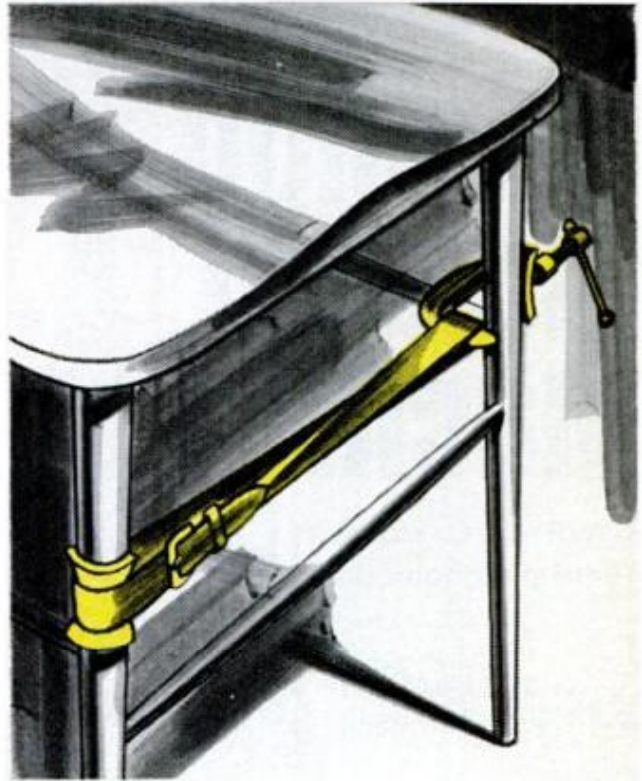
STORE A CARPET easily by spotting three clothes-line hooks on your garage wall about 4 ft. apart. Then, using two shaped wire hangers per hook, hang the rolled-up carpet from the hooks.—*Allen Wilks*

HOME PROBLEMS

Illustrations by Adolph Brotman, Worman Associates



A DANDY SMALL "STOVE" for your shop can be made from an old iron. I rescued one about to be thrown out, removed the handle and placed it on an asbestos stand to heat coffee and warm glue.—*Frank Shore*



LACKING AN ADJUSTABLE BAR CLAMP of the right size for a gluing job recently, I made a substitute using a buckled belt and C-clamp. Padding under belt and handle protects surface.—*William Kuester*



PERFORATED-BOARD HOLES that enlarge due to continual use can be kept in service simply by placing a piece of tape over the wire hook shank. Nylon filament tape seems to work the best.—*Bob Olson*

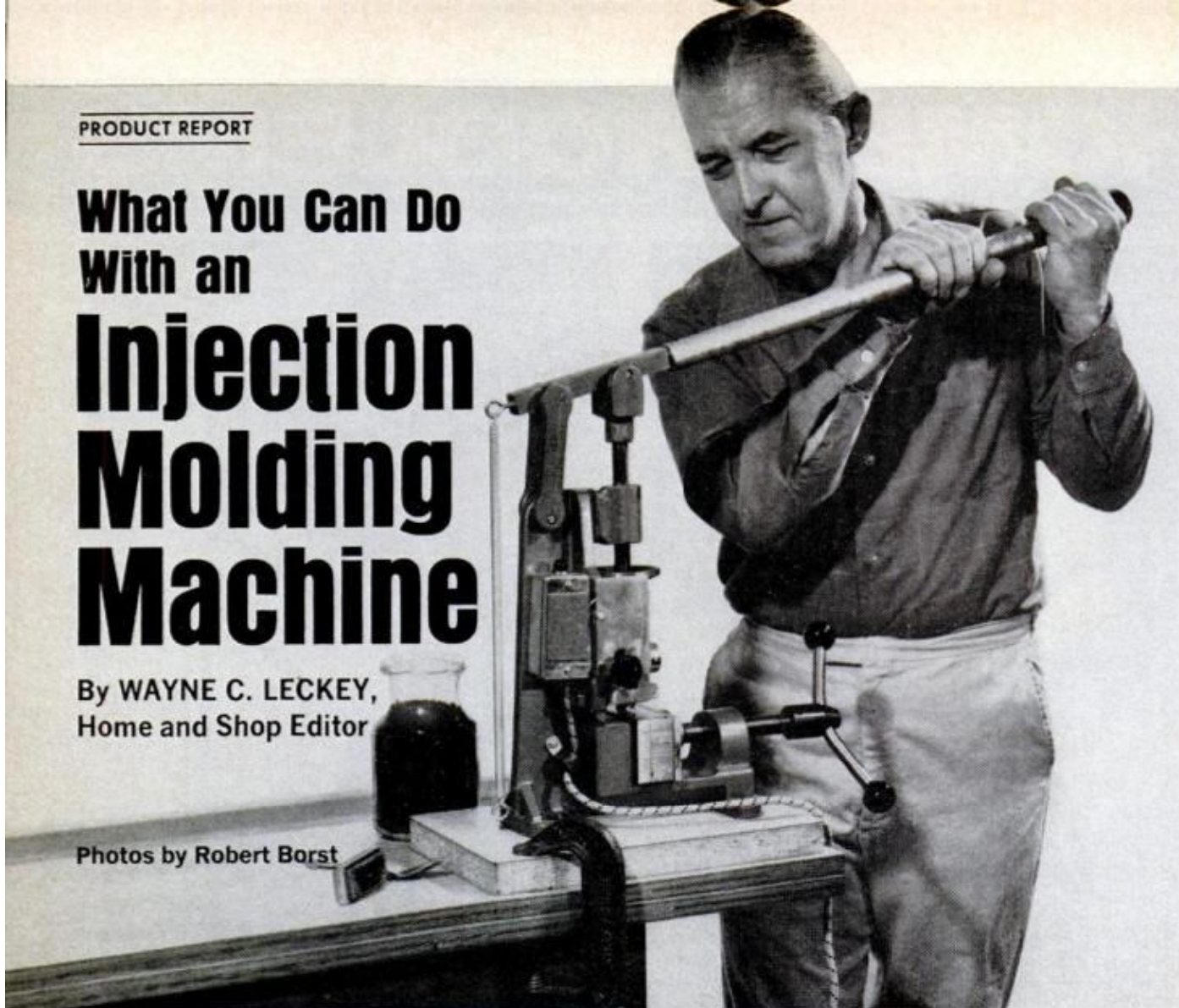


NEXT TIME YOU NEED LIGHT but can't find a candle, try wrapping a tuft of cotton around a toothpick. Coat the cotton "wick" with petroleum jelly, then insert it in the jar and light it.—*William Swallow*

What You Can Do With an Injection Molding Machine

By WAYNE C. LECKEY,
Home and Shop Editor

Photos by Robert Borst



MOLD IS FILLED by pulling lever down with steady motion and holding for a few seconds at end of stroke

Molten plastic forced under pressure into aluminum molds lets you mass-produce salable items at home

IF YOU HAVEN'T HAD the fun of using an injection molding machine, get ready for a fascinating new hobby—one that could put you in business.

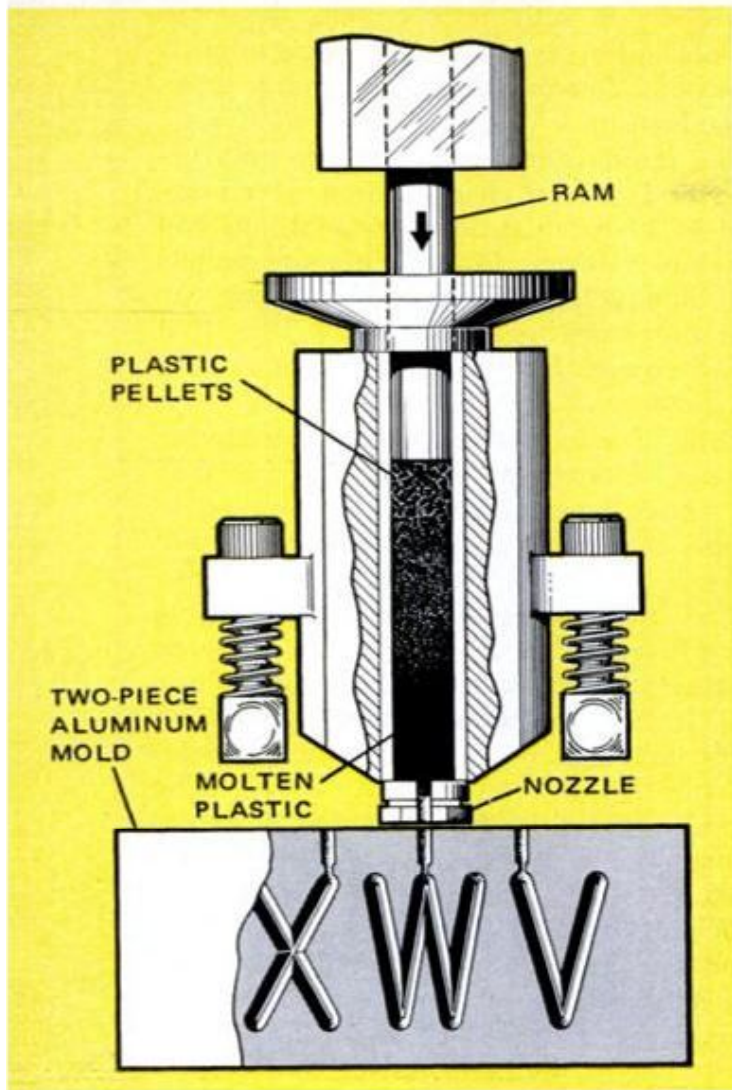
Injection molding is a process by which plastic objects can be produced in quantity by first heating resin pellets until they become viscous liquid and then forcing the molten plastic into a ready-made mold. Since the plastic solidifies instantly in the mold, you can produce one molded part after another just as fast as you can operate the machine. I found the whole procedure extremely interesting.

What can you make with a hand-operated molder like the bench model shown here? Dozens of things, and for pennies. You can mold three-dimensional letters of the alphabet for making signs and nameplates. You can make rubber stamps

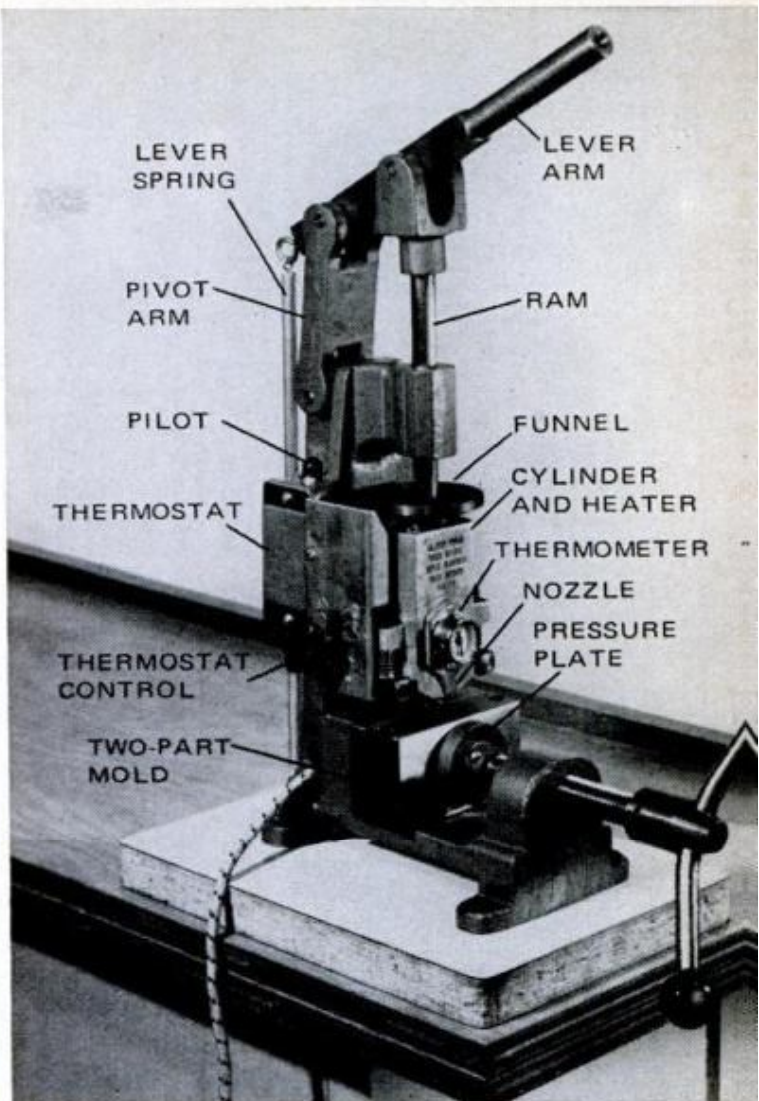
which require no vulcanizing. You can mold plugs on the ends of lamp cords, produce all kinds of specialty items such as bottle cappers, telephone dialers, golf tees, fishing lures, screwdriver handles, corncob holders, key chains—you name it. The many different molds available give you a wide choice of things to make for fun or profit.

The machine is operated by a pipe-handle lever which exerts a pressure of some 2000 pounds per square inch on a vertical ram which, in turn, forces the molten plastic into the mold's cavity. All it takes to fill the molds is a steady, uninterrupted pull on the lever.

Once the mold is filled, the ram is returned to the top of its stroke, the two-part mold is unlocked, opened and the finished part is removed. Then the cylinder



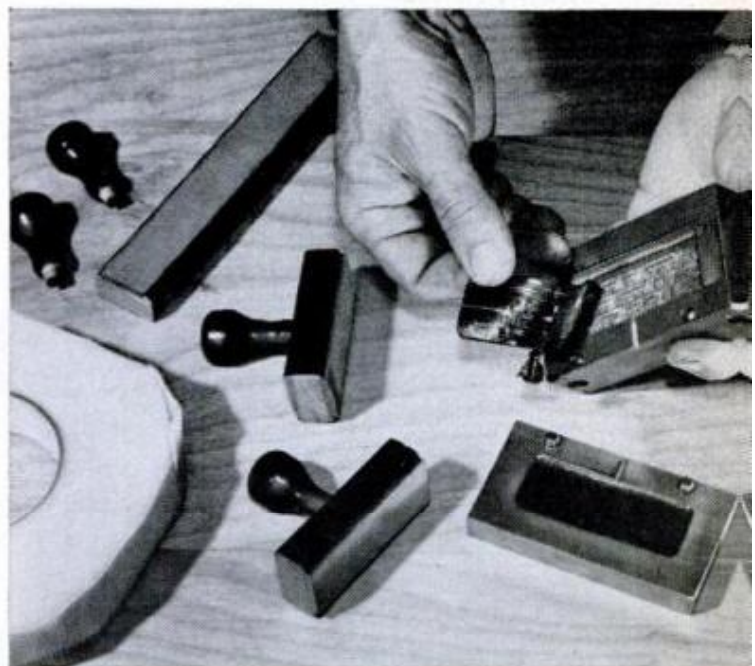
CUTAWAY DIAGRAM (above) shows how ram forces molten plastic in cylinder through the nozzle and into the mold. Each letter in set of three-letter molds has own sprue hole for casting letters individually



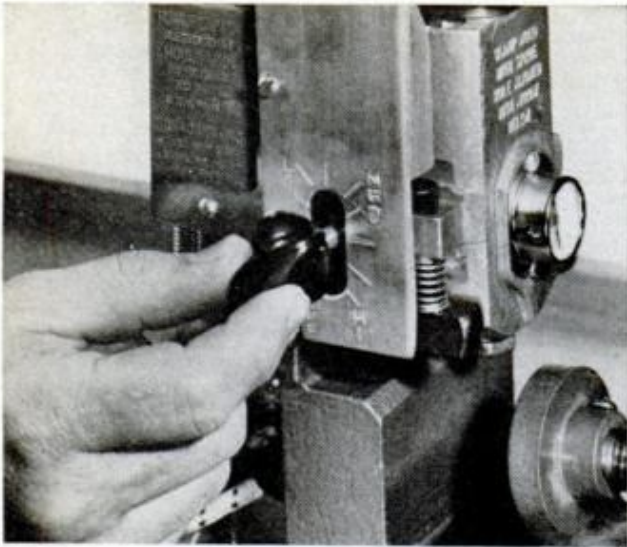
BECAUSE LEVER OPERATES RAM, machine must be bolted solidly to sturdy benchtop so it won't flip up. Pipe extension slips over the lever arm to provide the necessary leverage to force plastic into mold



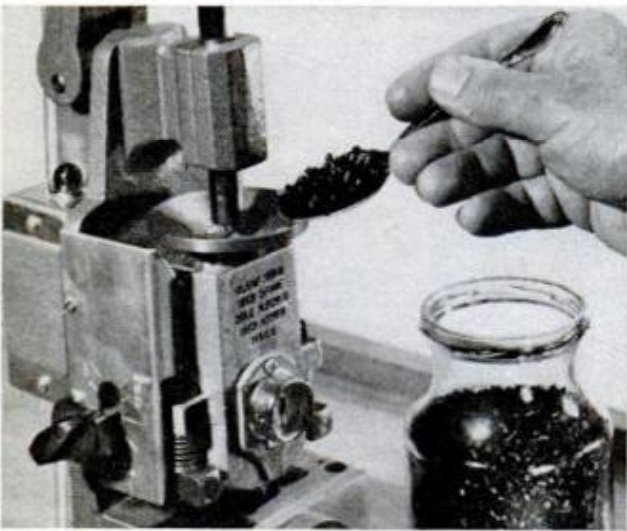
MOLDED LETTERS AND NUMERALS are lifted from mold either singly or in groups, depending on size. Sets of alphabet molds come in $\frac{3}{8}$ and $1\frac{1}{2}$ -in. letters
SEPTEMBER 1970



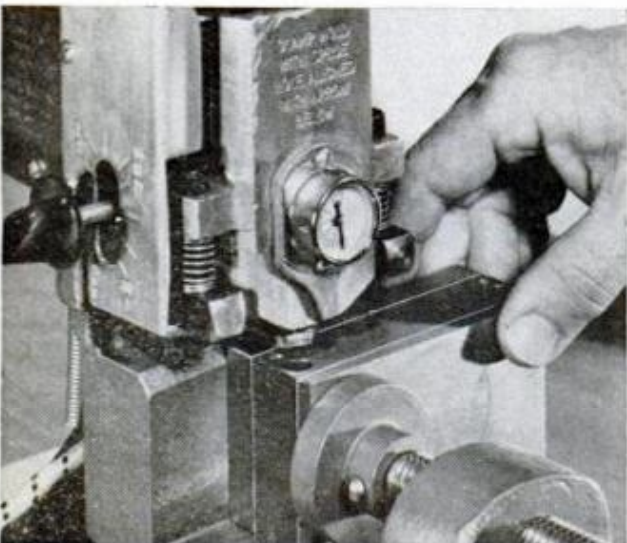
SPECIAL FONTS of recessed type let you mold raised letters for hand stamps in one operation. Here rubberlike molded part is being peeled from mold



AFTER PLUGGING IN MACHINE, set thermostat at medium and preheat for two to three minutes. Machine is ready for molding when thermometer reads 300°F.



USE SPOON TO FILL CYLINDER each time with plastic pellets. Pack even with top by tamping slightly with end of ram. Don't overfill cylinder with pellets



ALIGN SPRUE HOLE in two-part mold with machine's nozzle; lock the mold by tightening pressure plate. See that tightening does not cause mold to shift

is recharged with more pellets, the mold is relocked in its vise and the operation is repeated. You can do this as many times as you wish.

The molding materials include polystyrene and polyethylene pellets which are sold in 10-lb. quantities. In addition, you can buy colorant for coloring the pellets red, blue, yellow, green or black. You can also purchase special plastic pellets that are designed for use in molding rubber hand stamps.

Best of all, there's no waste material. Sprues, flashing and rejected parts may be reused and molded again and again simply by cutting up the plastic into small pieces.

The machine is designed to plug into any 110-v. outlet. To ready it for use, you first set the thermostat knob to medium and let the machine warm up two or three minutes, or until the thermometer at the front reads about 300°F. The proper operating temperature is determined by the nature of the plastic being used.

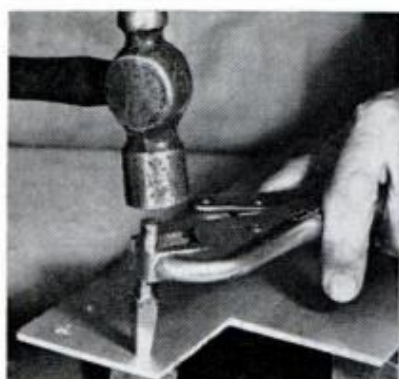
When you find that the molten plastic cannot be injected by normal pressure, increase the temperature a little. If the finished part shows signs of excessive shrinkage in the mold, lower the temperature a bit.

The important thing in the making of a perfect part is to remember that the lever must be brought down with one deliberate motion. Any hesitation during the full stroke will cause the plastic to "freeze" in the mold and will result in an incomplete shot. It is important, too, that the ram be held a few seconds under pressure at the end of the stroke before withdrawing it from the cylinder.

To change from one color to another, or to change from one type plastic to another, you purge the cylinder while it is hot. This is done by supporting the nozzle with just a corner of the mold so the plastic can run free. Then, after adding the new plastic on top of the old (or the new color) you gently squeeze the multicolor plastic from the cylinder and out the nozzle like spaghetti. This is done several times, or until the plastic finally emerges in its true color.

For further information about this fascinating money-making machine, write to Honacast, Inc., 131 E. 169th St., Bronx, N.Y. 10452. ★★★

HINTS FROM READERS



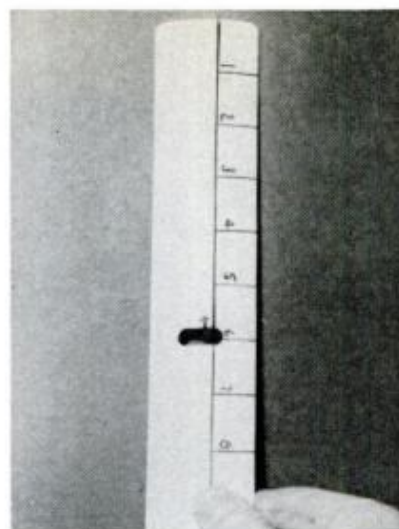
Punching square holes

Recently, I had to machine several holes that were to receive square, taper-shank bolts. To do it, I cut the shank end from an old auger and used it as a punch to broach the holes. Using a torch, I heated the hole surface, held the shank with a pliers and gave a few raps with a hammer.—*Robert J. D. Hill*



Curing sick clocks

Clock failure is usually due to friction in the power train. Often, you can re-oil the clock without disassembling it. Dissolve gummed oil first with kerosene and a small brush, then put a drop of light mineral oil in each bearing. While you're at it, oil the mainspring to minimize rubbing as it unwinds.



Durable 'yardstick'

The next time your wife throws out a venetian blind, hoard a couple of the slats for use as rulers; their straight edges beat using a yardstick. Simply mark off desired increments using nail polish or indelible ink. If you make several rulers, calibrate each for special jobs.

—*William Swallow*

BX cable makes handy snake for cleaning clogged downspouts

Cleaning gutters and downspouts is just one item on the annual spring cleaning schedule. A trick that I have used, when I have been unable to flush the downspouts out with the garden hose, is to use a length of old BX cable as a snake. It easily loosens twigs, leaves and an occasional tennis ball. Feed the BX up from the bottom, and then flush from the top with the hose.—*E. M. Woodbury*

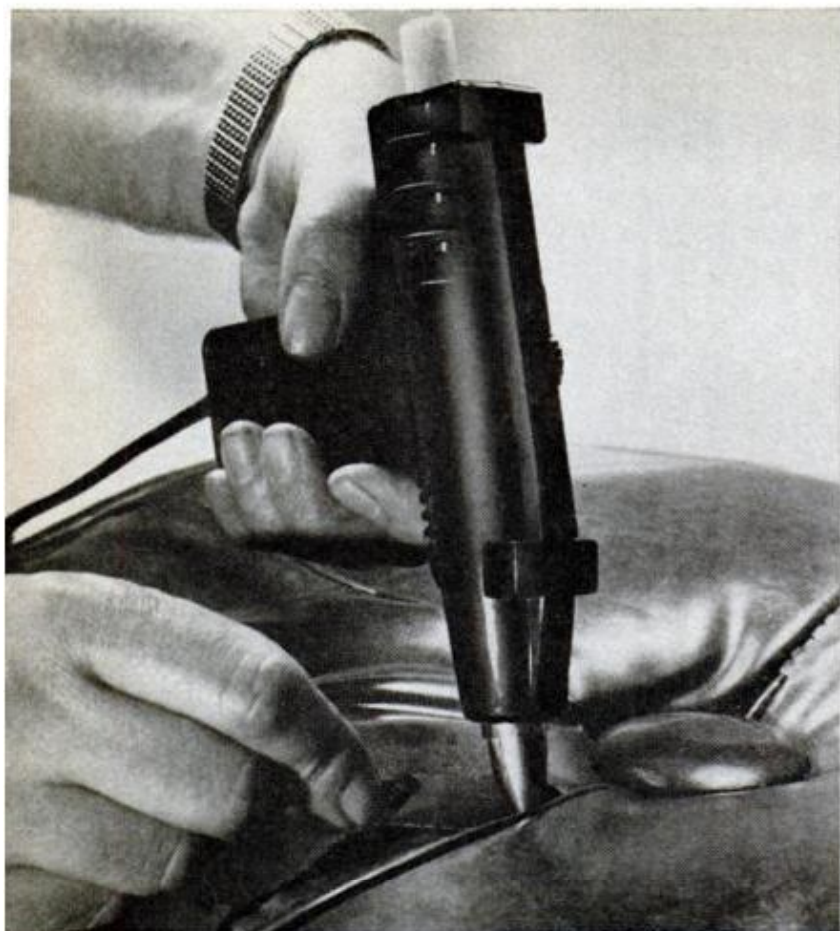
NEXT MONTH IN SHOP AND CRAFTS

LOOK WHAT YOU CAN DO WITH A SWIVEL-BLADE SABER SAW. They're the latest in portable jigsaws, and three makers are now offering them at retail. With one you can do cutting tricks that were once impossible. And if you already own a conventional saw, you can steal some of the tricks and get more mileage from your present tool. Look for it in October *PM*.

HOW TO PAINT WITH SPRAY CANS. They're a good way to get small jobs out of the way in a hurry, but, if they're used improperly, the results can be a lot less than satisfying. Read October *PM* and you'll be able to avoid the spray can pitfalls that have trapped so many others.

BUILD THIS ELECTRONIC BANJO. You're sure to make a hit with your youngsters—and all their friends—if you tackle this project. You can make the instrument practically from scrap and, the effort will pay off at your next get-together. Complete plans in *PM* next month.

A WORKBENCH FIT FOR A PRO. Besides being handsome, this workbench is exceptionally rugged and has a top with a density that equals rock maple. You'll find complete plans for building it in next month's *PM*.



Hot Tips For Using Glue Guns

By JOHN BURROUGHS

Hot-melt glue gives you a flexible bond in a hurry. Here are some of its uses that you may never have thought of

ANYONE using a glue gun for the first time discovers that the polyethylene-base, hot-melt adhesive applied with electric guns differs completely from other common glues. For example, it's not like the hide glue that cabinetmakers cooked up in glue pots or the white glue that comes in squeeze bottles.

A glue-gun glue's special advantage—besides fast-method application—is its flexibility, which is a key property for any adhesive. The lack of brittleness in a layer of glue is a factor as important as adhesion in determining the strength of a glued joint.

Like hide glue, which is flexible, most synthetic-resin base glues are also hard-drying and must also be applied in thin glue lines to prevent cracking and glue failure.

White glue, which is polyvinyl acetate emulsion, is more pliable. Since even a thick glue line won't harden enough to become brittle, this glue holds tenaciously. Aside from its lack of water resistance, the only serious disadvantage (for anyone in a hurry) when using white glue is its dry-

ing time. It takes an hour or more to dry out.

Polyethylene-base, hot-melt glue was developed to supply a flexible, waterproof adhesive suitable for fast production-line bonding procedures, especially those in use by the shoe manufacturing and packaging industries.

The adhesive is simply ordinary linear polyethylene—the familiar flexible white plastic used to make squeeze-bottles—with sticky plasticizer added. It comes in slugs, or sticks, about $\frac{1}{2} \times 1\frac{3}{4}$ in. The sticks can be stored indefinitely without deterioration.

When heated to around 300° in an electric gun, the solid adhesive becomes quite fluid—about like maple syrup—and can be squirted readily through the gun's nozzle. A bead of hot glue from the nozzle, applied to wood, stays hot enough to remain workable for about half a minute, which is time enough to permit pressing together whatever you're gluing.

Since the adhesive sets by cooling rather than by drying out, the bond develops some 90 percent of its ultimate strength



SQUIRT OF HOT-MELT GLUE permanently repairs shoes, leather goods such as chair seat (opposite)

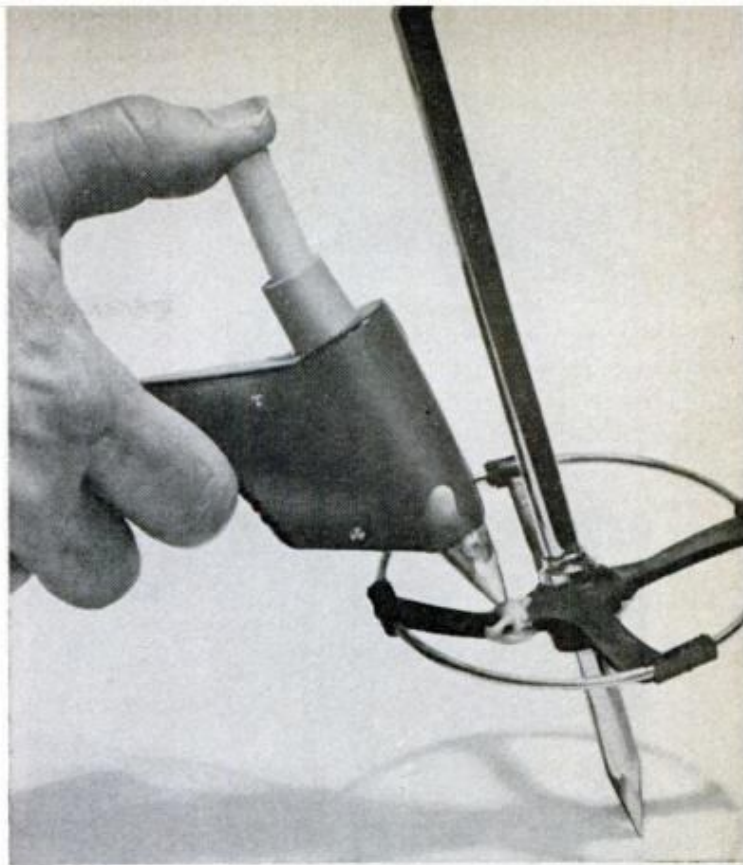
in about one minute. As it cools, the glue layer becomes a gummy solid that adheres particularly well to wood, ceramic, glass, plastic, leather, fabrics, paperboard and similar materials. It also adheres fairly well to steel if the metal is first preheated to prevent the glue from chilling as it is applied. The adhesive does not shrink appreciably, it's nontoxic and it's nonflammable. Squeezed-out glue can be trimmed away with a sharp knife after it has cooled.

The three most popular guns for applying hot-melt glue are operationally quite similar.

The top-of-the-line version is USM's Professional Model 250, pictured on page 190. Built with a die-cast aluminum melting chamber and nozzle, the tool has a 285-watt, ceramic-cartridge heating element with an adjustable thermostat regulating heat—and therefore rate of melt—from approximately 250 to 450°F. Glue sticks are inserted in a silicone rubber inlet tube, four sticks filling the gun; the sticks are fed by pressing with the thumb. Pulling the gun's trigger opens a valve in the nozzle and permits the molten adhesive to squirt out.

Though this model is priced several dollars more than the others, it's the only gun available with the capacity for large gluing jobs. Its 3/32-in.-dia. nozzle hole can discharge a large quantity of liquified glue

SEPTEMBER 1970



GLUE IS WEATHERPROOF, thus ideal for repairing outdoor sporting equipment such as broken ski pole

over a large area rapidly. Nozzles are interchangeable, with special-purpose nozzles also available. USM has also marketed a lighter-duty glue gun at approximately \$8.

The low-wattage, single heat-element unit offered by Sears has an aluminum nozzle with a 1/16-in.-dia. hole. The nozzle has a ball-check valve that opens automatically when thumb pressure is applied and closes to stop melted glue from drooling out when thumb pressure is released. Glue is delivered at 300-400°F., and the nozzle's rate of flow is entirely adequate for the making of ordinary repairs and the hot-gluing of small-area joints in woodwork.

Swingline's automatic-feed gun, which uses a special glue stick having a molded-in ratchet along the bottom, is equipped with a high-medium-low thermostat. The low setting is used when the gun is set aside for short periods to reduce reheating time. The gun's nozzle can be turned with a plastic box-end wrench supplied with the gun to either *open* or *closed* position. When the gun has heated you open the valve, and when you're through, you close it.

The real secret of success when using any of these guns is to work fast. Squirt the hot glue on the joint liberally and press the glued parts together with firm hand pressure in the shortest possible

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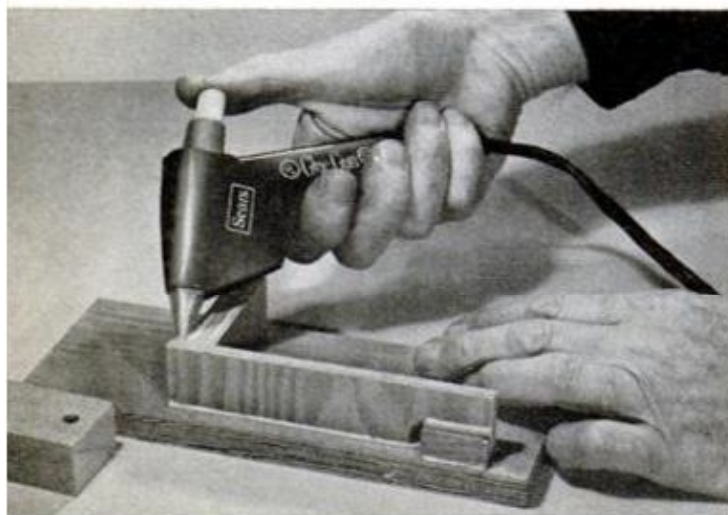
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YOU'LL SAVE MONEY if you buy the glue sticks in large quantities. Box with 60 sticks costs \$2.65



SPECIAL GLUE STICK for Swingline's Auto-Feed has a built-in ratchet; pawl mechanism feeds the sticks



MODELS OFFERED by three leading makers vary in size and price. From left to right, Auto-Swingline, \$9.95; Sears, \$7.95 and USM's "Zap" gun, \$22.95

time. For best results, you should have all parts ready before you start the gluing operation.

Ordinarily, hot glue is applied to only one face of the joint. A little practice will show just how much is required. Pressing the joint together while the glue is still fluid distributes the adhesive evenly throughout the joint. Thereafter the parts should be held firmly in position for at least 20 seconds. In one minute the joint will have cooled enough for it to be put to use.

No surface preparation is required on most materials, although the work should be clean. When gluing to a gloss paint or other smooth surface, roughening the parts with an abrasive cloth improves the bond. Avoid using the gun before it has become fully heated, since any joints made with lukewarm glue can't be squeezed tightly together.

A word of caution. When fully hot, the gun will inflict burns if you should touch it near the nozzle. And the glue itself will burn like fury if you should get it on your skin.

In addition to glue, sticks of hot-melt polyethylene caulking sealant are also available. These are fed through the gun in the same way as the glue. Applied in a hot bead, the clean, bright-white sealant can be forced into cracks with a heated putty knife, wiped into joints while still hot with a rag, or tooled to a neat fillet with the hot tip of the gun. The sealant isn't quite as adherent as the glue, but it sticks satisfactorily to nearly all common materials. Flash can be removed fair-

LOWEST-PRICED VERSION has 60-w. ceramic element, heats to 400° operating temperature in three minutes

POPULAR MECHANICS

ly readily with a knife. The sealer is fully waterproof.

In general, the three guns shown have the same advantages and disadvantages. A glue gun shines when you want to bond a number of small parts in a hurry. It's also very handy for joining roughly-fitted, quick-and-dirty woodwork. A framework of 1x4 lumber, for example, will have considerably more strength and rigidity when assembled with hot-melt glue than when joined with nails. And using the glue gun will take no more time than the nailing operation.

But glue guns do have disadvantages. For one, joints joined with hot-melt glue can't withstand heat above 135°. Thus, it's unwise to use a glue gun, say, to glue in automobile headliners. Since the temperature inside a closed car can soar as high as 200°F. on a hot summer day, the glue would fail.

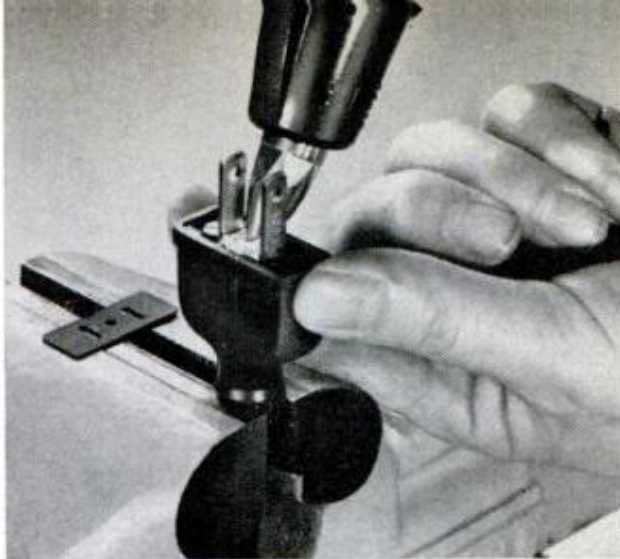
Occasionally, the fact that the glue can be remelted can be used as an advantage. For example, hot-melt adhesive can be used to bond metal parts to a machine table for machining, and later melted off with a propane torch.

Probably a glue gun's most serious drawback is the difficulty of making large-area joints. Joints larger than roughly one foot square and requiring more than one stick of glue usually must be made a section at a time. If you attempt to glue the full area, you'll find that the glue congeals before you can join the parts together. Generally, when making broad-area bonds, it is recommended that you use some kind of cold glue or cement.

If you think of a glue gun as primarily a line-gluer and spot-gluer, rather than an area-gluer, you'll enjoy the tool's advantages and not be bothered by its disadvantages. Speed of application with flexibility and shock-resistance are polyethylene-base, hot-melt glue's real virtues. If you stick to using the gun on jobs for which it's formulated, the glue is simply great.

When you've become used to handling a glue gun you'll find more than enough hot-melt gluing jobs turning up to justify the tool's purchase price. How else would you glue a tip back on a pool cue? Or fill nicks in a white-plastic-covered ski? And, for bonding polyethylene or repairing rips in plastic upholstery material, it's certain to be the glue you'll turn to. ★★★

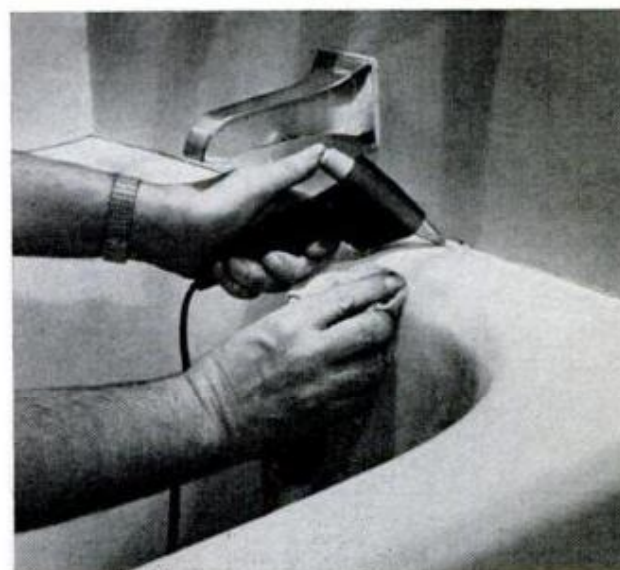
SEPTEMBER 1970



GOOD INSULATING PROPERTIES make hot-melt glue a great agent for anchoring wayward cords in plugs



FAST WAY to make strong joints: Apply beads of hot glue and press the parts together within 20 seconds



POLYETHYLENE-BASE SEALANT applied with gun around tubs or windows provides a lasting caulking

PLASTIC PIPING

(Continued from page 175)

or connection into any threaded pipe or fitting. It also hooks up with almost any compression fitting of the same size. As a union it can be assembled and taken apart as many times as necessary.

To connect to a nonplastic piping system, merely install an elbow, tee or coupling or other fitting with inside or outside pipe threads available. Then thread on the brass end of the transition fitting. Use pipe dope or wrap a Teflon tape on the outside threads. The plastic bayonet then can be solvent-welded to begin the plastic piping system.

In addition to adapters, you can connect to nonplastic systems with flare fittings. Plastic pipe can be flared if you're careful. The main hang-up is trying to flare a pipe with a nicked end. It tends to break. To avoid this, cut the end with a tubing cutter or file it smooth after sawing. Heating the pipe end also helps.

Precautions. Because the temperature-

Plastic pipe must be installed so that it is not restrained

pressure threshold of CPVC pipe is lower than that of steel or copper pipe, it requires proper installation to prevent damage from expansion and contraction, as well as from overheating and overpressure.

In general, installation of plastic pipe is no different from any other. All materials expand and contract with variations in temperature. Plastics, however, change more than copper or steel. For this reason, plastic pipe must be installed so that it is not restrained. Always use smooth-face plastic strap hangers so that the pipe can slide back and forth on these hangers and not have any clamps digging into it.

Heated from 60° to 160°, a 10-foot length of CPVC pipe will expand ½ in. Provide for this expansion throughout your plastic system. Be sure the ends of the pipe runs aren't blocked in. Branches leading away from long, straight pipe runs should have sufficient length (at least 20 pipe diameters) to bend with the movement. Keep pipe hangers at least 2 ft. away from fittings to allow for sufficient free movement.

Support the pipes at least every 3 ft.; every other joist is better. Vertical runs of pipe can rest on the sill or on a header in-

stalled to support them. Install metal strips where plastic pipes are run through studs as a safeguard to keep nails from puncturing pipes.

Your water heater can be a source of temperatures too high for plastic pipe. As in any water-heater installation, there should be a temperature-pressure relief valve in a galvanized steel tee so that its temperature-sensing probe reaches down into the water storage tank. The temperature-relief setting may be as high as 210° but no higher. For the best job, run 10-in. metal nipples off the top of the water heater to dissipate conducted heat from the burner. Fit your plastic pipe to them using threaded CPVC adapters.

The recommended water-heater setting for use with plastic pipe is 140°. This is hotter than your hands can stand. However, you can set the heater dial as high as 180° and still be within the design limitations of CPVC pipe.

Eliminating overpressures: When water flow is shut off quickly, overpressures can reach many times the normal working pressure of CPVC pipe. The resulting water hammer can wreck any kind of pipe if bad enough, but it's deadly to a hot plastic system. Every plumbing system must be designed to prevent water hammer. Automatic washers with fast-operating solenoid fill valves are especially bad actors. Your plumbing system should have air chambers at every outlet to cushion water hammer. Such chambers are formed by capping a 12-in. length of ½-in. pipe and extending it up from the tee behind the wall stub-out to the fixture. Air chambers for automatic washers should be made from 18-in. lengths of ¾-in. pipe.

In time air chambers may become waterlogged. Whenever this happens, turn off the water, open all of the faucets and drain the system enough to let air in again.

Never use CPVC pipe in a hot-water heating system—and don't use it for piping to or from a hot-water coil immersed in a boiler. Temperatures here often skyrocket to 200° plus.

Where to find. CPVC pipe still is not widely distributed. B.F. Goodrich and other manufacturers make the materials which specialized manufacturers turn into the pipe and fittings. If you have trouble finding CPVC pipe in your area, contact Genova Products Co., 300 Rising St., Davison, Mich. 48423. This firm is the largest marketer of CPVC pipe and fittings and can advise you where to find its nearest dealer.

In 10-ft. lengths, the ½-in. pipe sells for about 25 cents a foot and the ¾-in. costs about double that. ★★★



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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Rotary mower 'gases' lawn?

I've been told that rotary mowers with two-cycle engines—in which lubricant is mixed with fuel—damage lawns by exhausting gases and particles of unburned oil. I have noticed that many lawns have a yellowish-gray color a few days after mowing. Is this caused by the mower?—L.W., Ohio.

Could be, if the engine is in poor condition or the exhaust system is misdirected or damaged so that exhaust gases are directed downward onto the turf. I don't know that any tests have been run to determine if lawn damage results from engine exhaust. Offhand, I'd say this does not cause the condition you describe. Other possibilities are: mower set to cut too low, resulting in "scalping" the entire lawn or areas that may be slightly rolling or undulating; turf allowed to grow abnormally high between mowings; a dull blade which doesn't cut the grass cleanly.

... it's the humidity!

What's the meaning of relative humidity? What's it got to do with condensation on windows, walls and elsewhere in the house? So far, no explanations mean much to me. Can you clarify?—W.W. Tex.

To simplify the explanation, it might be put something like this: Relative humidity is the ratio between actual vapor content of the atmosphere at a given time and place and vapor (or moisture) content of air that's saturated with vapor. If air temperature rises and there is no change in the amount of vapor the air contains, the relative humidity is lowered—that is, the ratio changes. Conversely, a drop in temperature increases relative humidity. Thus, relative humidity can reach 100 percent—the dew point—at which the water vapor condenses as droplets on any surface, such as on grass in summer or window panes in colder months.

In winter, warm, moist air inside the house tends to seek the colder, drier air outside the walls. Since the walls are generally at a lower temperature than the air they contact on the room side, this sometimes causes moisture to condense on the walls—more often on the window

panes which, unlike most common building materials, are impervious to passage of air from inside to outside.

Louvers in storm sash

All last winter our storm sashes sweat badly—so much that water dripped down and damaged the frames, causing the paint to peel and the wood to turn a soggy, brownish color. Moreover, the frames swelled so much, they were difficult to remove last spring. I've been told to cut louvers in the lower rails of the sashes. Will this prevent sweating?—M.S., Minn.

No. In fact, louvers or holes in the lower rails will only enlarge the problem and defeat the basic purpose of the storms which is to entrap air between the sashes to serve as "insulation" and prevent condensate from forming. However, both inner and outer sashes should fit quite tightly, or the inner sashes should be weatherstripped to prevent leakage of warm, moist air from the room side and leakage of cold air from outside. In the latter case, the storms should be sealed with strips of adhesive weatherstripping or felt about 1/2 in. wide. They should be held tightly in place with turnbuttons.

For ventilation during warm periods in winter you can cut an elongated opening in the lower rail of each storm sash but this should be fitted with a pivoted cover which closes the opening tightly when dropped to a horizontal position.

Shingles 'washing' away

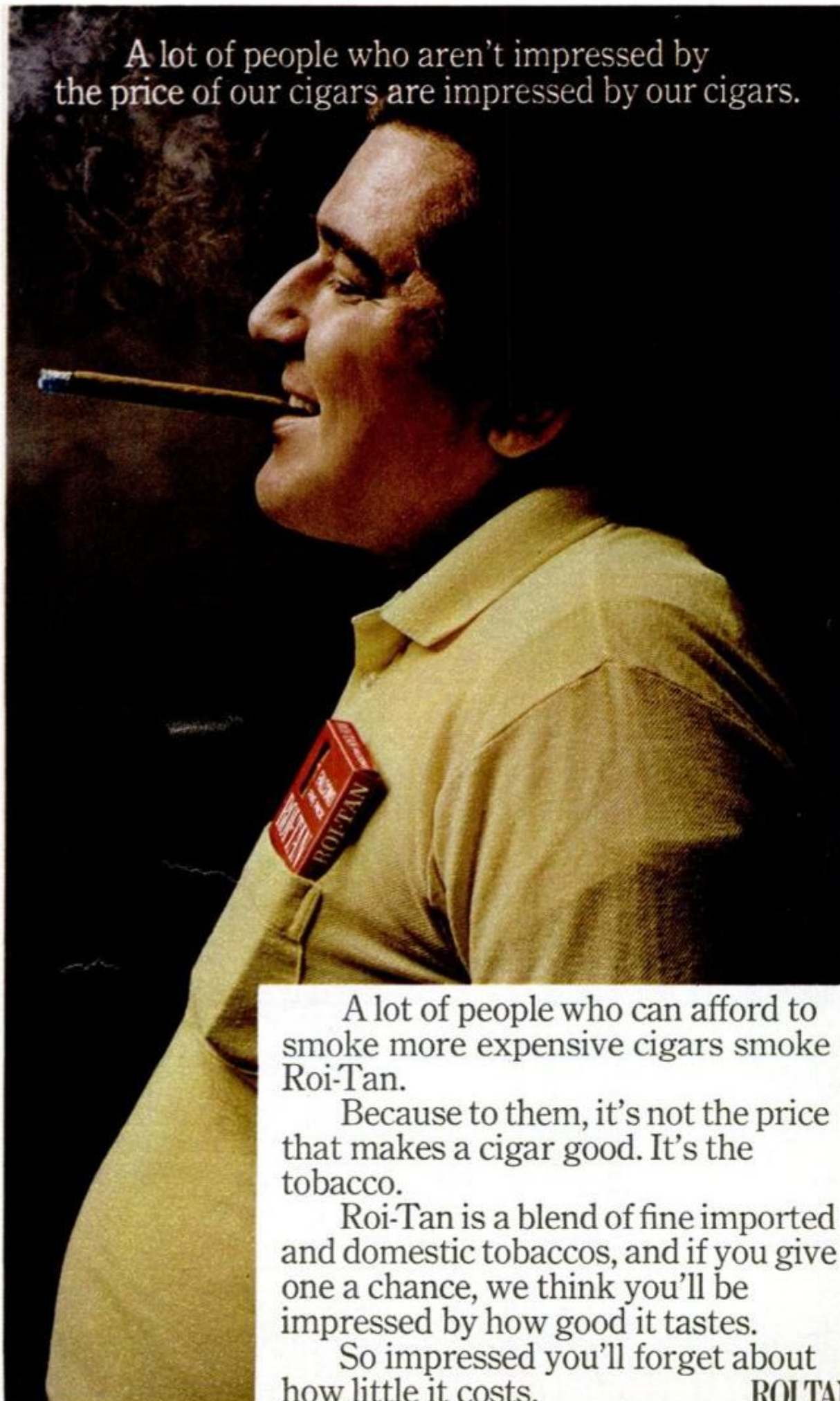
My home is only a year old and recently I noted that the gutters contain a quarter to a half inch of the fine particles with which the shingles are coated. The roofing is supposed to be good quality, but I'm wondering what's happening. Is my roof washing down the drainpipe?—G.S., Tenn.

I'd put this "problem" out of mind for the next 15 or 20 years. It's quite normal for asphalt roof shingles to shed the particles of slate with which they are coated. Some are loosened just in handling and applying. Others, not too solidly embedded, are loosened by rainfall, snow and sleet. Just clean them out of the gutters so that rainwater will flow freely. ★ ★ ★

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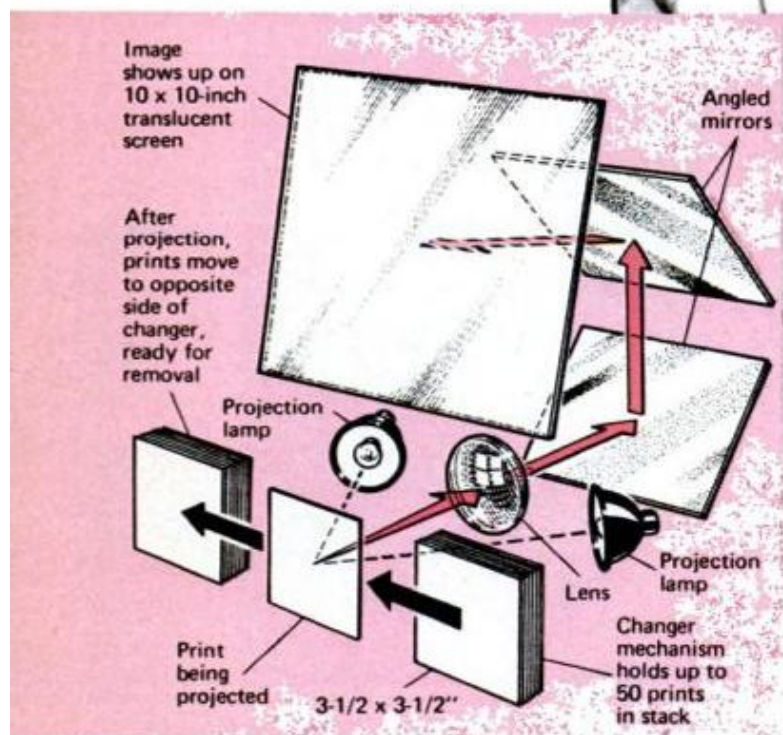
Because to them, it's not the price that makes a cigar good. It's the tobacco.

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ROI TAN *Falcon*

New Tabletop Viewer Shows Color Prints



HINGED DOOR on front of viewer swings out for easy loading of prints into changer mechanism. Changer holds stack of 50 prints and moves them, one by one, in front of projection lens

OLD PHOTO PRINTS usually get stored away in shoeboxes or seldom-looked-at albums. But not anymore. Now you can project your prints just like slides and movies. The answer is a trim tabletop viewer—first of its kind—that shows black-and-white or color prints on a 10-inch-square screen so you can easily put on picture shows for your family or friends.

Made by GE, the portable, plug-in viewer holds up to 50 prints in a changer. To switch from one picture to the next, you just slide a knob across the front. The prints feed, one at a time, from a loading chamber on the right to a collection chamber on the left. After viewing, they can be removed and stored neatly in an accessory file box for future use.

The optical system is similar to that found in old-time opaque projectors except that the modern version uses a rear-projection setup. As each print is moved into position for viewing, it's illuminated by two bright lights, and the image is reflected through a system of lenses and mirrors onto a translucent screen. The changer is designed to take the familiar 3½-inch-square print size made from 126 instant-load film cartridges. It will also take 3½-inch prints made from 620, 120 and 127 film or any other prints that can be trimmed to the 3½-inch size.

The GE viewer sells for \$69.95. The accessory file box, which stores up to 600 prints along with their negatives, is priced at \$5.95.—*Sheldon M. Gallager*

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BY WADE MITCHELL

IF YOU'RE TIRED OF MOTOR-HOME BARGAINS that don't include all the essentials, Winnebago is producing a new economy model to suit your needs—and pocket-book. The F-17 (Ford chassis—17-ft.) Renegade at \$5995 includes furnace, 36-gallon holding tank, gas/electric refrigeration, stove with oven, and sleeping for four with optional room for six. In addition, Marketing Manager John V. Hanson promises no skimping on ventilation, doors, mattresses or armrests! Now that is a bargain!

CAN YOU NAME 10 MOST POPULAR NATIONAL PARK AREAS? Surprise! Yellowstone National Park isn't listed in the top 10. In order of daily attendance, the top 10 parks for 1969 were Blue Ridge Parkway, Natchez Trace Parkway, Colonial National Historical Park, Great Smoky Mountains National Park, Lake Mead (Nevada), George Washington Memorial Parkway, Cape Cod National Seashore, Lincoln Memorial, Gettysburg National Cemetery and Grand Teton National Park. Notice that eight of the parks are east of the Mississippi River.

WORLD SPEED RECORD SET FOR MOTOR HOMES. A Toronado-engined Tra-Voy, California-built motor home, was officially clocked at 97.613 miles per hour on El Mirage Dry Lake. The big fiberglass front-drive Tra-Voy, weighing about 9000 pounds, was equipped for actual camping duty with all beds, galley and bathroom facilities intact. Just what we need barreling down a two-lane mountain road!

NEW GMC LUXURY VAN ANNOUNCED. They call it the Rally STX and it comes in half, three-quarter and one-ton sizes. Completely restyled, the new GMC vans will offer wheelbases of 110 or 125 inches for all models, with larger bodies all around. A sliding right-side door and choice of three engines are available. Largest engine for the STX is the 350-cu.-ft. V8.

USED COACHES HOLDING TOP RESALE VALUE. One California dealer reports he can get up to 85 percent of new-unit cost out of used motor homes, up to 75 percent out of used travel trailers and tent-trailers, and up to 70 percent out of van-conversions and pickup campers. Toughest to find: clean, used luxury motor homes. A used 22-foot Winnebago that sold new for about \$10,000 two years ago recently resold in used condition for \$8500! All coach dealers contacted indicated trouble finding enough clean *used* trailers, campers and motor homes to satisfy the demand.

RECREATIONAL-VEHICLE CONDOMINIUMS SPREADING. Typical model is in Waterville Valley in New Hampshire's White Mountains. Instead of renting a site by the night, you can *buy* your space. Owners collectively pay for maintenance. The advantages include instant availability of campsite at all times—and you can *rent out* your space during periods of nonuse. Neither public nor private, such condominium campgrounds will be operated much like country clubs. But instead of luxury hotel bungalows, you bring your own camping vehicle.

PARK RANGERS PACKING GUNS? Yes, that's the status in some national parks during hours of darkness. Tremendous crowds of campers packed together cause many frictions and, to preserve tranquility, a show of force is sometimes necessary. The old one-man park is a thing of the past. Rangers are considering adding full-time security men to patrol duty. As one ranger put it: "It isn't so much the campers we worry about—but the *punks* who cruise through the perimeter after dark looking for easy pickings."
★★★



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MADE IN OHIO BY ROBOTS

(Continued from page 83)

system. Five separate articulations provide up-down, in-out and rotary motion from a central pivot point and, at the outer arm, a bending and swiveling motion. The arm can pick up an 80-pound item and move it anywhere within a 350-cu.-ft. working area with an accuracy of 0.050 inches. It can reach from three-and-a-half to seven-and-a-half feet and rotate 220°.

"Unimate is taught a job by leading it manually through the required motions, establishing the work program in the machine's memory. The work program can also be fed into the machine via paper tape. Up to 180 sequential commands can be employed in a program. The memory receives information from machinery as it works and makes limited decisions based on incoming information. It can also issue commands and control operation of other machines."

There's more. Unlike some "dummy" equipment used by automakers, Unimate is not a single-purpose robot. It can be fitted with a practically endless variety of hands, fingers and gripping surfaces for grasping and holding objects. Power tools can be substituted for fingers without dismantling the unit's "hand."

Unimate is a quick learner and equally quick at forgetting. An old program can be erased instantly by pressing a button and leading the machine through a new series of motions—and so be able to work on any number of models or body styles.

The GM robots are incapable of turning out an inferior job. There's no chance for error as there is with humans. If something goes awry, the machine will send out an SOS or shut-down the line. It will not allow a botched job to slip through.

The slave machines can work 24 hours a day, seven days a week. No coffee breaks, no lunch hour, no vacations. GM says it doesn't know how long the equipment will hold up under a nonstop schedule, but it intends to find out. The company that makes the robots says they will average 600 hours mean time between failures.

Lordstown will be getting into full swing just about the time you read this, hence GM doesn't have any solid figures on how many cars can be turned out using the new equipment. Preliminary studies indicate a production capability of at least 100 cars an hour. GM normally considers a run of 50 to 60 cars an hour absolute tops. But PM believes GM is understating the case again in forecasting maximum output of 100 vehicles an hour. Our information is

(Please turn to page 206)



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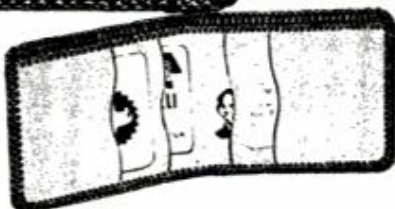
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MADE IN OHIO BY ROBOTS

(Continued from page 204)

that Lordstown rev up to 110 to 115 cars an hour—almost two a minute—without straining either men or machines.

One reason GM is proceeding so cautiously in the use of Unimates—aside from not wanting to step on the toes of the union—is that it has no bank of experience with industrial robots. The handbook GM executives live by requires that every angle, every contingency, every plus, minus and maybe be weighed before making a decision. And GM still has a lot of questions about robots.

Although Fisher Body has had experience with robot welders at another Ohio plant, in Norwood, many of the decisions GM has had to make at Lordstown have been based on information obtained from the company that created Unimate. GM doesn't question the accuracy of this information. But it believes there's no substitute for firsthand experience.

Despite the questions dangling in the air, GM is committed to the concept of robotizing more operations in more of its plants. Months before the first Vega came off the line at Lordstown, Fisher Body had already developed a second-generation version of Unimate.

Fisher calls its offspring "SAM"—short for Six-Axis-Manipulator. SAM is a one-arm automatic welder. It can maneuver a welding gun or other tool through extremely complex motions and find its way into relatively inaccessible areas with what Fisher describes as "great accuracy and speed."

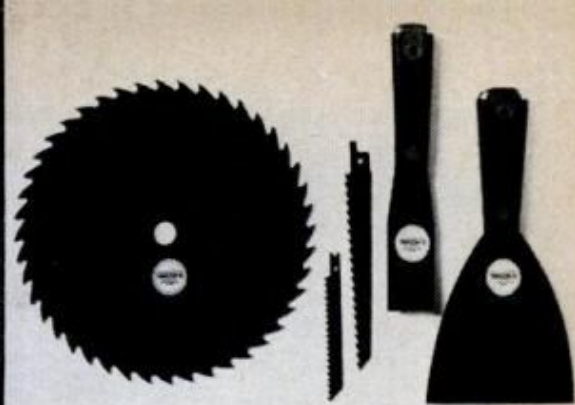
SAM can move in six directions—longitudinal up-down, in-out, bend, swivel and rotate. The machine has a logic panel consisting of a magnetic core for storing program information and integrated circuitry to pass and compare command and encoder information. It can store 510 commands over 10 different programs.

SAM learns the same way Unimate is programmed—by inching the machine through the movements of the work program. SAM can tell the difference between different body styles—a four-door and a two-door, for example. Switches brushing the surface of the car body as it comes down the line alert the robot to what the next vehicle will be and SAM automatically changes the welding sequence to match up with the car.

Fisher has a working model of SAM and is building 14 more. The division won't say where they'll be used except that they will go in GM plants.

SAM's edge over Unimate in I.Q. may

(Please turn to page 208)



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MADE IN OHIO BY ROBOTS

(Continued from page 206)

be short-lived. Unimation, Inc., is already at work on an anything-you-can-do-I-can-do-better version of its machine—a robot with eyes! Up to now, the part a robot picks up and the area where the piece is to be placed has to be locked in a fairly rigid position, so the machine can find its work. Unimation has a big brother to Unimate under development that will come with a TV scanning device, enabling the machine to "see" its work.

Will there be more Lordstowns? More robots taking over from men? Or will the Auto Workers Union force the car companies to make an antirobot reassessment of plans?

The UAW's position is not antirobot. The union is against its members being thrown out of work as a result of machines taking over. But if workers can be shifted to other jobs at the same pay, the union has no objection. The late Walter Reuther, long-time president of the UAW, went so far as to say that certain jobs in the auto factories are so arduous, mentally enervating and degrading to humans that they should be robotized.

A don't-quote-me-by-name source at GM notes that in every instance where GM has introduced automatic equipment into its plants, the company still has the same number of employees on the payroll as it had premechanization. Workers have been absorbed in other jobs, frequently at higher pay.

Another pro-labor source, an economist for the AFL-CIO, predicts that if the nation's robot population climbs to 50,000 by 1975—that's 50,000 for all the industries, not just the auto firms—the machines would constitute only two-tenths of one per cent of the country's total labor force. The people who make robots forecast a machine labor crew of 5000 by 1974. They don't see robots reaching the 40,000 to 50,000-unit level before 1980.

Finally, an official of Unimation points out the rate at which robots are entering industry is substantially lower than the normal attrition rate for humans.

The auto companies are always too occupied with now and tomorrow to reflect on yesterday or the day before. They lack a sense of the historical importance of day-to-day developments and seldom put up plaques or markers as reminders of events and achievements scored along the way. But if the industry ever pauses long enough to put up a tablet marking the site where the robot served his apprenticeship in auto-making, it will be at GM's plants in Lordstown. ★★★

POPULAR MECHANICS

How to get rich

How can you get rich some day? Make a hit record . . . a killing on the stock market . . . or invent a gadget like the hula hoop?

For most of us, these are just dreams. But have you ever stopped to think that there is a way to get rich—possibly only one sure way? Most fortunes, as you know, are made by people who own their own business.

Perhaps you've thought of starting a small business of your own . . . a franchised drive-in, or maybe a service business. Trouble is, you need \$10,000 to \$15,000 to get started and even then it's a gamble—with slim chances of ever making really big money.

But there is *one* business which could make you rich—almost overnight! And the beauty of it is, you can start on a shoestring during your spare time, even while holding your regular job.

Cash by Mail

The business is Mail Order—and it's fabulous! Come up with a 'hot' new item . . . and WHAM!

It strikes like a bolt of lightning! Suddenly, you are deluged with cash orders from all over the country . . . MORE MONEY than you could ever make in a lifetime!

Like the Vermont dealer who ran one ad in Sports Afield Magazine. His ad pulled 22,000 orders—over A HALF MILLION DOLLARS IN CASH!

There is no other business where you can make a fortune so quickly!

● A beginner from Newark, N.J., ran his first small ad in House Beautiful—offering an auto clothes rack. Business Week reported that his ad brought in \$5,000 in orders. By the end of his first year in Mail Order, he had grossed over \$100,000!

● Another beginner—a lawyer from the midwest, sold an idea by mail to fishermen. Specialty Salesman Magazine reveals, "he made \$70,000 the first three months!"

Proof

It's a fascinating business! Running ads in newspapers and magazines . . . mailing gift catalogs . . . getting cash orders in your daily mail—steady as clockwork.

There is no other business where you can start on a shoestring and pyramid your profits—without investing in merchandise! One husband and wife mail order team took in \$40,000 selling one item. They obtained FREE ads in national magazines . . . didn't invest a cent in merchandise, and even got the supplier to ship all orders for them!

These exceptional cases are absolute proof that you can get rich in your own Mail Order business. Very rich. Even a U.S. Gov. Report stated: "A number of

one-man Mail Order enterprises make up to \$50,000!"

Pick up any magazine. Notice how the same mail order ads are repeated . . . month after month? That's concrete proof! You know those ads wouldn't be repeated over and over again—unless they were bringing in big cash profits to their owners.

The Secret

The secret of getting rich in Mail Order lies in *financial leverage*. It's a little-known, almost secret method—using other people's capital to make money for you!

You can get thousands of dollars worth of advertising in big national magazines—without investing your own money! And you don't have to write a single ad. Tested and proven ads are prepared for you by experts. Reinvest the profits from your first successful ad—to get more, larger ads, and the profits begin to snowball! It's like building a chain of stores . . . each new store puts more money in your pocket.

You mail out beautiful catalogs which offer hundreds of dollars worth of fine, quality gifts—yet you don't invest one



The thrill of receiving money in your mail is one you'll never tire off!

cent of your own money in merchandise! Your catalogs are printed with your name and address, so all orders come to you. Everything is "drop-shipped" for you, and there's up to 100% mark-up! You pocket the cash profits immediately—even before the orders are shipped to your customers!

Repeat orders alone, just from mailing catalogs, could bring you a steady income for the rest of your life!

Yes, Mail Order is the fastest-growing, most profitable business in America! And now, with more people moving to the suburbs . . . the population explosion . . . and the expanding teenage market . . . we are on the verge of the BIGGEST BOOM in Mail Order history!

Now, with the help and backing of Mail Order Associates, Inc., of Montvale, N.J., you can follow the same proven steps to Mail Order success—using the 'secret' of financial leverage!

Start Now

We supply you with beautiful gift catalogs throughout the year. All products are dropshipped for you, with up to 100% mark-up! You get free samples of top-selling mail order items, plus monthly trade reports on 'hot' new products . . . tested, successful ads are sent to you monthly. You get advertising directories, postal laws, complete courses, expert guidance—EVERYTHING you need to practically guarantee YOUR SUCCESS. Why? Because *our* business depends upon your success. It's mutually profitable!

A recent feature article in Income Opportunities Magazine stated, "Mail Order Associates Inc., offers the most comprehensive Mail Order program ever offered to beginners." They go on to say, "This could be the opportunity you've been looking for. A chance to get in on the ground floor in a little-known business which we believe is on the verge of a new boom."

Free

We are now accepting a limited number of charter members in our new Mail Order Program. No previous experience is required but you must be over 21.

If you are sincerely interested in starting a profitable business of your own . . . if you can see the tremendous advantages which Mail Order offers . . . then ACT NOW!

Mail the coupon today, or simply send your name and address on a postcard. No salesman will call. We will send you a free book—gift catalog, reprints of feature articles, plus complete facts about our program. Write to:

Mail Order Associates, Inc., Dept. 285
Montvale, New Jersey 07645

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plus reprints of
Mail Order
articles

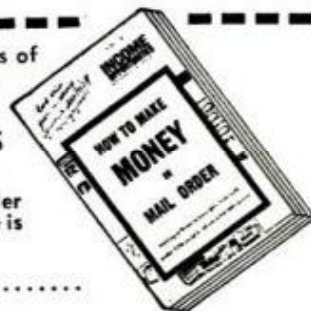
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Please rush complete details on your Mail Order Program. I understand everything is free and there is absolutely no obligation. I am over 21.

Name

Address

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





WITH A FRIEND HELPING, author knocked out windows in one day and had the room closed in by sundown. Opening was stripped down to the wall studs before any rebuilding was started. For safety, keep the work area free of debris



ROUGH OPENING is measured for new framing (left); exterior sheathing is applied next. Small opening in background (right) is framed for windows, which go in next. Windows here were installed with one stud between them



WINDOW INSTALLATION is simple; plastic "fins" that you insert into the side jambs are provided with holes for use in nailing to sheathing. To prevent leaks, felt is stapled over the fins. Clapboard, which follows, finishes exterior

PORCH TO FAMILY ROOM

(Continued from page 158)

mullion was covered with a shop-made molding.

All framing for windows and the recessed radiator was accomplished in one day with the help of a friend. I completed the balance of the job over four weekends.

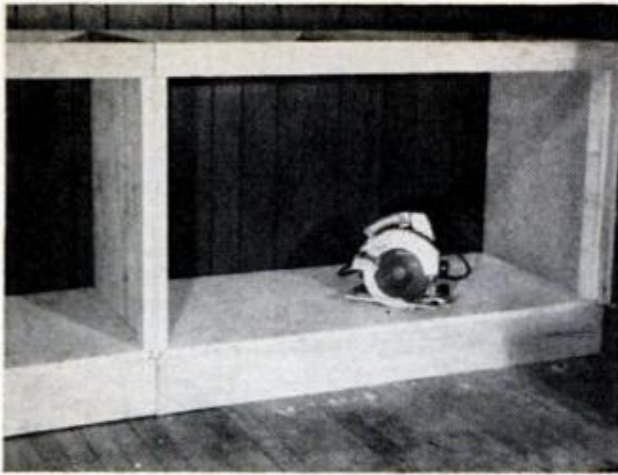
Walls. The original plaster walls were left intact. In the holes created by the new framing, insulation was installed between studs and then plasterboard was applied. To bring the plasterboard flush with the existing walls, it was necessary to shim the face of the studs about $\frac{3}{8}$ in. As shown in photos of the exterior, the holes were covered with $\frac{3}{4}$ -in. sheathing, 15-lb. felt and clapboard. Finally, in the crawlspace below, insulation was installed between joists. This completed the rough construction.

The wall finish selected was Cambridge Red Antique hardboard paneling, which sells for about \$10 per sheet. The material is also available in four other colors, each toned to match one of the popular antiquing kits on the market. (This makes it simple to finish the trim to a perfect match).

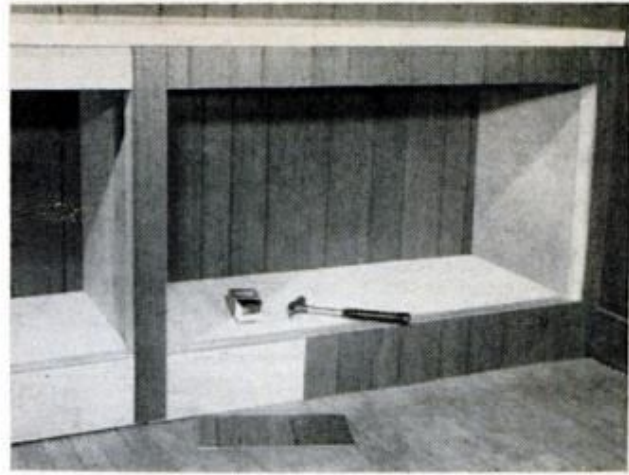
Since room height was just about $8\frac{1}{2}$ ft., I left the 1x6 baseboard in place and rested the panels atop. As they were cut, scraps were carefully placed aside for use on other parts of the job. All paneling was applied using a generous amount of adhesive and color-matched nails. Any mars or nail holes were filled with PanelTouch, a Masonite product that comes in tube rather than stick form.

The ceiling. This was in terrible shape, so I added furring strips and covered it with paneling. I picked up the cheapest V-groove plywood available (about \$3 per 4x8 sheet). After installing the panels, I sealed, primed and painted them white. The beams that cover the joints are 4x4 cedar that I "antiqued" (roughed with an adz). Beams are held in place by countersunk screws which are concealed by short lengths of doweling. To create a "half beam" look, 2x4s were used at both ends of the room.

Along both sides (length) of the room, I installed a 1x6 skirt (or apron) at the ceiling. Where it was necessary to butt two boards end-



ENTERTAINMENT CENTER, framed almost entirely with $\frac{3}{4}$ -in. plywood, is built to suit width of room



FACE OF UNIT was skinned with scrap paneling obtained from cutouts and applied with glue and brads

to-end, I invented a joint that would give an [Early American feeling](#) (see [skirt butt joint detail, page 159](#)). Dowels at these joints heighten the effect. Skirts were notched for the beam ends to rest on. To make the job go faster, all materials used for beams and skirts were stained and antiqued before installation.

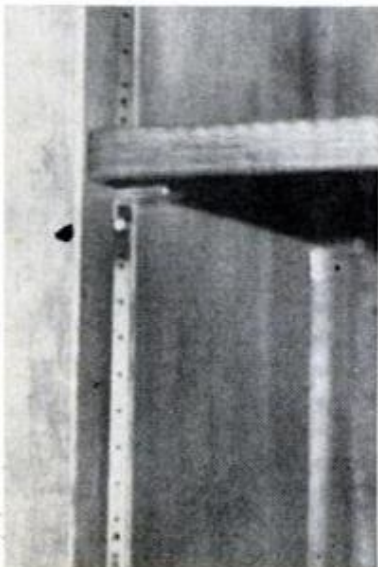
Entertainment center. Now the busiest corner of the house, this built-in was challenging, but fun, to build. It is built in place and permanently fastened to the wall. The counter height is a standard 36 in. The deck and shelves below give ample storage for items such as records, games and photography gear. Sliding doors were used for a practical reason; swingers would have required clearance in the room, thus restricting furniture placement. Above the deck, four 2x12s (for economy, structural grade was used) were installed vertically to create shelf space. These were placed to give three

bays of equal width. At bottom, they rest on shop-made plates that were cut from exterior, 5/4-in. casing that was saved when the old windows were torn out. For appearance, their edges were shaped with an ogee cutter in the router. The verticals were simply toenailed at top into the ceiling, at bottom into the counter and at several points along the back edges into the wall. Before installing them, the grooves for the flush-type wall standards were routed. ★ ★ ★

CREDITS

Perma-Shield windows, Andersen Corp., Bayport, Minn.
 Recessed radiator, American-Standard, 40 W. 40th, New York.
 Hardboard paneling, Masonite Corp., 29 N. Wacker Dr., Chicago, Ill. 60606.
 Chateau doors, General Products Corp., Box 887, Fredericksburg, Va. 22401.
 Carpet, Ozite Corp., 1755 Butterfield Rd., Libertyville, Ill. 60048.
 Adjustable shelf hardware, Stanley Hardware, New Britain, Conn.
 Exterior nylon shutters, DuPont, 3301 N. Market St., Wilmington, Del. 19802.

ADJUSTABLE SHELF HARDWARE is let into routed grooves for a snug shelf fit. The bifold doors were actually designed for a closet, had unfinished backs. Strips of pine were cut to force-fit into channels, then the paneling was cut to suit, glued and nailed in place. Metal frame was finished with antiquing kit



TOO FAST IN FOG

(Continued from page 89)

center steel guard rail. It now faced backward toward the home he had left not long before.

Trooper Winkler, helped by a few others, began searching cars near the propane truck, hoping firemen would arrive to cool it. He was afraid it would explode. He attempted to reach those in the burning cars but found it impossible to get close because of the fire. There was no hope of getting to the man and woman trapped in their cars.

Winkler knew they must be dead. As the fire rose he watched the truck cab become a skeleton of red-hot steel. Then the huge van's metal sides actually began melting away, revealing its cargo: three new diesel engines in big wooden crates. The crates were on fire.

Back in the fog a fourth truck, a big Mack tractor pulling a long rental trailer, shuddered to a safe stop in the right lane,

There was a shuddering collision . . . the car was rammed ahead far under the trailer.

air brakes whistling. Behind it came another truck, a White tractor from Maryland pulling a long van. Then a big Cabrini moving van pulled off on the shoulder and stopped.

Then through the fog came a sound like an explosion, and then another. Other collisions were happening . . .

Earlier, when the Blake family had come to a stop on the right shoulder, the young husband shouted: "Get out and run—quick! Get across the ditch and on the other side!" It was good advice. His family fled safely.

But when he opened his own door to get out, he was hit and hurled against his fender. Though injured, he ran to join his family. All hurried northward off the road.

"We were just trying to get away," he said later. They had gone some distance when the three trucks—the fourth, fifth and sixth to come along—made safe stops. Then, dimly in the fog, Blake made out a "long low vehicle" that was approaching and seemed about to stop, too. It looked like a truck, but actually it was the Pontiac Tempest from New Jersey with its U-Haul trailer. In the Tempest, an elderly couple named Matos were heading south.

Driver Matos stopped safely behind the fifth truck, the big White from Maryland. He sat in the car, as if wondering what to

do next when a seventh truck came along. The truck's brakes went on hard. Then there was a shuddering collision and the U-Haul trailer was hurled high into the air. The Tempest, with both occupants in it, was rammed ahead far under the trailer of the White truck from Maryland. Young Blake ran to help. When he reached the car he could see Mr. and Mrs. Matos hopelessly trapped in the crushed metal. Then fire broke out, fed by gasoline from the car itself, and soon the Matos couple was dead.

The truck that had hit the Matos car and trailer continued rolling. (A big gasoline tanker, badly damaged, was later found stopped just ahead on the left shoulder, but whether this was the truck is not known.)

Next came the young mother from Maryland driving a Pontiac station wagon carrying several children. She managed a safe stop on the left shoulder.

A couple from Georgia, also riding in a '66 Pontiac station wagon, approached in the left lane. When the husband saw the burning Tempest and U-Haul he started to pass, but his wife was afraid to go farther. He stopped. Then his car was rammed by a '66 Ford Fairlane from New Jersey. A fourth pileup had begun.

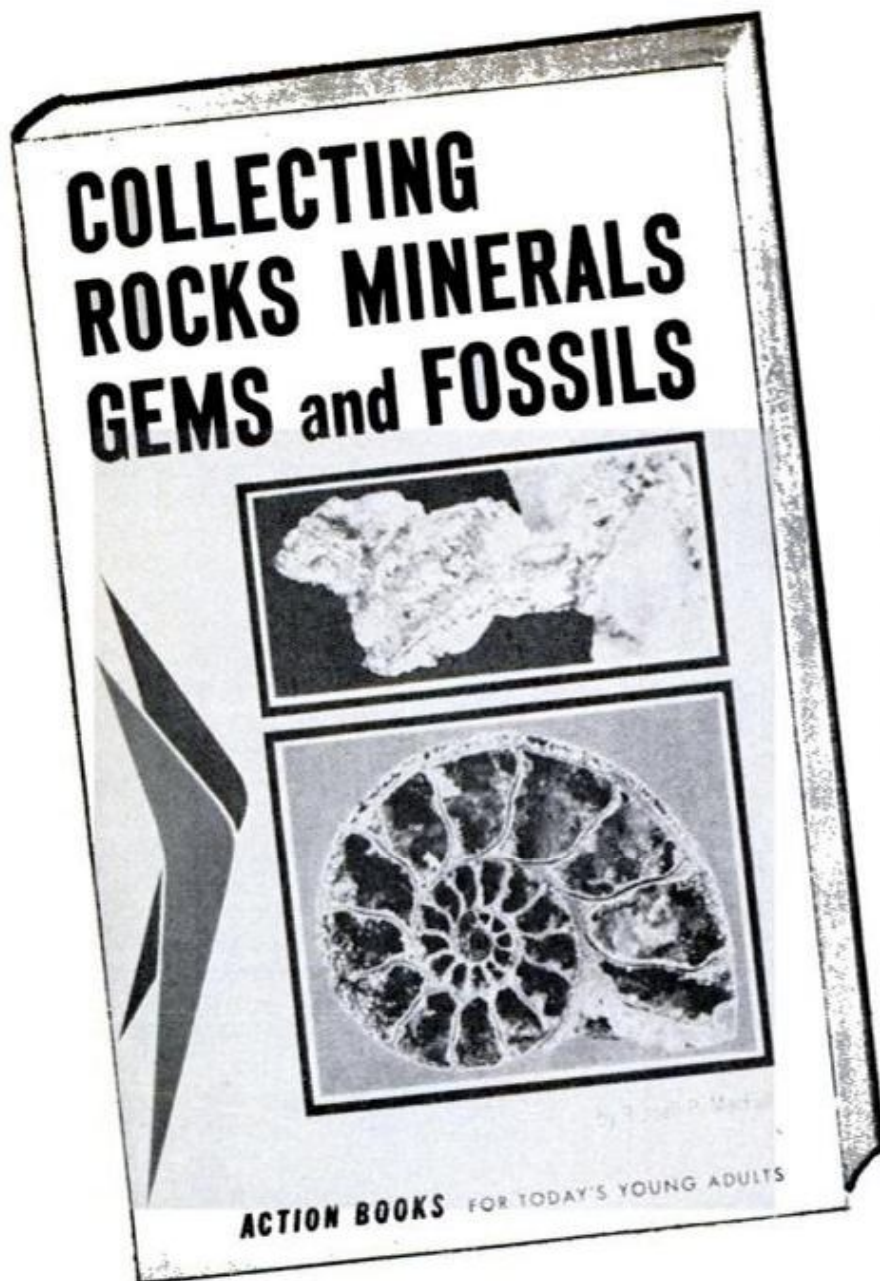
Now came a tractor-trailer from Massachusetts. It swerved left, probably in an attempt to miss the two cars that had just collided. It ran on the shoulder and stopped inches from the Maryland station wagon with the children in it. In making this maneuver, the Massachusetts truck may have partly run over still a third Pontiac, a '68 Bonneville from Connecticut. The Bonneville, squeezed off the road, was found jammed against the steel guard rail and part way under the Massachusetts trailer. This, as counted by U.S. Highway Safety Bureau investigators, was the nineteenth collision in 20 minutes.

And suddenly it was all over. The fog, heated by fires in several vehicles, was thinning. Troopers had stopped all traffic at last. Firemen had arrived and were pouring water on the hot propane truck to keep it from exploding.

And a shaken Trooper Winkler now surveyed 380 feet of highway devastation. Six persons were dead. Four motorists had been trapped under trucks and burned to death. A fifth had burned to death in a fiery collision to the right of the propane tanker. The sixth death was that of the propane tanker's driver. Twenty cars were demolished, six trucks destroyed or damaged. The pavement was so badly damaged that it would have to be repaved.

Winkler looked at the trail of wreckage;

(Please turn to page 214)



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TOO FAST IN FOG

(Continued from page 212)

it was a monument to the folly of driving in superhighway fog. And it was something more: *A warning of tremendous disasters to come unless drivers, officials and truckers work together to find a solution.* Ironically, the Turnpike disaster came at a time when the trucking industry was pressing hard in Washington for permission to run wider and longer trucks on the highways.

As the fog cleared, Dr. Jaffee recovered consciousness. He found himself stumbling in the grass far beyond the northbound side of the Turnpike. He saw the wreckage, the smoke and fire, the people running. He heard the screams. It was last year all over again, but this time he was in it and hurt. He slowly found his way back to the lump of metal that had been his new blue car. He probed in it, found the small box with the denture, and carefully tucked it into a pocket. Its recovery, oddly, gave him comfort. ★★★

ATOMIC POWER FOR YOUR HEART

(Continued from page 107)

to a normal "beat." Electric pulses produce the necessary 70 or so heartbeats a minute by adding a pulse generator to a power source—truly a miracle in a battery.

There are two types of pacers—myocardial and transvenous. The *myocardial*, rapidly losing favor, requires major chest surgery to expose the heart so the surgeon can sew the electrodes to its surface. Power source and pulse generator are buried under the skin nearby. This pacer is particularly useful in children whose growth will stretch and strain the electrode.

Often using only a local anesthetic and working at the bedside, the heart surgeon can insert a *transvenous* pacer by making an incision in the armpit, neck or abdomen. He then locates a large vein and snakes the pacer's electrode through the veins to the heart. The power source most commonly used today is a set of five or six mercury batteries (each little more than a half-inch in diameter and less than a half-ounce), connected in series.

Pacers work essentially in two ways—at a fixed rate or "on demand." The fixed-rate pacer, also losing favor, delivers its pulse automatically at a set rate (usually about 70 a minute). However if the heart should suddenly beat by itself at the exact moment of the pacer's shock, the double impulse can throw the heart muscles into

runaway disorganized contractions and lead to major problems. For this reason "demand" pacers were developed.

The demand pacer is designed to utilize the heart electrode as both the stimulating and the sensing device. If the heart has a normal beat, the electrical impulse in the muscle is sufficient to inhibit the pulse generators and the pacer will rest until the normal heartbeat stops. Even a single missed beat, however, will bring the pacer back into action!

The pulse generators emit a 3 to 6-volt impulse lasting for 1 to 2 milliseconds (thousandths of a second) and taking a tenth to a thousandth of a millisecond to reach full intensity. The heart electrodes may be helical coils of metal covered with silastic: platinum-iridium, stainless steel, gold or platinum-plated stainless steel, or even Elgiloy (chromium, nickel, iron and other metals) at a thickness of about two human hairs (0.006 inches) are all used.

What effect has the wearing of a pacemaker on its owner? How much does it limit his activity? At what ages can it be used? U.S. Supreme Court Justice William O. Douglas—whose pacemaker is almost always mentioned in stories about him—is past 70 and is an avid mountain climber. At the opposite extreme, is Elliott Wilson: Only a few hours after birth, his electrocardiogram showed heart-block. By his tenth day he was receiving digitalis for congestive heart failure, a condition more often found in the aged.

At four months, Elliott had a temporary pacer and shortly thereafter a permanent junior-size one. There are a considerable number of children like Elliott who attend regular school, enjoy unrestricted activities, even go to camp. At Yale University, doctors have successfully implanted an extra six or eight inches of electrode coil enclosed in a Teflon envelope—it pays out as the child grows.

There is Will Gray, an active 40-year-old executive who works and travels at high speed. His first pacer was an early, and relatively primitive, myocardial one installed in 1961. It failed, and Furman replaced it with a transvenous model. When the batteries recently ran down, Gray entered the hospital on a Thursday afternoon. His battery was replaced on Friday, and he was home catching up on work by Saturday. Incidentally, Will is not a guy to tangle with—he takes jujitsu lessons!

While you're certainly better off if you never need a pacer, if you do, this marvelous electronic device can save your life! And when the atomic pacemaker is perfected and available, you may never have to give it another thought. ★★★



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MAZDA 1200, from Japan, is two or four-door model

'SENSIBLE' STATION WAGONS

(Continued from page 139)

particularly attractive, but it houses round, easy-to-read gauges and sensibly placed controls. A thermostat modulates the heater output—a nice touch. But two hard-to-find, one-inch-square buttons on the steering wheel actuate the horn. Why?

Front bucket seats provide good comfort along with a fantastically generous amount of fore-and-aft adjustment. The rear seat is roomy enough for two adults, and a collapsible rear jump seat holds a couple of small children or two desperate adults.

VOLVO 145

If you like a big-car feel, check out the Volvo 145. Its ride, interior accommodations and all-around performance resemble those of a domestic compact or even an intermediate-size wagon.

Padding in each individual front seat adjusts with a knob for lower-back support—very comfortable. The rear bench seat holds three without crowding, and rear jump seats are optional. The rear window has a wiper (gosh) and a defroster. Controls, most of them massive, are well-placed on the instrument panel.

The steering wheel is large, set a bit too close to the driver and its slow gearing limits maneuverability. Otherwise, handling is pleasant and predictable, with lots of tire squeal and mild oversteer coming in near the Volvo's respectably high limit of adhesion. The four-speed floor shift is precise, but stiff, and the clutch pedal is rather heavy, especially for women.

The Volvo engine gave the best performance in our group of test cars; it pushed the 2860-pound wagon to 60 mph in 11.7 seconds, and from 50 to 70 in 8.1 seconds. During the latter runs it didn't seem to matter whether we used third and fourth gears or third alone. Volvo's fuel economy, though lowest of all our wagons except the Toyota, was a decent 21.9 mpg.

CITROEN

It's not really an economy wagon, but the Citroen is so unique mechanically that we included it in our group.

The oddest feature of the Citroen is its hydropneumatic suspension, which auto-



HORNET SPORTABOUT, new in AMC's '71 lineup

matically levels the car regardless of load or incline of the road surface. It also gives a fantastically comfortable ride (better than Cadillac's) over all road surfaces and regardless of load. But when stopped at traffic lights, Citroen occupants need a sense of humor to shrug off the stares of other motorists as the car, sighing contentedly, alternately rises and sinks.

The suspension has no metal springs; countless feet of hydraulic spaghetti carry a "special green fluid" (to quote the owner's manual). A lever under the instrument panel raises the suspension for greater clearance over rough roads. To change a flat tire, simply raise the suspension, prop up the car with a jack stand, and push the lever to the lowest suspension setting. The wheel tucks up into its well without any jacking.

The interior is absolutely splendid. Well contoured, thickly-padded bucket seats provide superlative comfort, and the equally comfortable rear bench seat cradles three adults if necessary. Legroom is good in front, exceptional in back, and the front-wheel drive allows a perfectly flat floor. Headroom is ample all around. And for occasional extra passengers, jump seats unfold in the load area. Wall-to-wall carpeting over thick foam padding adds to the feeling of luxury. But the inside door handles are abominations; Houdini would have had trouble escaping from inside.

The instrument panel design could have been lifted from a captured World War II Japanese submarine. We suppose the controls make sense once you've memorized the layout, but we never quite managed this during our five days with the car. Gauges, including a tachometer, are large, round, and legible, but we'd be happier without that Mickey Mouse rotating band on the speedometer telling you how many feet you need to stop at various speeds.

The finish inside and out was flawless. But the load area—plain painted metal—should have at least a rubber mat to prevent scratching.

The weird, single-spoke steering wheel takes lots of effort in spite of power assist. The disc and drum brakes stop fast

(Please turn to page 218)

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'SENSIBLE' STATION WAGONS

(Continued from page 216)

and straight, with little fade. Clutch action is smooth and progressive, and the four-speed column shift, though vague, allows reasonably fast gear changes.

By exceeding the 6000-rpm redline slightly to avoid a two-three shift, we covered 0-60 in 13.9 seconds. With third gear only, 50-70 runs averaged 8.7 seconds. On our fuel economy tests the Citroen recorded 23.9 mpg. The speedometer was two mph fast at 30, three mph fast at higher speeds.

Specifications of the wagons that were not available in time to test are in the chart. All in all, 20 attractive alternatives to large, domestic land cruisers. ★★★

HURRICANE CAMILLE

(Continued from page 95)

room down. When the door wouldn't yield they smashed a window and climbed in.

The girl was hysterical. Her husband, hands bloodied, was trying to smash a hole through the wall. Hood and the lieutenant grabbed them and led them, one at a time, back to the other rooms.

Through it all, incredibly, the young guardsmen in the LARCs kept going. They bumped submerged cars, tangled with wires, got blown toward the Gulf and struggled back to tie up to rooftops. They saved hundreds of people.

Back in Pass Christian, a group of men and boys were rescuing people from treetops in a DUCK borrowed from the National Guard. A boy standing in the bow lifted fallen wires and passed them back over the heads of the passengers, not knowing for sure whether the wires were live or dead.

At 10:00 p.m. the DUCK got a frightening radio message: The Episcopal Church had blown away with 14 people in it. Soon afterward, Civil Defense Director McKay also got a call: Randolph School gym had just collapsed. McKay knew that some buildings strong enough to take the battering of wind and sea were exploding as air pressure dropped sharply outside their walls. In one parking lot, it was later learned, 180 cars exploded.

Luckily no one was in the gym at Randolph, an elementary school. McKay now was concerned about the 700 people in the public high school gym. If one gym had gone, another might go, too.

He wasn't worried about the strongly built Catholic school gym. But he flashed a radio order to the high school: "Get those people out of the gym—quick!"

They came out, wading, stumbling, gasping in the wind. The last stragglers had just reached the main schoolhouse when, with a roar, the gym walls blew and the massive roof caved in. As many as 500 lives may have been saved by McKay's quick thinking.

A huge tide came at 11:00 p.m. Forty-five minutes later there was an attack from the rear. A second tidal wave, a backlash, came rushing toward Pass Christian from the north. It swept down from the forests, which now were treetop deep in water. It crested and knocked down houses in its way.

This second wave peaked out at 12:30 a.m. At that time Director McKay waded out of the firehouse, trying to find what was left of his town. Chest deep, he got into a factory building, helped by an aide. "We've got to see if anybody else is alive," McKay said. But finally they had to turn back. The sea was too deep, the night too black.

By 2:00 a.m., Monday, the worst was over. A total of 136 people had been killed along the Mississippi coast—over 100 in Gulfport, Long Beach and Pass Christian, and at least 15 in Biloxi. (Three days later Camille, swinging northeast as it petered out, unleashed furious rains over Virginia, killing over 100 more people.) Property damage in Mississippi totaled nearly \$1 billion. Over 36,000 homes and nearly 600 mobile homes had been destroyed or damaged. The Towne House Motel—or at least a good part of it—remained standing. But not a trace remained of the Richelieu apartments.

The oil company LST miraculously survived. The pirated ship *Wade Klein* had been hurled high over the island where it had anchored, and landed ashore in full view of police. But there was no sign of its crew.

The yacht with the old man and the boy had been swept right over the closed Biloxi drawbridge, smashing against a bridge lamppost. The boy, in a desperate leap, grabbed the post. But the yacht and the man vanished. Next day the boy was found, still alive, clinging to the post.

If the horror that hit Mississippi should ever strike a big city, say Miami or New Orleans, experts warn that a quarter of a million people could die. May it never happen. As for the Weather Bureau, though it did a good job of warning residents, it was so shaken by the death and destruction that it has wiped the name Camille off its lists forever—"retired" it like Babe Ruth's famous No. 3. Other names may be reused on future hurricanes. But never again will a storm be called Camille. ★★★

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VEGA

(Continued from page 114)

overhead-cam four. The aluminum-alloy block is die cast and weighs a mere 36 pounds. What makes it even more unusual is that the engine uses no cast-iron cylinder liners. Instead, the aluminum alloy carries a 17-percent silicon content. Cylinders are bored and then an electrochemical etch eats away a tiny bit of the aluminum. This leaves the silicon exposed for the pistons to ride up and down on.

To match the hard silicon cylinder surfaces, GM Research came up with electroplated pistons. Theirs is a four-layer process over a basic aluminum piston. The first flash is zincate, followed by a very thin film of copper. The third and primary coating is hard iron. A final flash of tin keeps the iron rust-free during handling.

Up top, the block has an open deck; that is, you can look right down into the water jackets as well as into the bores. Cylinders are siamesed (webbed together), with water jackets along both sides. Ordinarily, this open-deck arrangement would make the block relatively weak, but Chevy uses the cast-iron (not aluminum) head as a strengthening member.

Major differences between the 90 and 110-bhp engines are one and two-barrel carburetors, respectively, and different cam grinds. Transmission choices for the Vega include all-synchro three and four-speed manual, Powerglide two-speed automatic and semiautomatic Torque-Drive.

Disc brakes are standard up front, and they give excellent stopping. I could feel no fade from 80-mph stops on the flat nor during normal driving in the mountains. The brakes have no power assist and don't need any. It was safe going all the way to Phoenix. ★★★

PINTO

(Continued from page 115)

to the driver who wants familiar look, feel and handling in his car. One code name was, appropriately, Special Maverick.

Options, by the way, are numerous. Many more, as Ford boasts, than competitive imports. Is this good or bad? Tailor the car to your taste, goes one argument. On the other hand, when a potential buyer realizes that the cost of his Pinto will soar over \$2000 to set it up the way he wants it, he'll take a closer look at features imports may offer as standard equipment. Options include: airconditioning, manual front discs, tunnel console with electric clock, roof rack, whitewalls,

(Please turn to page 222)

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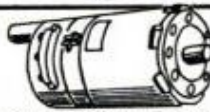
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PINTO

(Continued from page 220)

pivoting rear-quarter window, tinted glass, rear-window defogger, vinyl roof, AM radio. There are no less than five "groups"—protection, convenience, accent, luxury decor and sports appearance—including rubber-insert bumpers, various moldings, carpet . . . you name it.

Pinto—still to be tested in the marketplace—joins the Capri which got off to an auspicious start last April. The highly-acclaimed, European-built Ford has been a sellout to the delight of Lincoln-Mercury dealers who indicate they come through so well made they do nothing but wash them. The '71 model is the same as the '70½—same standard equipment: power front discs, radials, carpeting, bumper guards and so on. For such a sporty coupe, it's a bit underpowered with the 1600-cc engine (European version offers engines up to three liters).

Pinto and Capri are different—the American and European design approaches are quite evident—but will be very alike in their market impact. ★★

'71 FORD, LINCOLN-MERCURY

(Continued from page 119)

lower, wider, wider track, sheet metal shaped to hide wipers, recessed door handles, the same new convertible top linkage and a host of interior and exterior changes that are small but not insignificant. Four-way power seat is among the new options for five two-door hardtop and convertible models in the base, Cougar XR-7 and GT series. The 429 engines are now optional for all models.

Thunderbird's story for '71—after the design refinements inside and outside have been appraised—is, as usual, mostly about the standard and optional features that go even further in transforming this automobile into one of the most extraordinary personal domiciles on wheels. New weatherstripping better seals the interior where are found switches and controls for everything from new electric deck-lid release to electrically operated sunroof (now available on all models.).

Lincoln Continental and Mark III are slightly refined and unchanged "following the tradition of timeless automobiles," respectively. Both now offer as standard equipment airconditioning with automatic temperature control, Michelin white-side-wall radials, tinted glass, side impact beams, AM/FM stereo radio using integrated circuits, and more . . . better see the dealer nearest you! ★★



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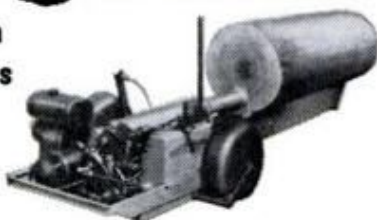


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HOW TO SIGHT-IN A RIFLE

(Continued from page 133)

with a 100-yard bullet velocity between 2500 and 2800 feet per second can be zeroed in to hit 2 inches high at 100 yards. Aimed directly at the target, it will then strike just 1 inch high at 50 yards and be right on the money at 200 yards. Longer-range cartridges with 100-yard bullet velocities between 2900 and 3300 f.p.s., when zeroed in 2 inches high at 100 yards, will also be about 1 inch high at 50 yards and exactly on target at 250 yards.

It's not really as complicated as it sounds. All you have to do is determine that 100-yard bullet velocity figure.

With a correctly sighted-in rifle, you can virtually forget about elevation adjustment for most game out to 200 or 250 yards and concentrate on a steady hold.

Some scope manufacturers offer a convenient, silent way to check their products for accuracy. An item such as Marlin's V70 Veri-Fine Columnator enables gunners to make a quick check of sight alignment in the store before you buy, on the range, or in the field just before a hunt.

A word about wind deflection. First, a formula we hope won't intimidate the beginner: $D = V (T_a - T_v)$. Translated, this means deflection in inches is found by multiplying the crosswind velocity in inches per second by the time of flight for the bullet in air minus its time of flight in a vacuum, both over the same distance. Our problem: How do we determine the crosswind velocity throughout the distance the bullet will travel (remember, it varies up and down the range)—all while the eight-point buck we're after is quickly moving out of sight?! In brief, the match shooter has half a chance to bring this formula into play; the hunter must rely on experience and instinct when determining wind deflection.

Something must be said about lateral drift arising from the bullet's spin. Up to 600 yards, drift is almost imperceptible. It increases rapidly with range, but at 1000 yards is still only about a foot.

Since most whitetail deer are shot well within 100 yards, zero your open sights dead on for that range and hold some 8 inches high on a buck across a 200-yard pasture.

If you're using a telescopic sight and a high-powered bullet and you're hunting mule deer in the West, you'd be unwise to adjust the sights for only 100 yards.

Know your rifle and where it will hit with regular ammunition. Once you have learned to sight-in accurately, you can put venison on the table instead of chicken-dinner alibis.

★★★

Next Month in Popular Mechanics

More on the 1971 Cars

Starting on page 112 in this issue, you can read about—and see in color—the Chevy Vega and the full Ford lineup. In October, PM's auto editors continue with American Motors, Chrysler ("four-wheel, antiskid system, headlamp washers . . .") all General Motors divisions ("each has its own surprises . . .") and add a kind word for the auto industry.

New Outboards and Snowmobiles for 1971

In two separate reports, Outdoors Editor George Reiger sizes up the new machines. For snowmobiles, he says: "New companies, new designs and better machines." For outboards: "Minor modifications, not major changes."

They Said I Was Crazy to Drive in Japan!

"But it was fun and easier than we expected in Datsun's snazzy little 1200," reports PM Editor Robert Crossley, who just got back from a visit to Japan's Expo '70.

What's Watt in Choosing a Hi-Fi?

Like a car's horsepower, the number of watts an amplifier puts out is an important key to good performance. Here's how to determine the amount of power you need and how to unscramble the various output rating systems manufacturers use.

Will You Lose Your Right to Fly?

Misleading "scare stories" about congested airspace and mid-air collisions may bring laws that will virtually eliminate private flying. Here's the truth—and the real solution—as seen by a professional pilot.

Build This Electronic Banjo

You can make it from scrap that you probably have lying about your shop, and you'll end up with an instrument that's sure to pep up your get-togethers.

A Workbench Fit for a Pro

The smooth, durable work surface of this basic piece of shop equipment is sure to make any project go better.

The Truth About Pet Foods

You can kill your pet with 'kindness'—by feeding him all-meat canned foods that were never intended to be his sole diet.

Electronic Football Lets You Play Like the Pros

This home-built game, based on an intriguing random-chance circuit, will give you hours of fun long after the football season has ended.

Look What You Can Do With a Swivel-Blade Sabre Saw

You can make cuts that once were impossible. And you can steal a couple of tricks to use with an ordinary portable jigsaw.

HOW CAN AN 8" TILT ARBOR SAW WITH \$80. PERFORMANCE SELL FOR \$19⁹⁵?

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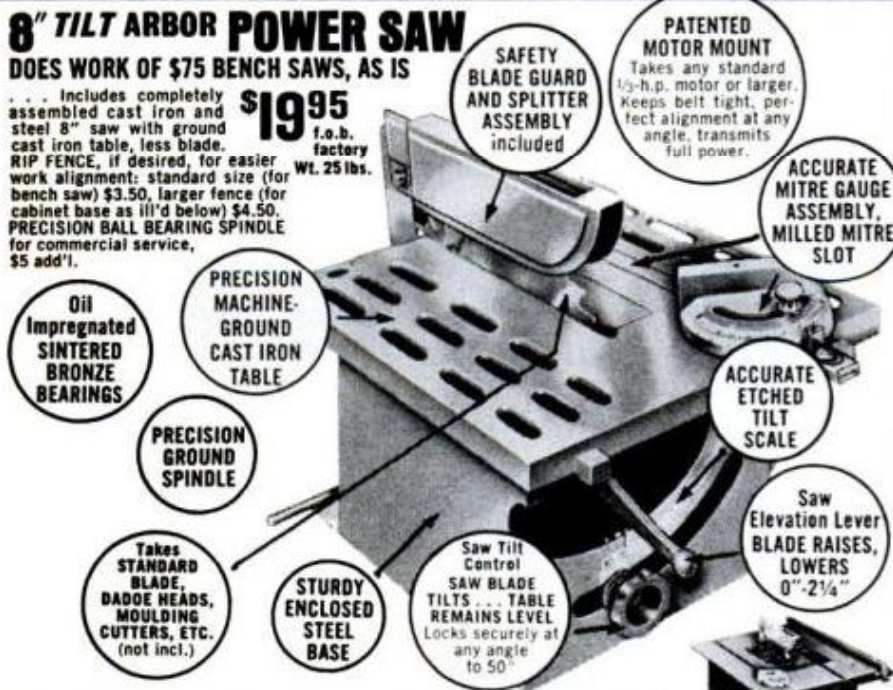
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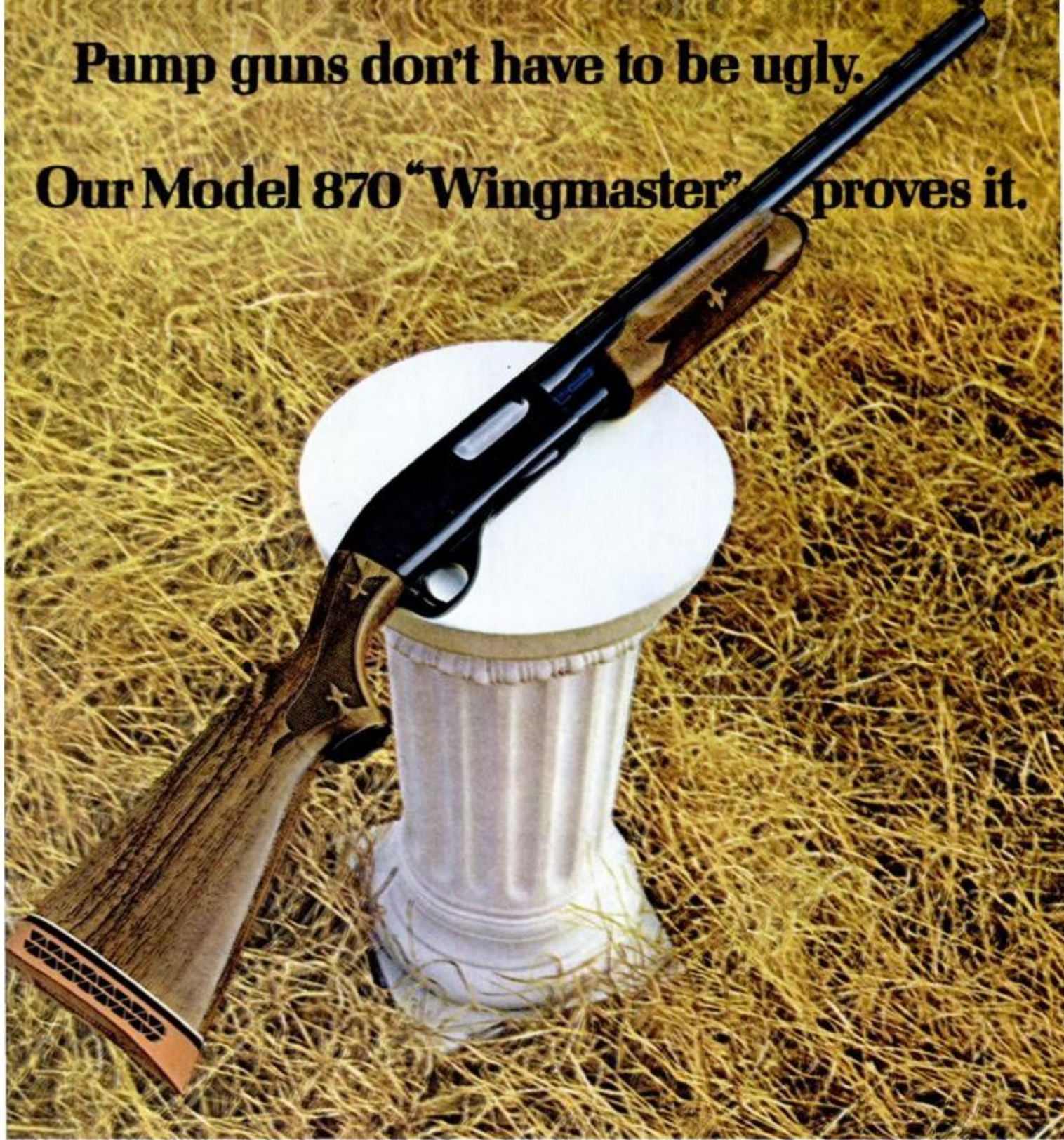
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