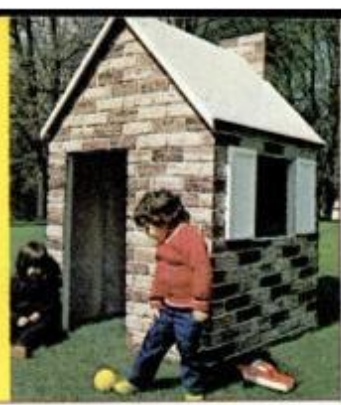


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JULY 1978

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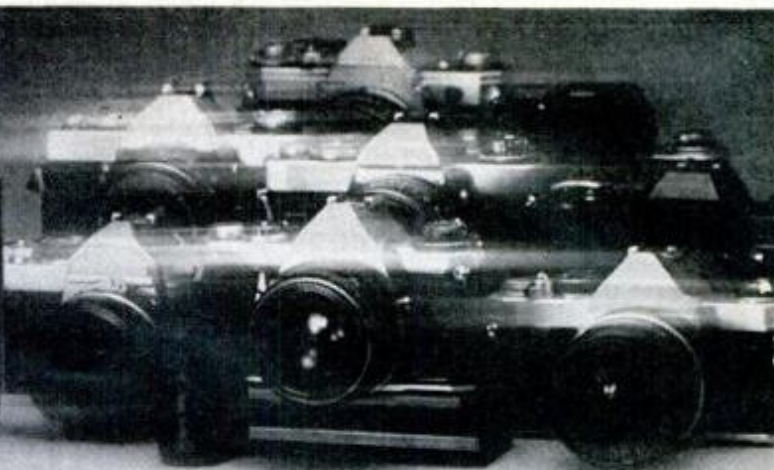
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Innovation.

Olympus innovated the concept of the compact SLR. The introduction of the OM-1 startled the world of photography by putting so many big ideas into such a small body.

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Enter the OM-1. Suddenly, the SLR camera is 33% smaller and lighter, yet incredibly rugged to meet the demands of professional wear and tear. Miraculously, the viewfinder is 70% brighter and 30% larger for faster, easier composing and focusing.

And suddenly the OM-1 became the #1 selling compact SLR. Its metering system is designed to give complete control to professionals and photojournalists. No distractions, blinking lights, or obscured images in the viewfinder.

A Quiet Innovation.

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It's the fully automatic OM, with major differences from all other automatics! The only SLR with "off-the-film" light measurement for those photographers demanding the ultimate innovation in automatic exposure control. Which means each frame is individually exposure-controlled even in motor drive or rapid winder sequences. And it makes possible the unique Olympus 310 Flash whose flash duration is controlled by the camera's metering system.

And of course, the OM-2 shares every other innovation and system component with the OM-1.


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Millions of Americans pay the price of high fidelity and don't get it.

This year, almost three million Americans will go out looking for high fidelity and come home with nifty little compact stereos.

Another four hundred thousand will put their hard earned money into massive fruitwood consoles.

And still others will spend almost \$240 million on cheap "private label" components.

A lot of the money these people spend will be wasted. Mainly because they won't be getting the high fidelity they think they're paying for. They'll be getting electronics that are often no better than what's in your kitchen radio.

And the pity is that for about the same money, they could have had the real thing.

What is high fidelity?

The minute you hear high fidelity, you'll know what it's all about.

Real high fidelity is an experience. It's hearing, and feeling music the way you've probably never heard or felt it before. The way you can usually only experience it at a live performance.

The only high fidelity equipment made today that can give you these experiences are separate brand name components.

Separate turntables, receivers, speakers and tape decks, each designed to do its one job perfectly. Each built by companies who care about music. Like Pioneer.

You don't have to be an expert to buy it.

Just go to any reputable high fidelity dealer. A dealer who not only carries brands like Pioneer, but who also features a separate soundroom for you to sit back and really *listen* to the equipment.

Tell the salesman how much you want to spend, how big your room is, and what kind of music you usually listen to.

If he starts talking about ohms or microfarads, ask him to be quiet. You're not interested in hearing about ohms or microfarads. You're interested in hearing music.

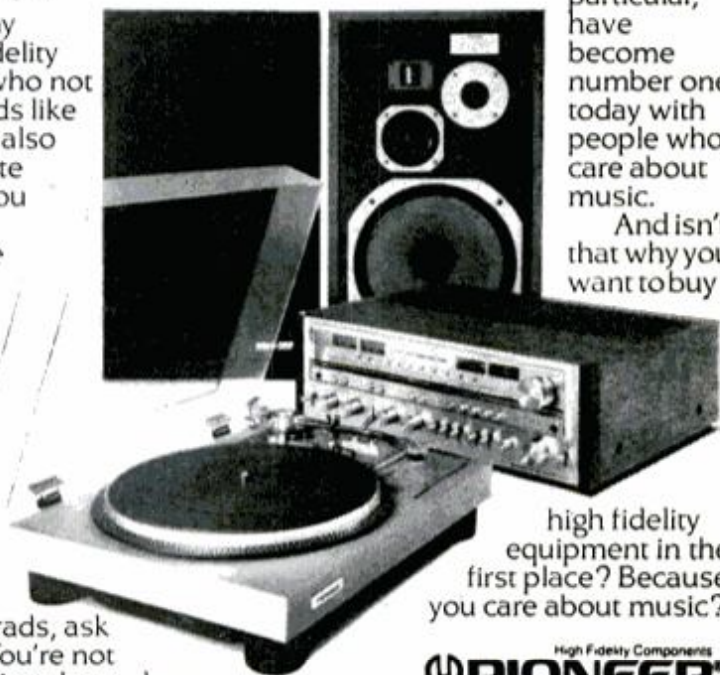
Compare the sound of Pioneer's hi fi components to

components made by any other quality hi fi company.

We think that you'll not only hear how incredible music can sound on good hi fi components in general, but that you'll also hear why Pioneer components, in

particular, have become number one today with people who care about music.

And isn't that why you want to buy



high fidelity equipment in the first place? Because you care about music?

High Fidelity Components
PIONEER
We bring it back alive.

LETTERS TO THE EDITOR

Burning question

The Boeing company will probably not forgive your reference to the flaming plane on page 85 of the April issue (*Target: A Safer Plane to Crash In*) as a C-133.

It is a Boeing Stratocruiser, known in the USAF as the C-97. I should know, I have many, many flying hours with the tanker version, the KC-97.

D.B. GRUNEISEN
CAMARILLO, CALIF.

Reader Gruneisen was one of many to point out this error. Maybe Boeing would have been just as happy that someone else's plane is said to be burning.

Model behavior

In reference to the article about the plastic models (*Plastic Models: Hobby That Grew Up*, page 106, Apr. '78): I don't think that modeling is just slapping a few plastic pieces together, I think it's much more than that. It's a world all its own, something you can express your feelings on, something to help the problems around you and just lose yourself in fantasy. I am 14 years old and an avid model builder. I'm not an expert, but I'm no klutz, either.

ANDY CALVERASE
OSWEGO, N.Y.

Divide and unite

My two sisters, ages 11 and 13, were always arguing about their room. One would read at night a lot when the other would want to go to sleep, but the light would keep the other awake. They would often yell at each other and disturb the rest of our family.

One night I left the September '77 issue on our kitchen table. The next morning one of the girls started leafing through it. She came upon the article *Two Rooms From One* (page 96) and showed my parents. About two weeks later the dividing wall was up. By the next week it was completely done. Now they live in peace and so does the rest of the family.

BRIAN PETERSON
SHRUB OAK, N.Y.

New shop needs Shop Guide

Thank you for a most interesting and enjoyable magazine. I am glad

to say PM has inspired me to start my own do-it-yourself workshop; for it to function properly I need your Master Shop Guide. How do I obtain this publication?

P.F. BEKKER
PRETORIA, SOUTH AFRICA

PM's Master Shop Guide, as well as a garden guide, home care guide, shop organizers and yearly indexes are available from PM Special Publications, Box 1014, New York, N.Y. 10019. The Shop Guide, which contains just about everything you need to know about workshop tools, materials and techniques, costs \$4.95 plus 50 cents (\$1 outside U. S.) for postage and handling.

Bond search

On Page 25, March '78 (*It's New Now*) you show bonding cement with fiberglass reinforced cement.

Would you please let me know where this product can be purchased?

DON PIGG
MAPLE LAKE, MINN.

Contact Jim Trowbridge of the W.R. Bonsal Co., Box 38, Lilesville, N.C. 28091 at (704) 848-4141.

Index inquiry

I was wondering if you are putting out the indexes for your magazine beyond 1976. I hope you are still selling them because I feel this is one of the finest innovations you have put out.

MARTIN LUCAS
LA VISTA, NEB.

We couldn't agree more, Mr. Lucas. PM Index and Shelf Wrappers are available for the years 1971-77 inclusive for \$2.69 each. Send check or money order to PM Index, Box 1014, New York, N.Y. 10019.

Prehung hangup

After reading *Install a Prehung Door for a Quick House-Front Update* (page 174, Apr. '78), it appeared ideal for a guy who doesn't wish to remove the existing frame.

The article left me with some unanswered questions. Even though a steel-clad door is more energy efficient than a solid wooden door and storm door, isn't there still a trans-

fer of heat causing condensation to form because the metal is continuous? Because of the continuous metal, or metal touching metal, would the door feel cool on the interior side?

THURMAN HUGHES
BUFFALO, N.Y.

We should have mentioned that Steelcraft's Perma-Door Replacement Unit has thermal breaks around its periphery. The sill/threshold is also equipped with one to prevent heat loss by conduction and formation of condensation.

Penney wise and moped foolish

For your fine magazine I say thanks, yet I take exception to a statement on page 32 of the March issue (*Imports and Motorsports*). It credits J.C. Penney as being the first national mass merchandiser to offer a moped under its own name. Sears Roebuck did this in 1955 with a Mo-Ped (it was called that name then, also) imported from Austria. I owned one and only wished I had kept it. I haven't seen a two-speed with a manual clutch in the new crop.

JIM SHIPMAN
PATRICK AFB, FLA.

No go on used RV guarantee?

The article *25 Checks for a Used RV* (page 124, Apr. '78) was very good except for the statement that "a dealer will normally offer a guarantee on a used RV."

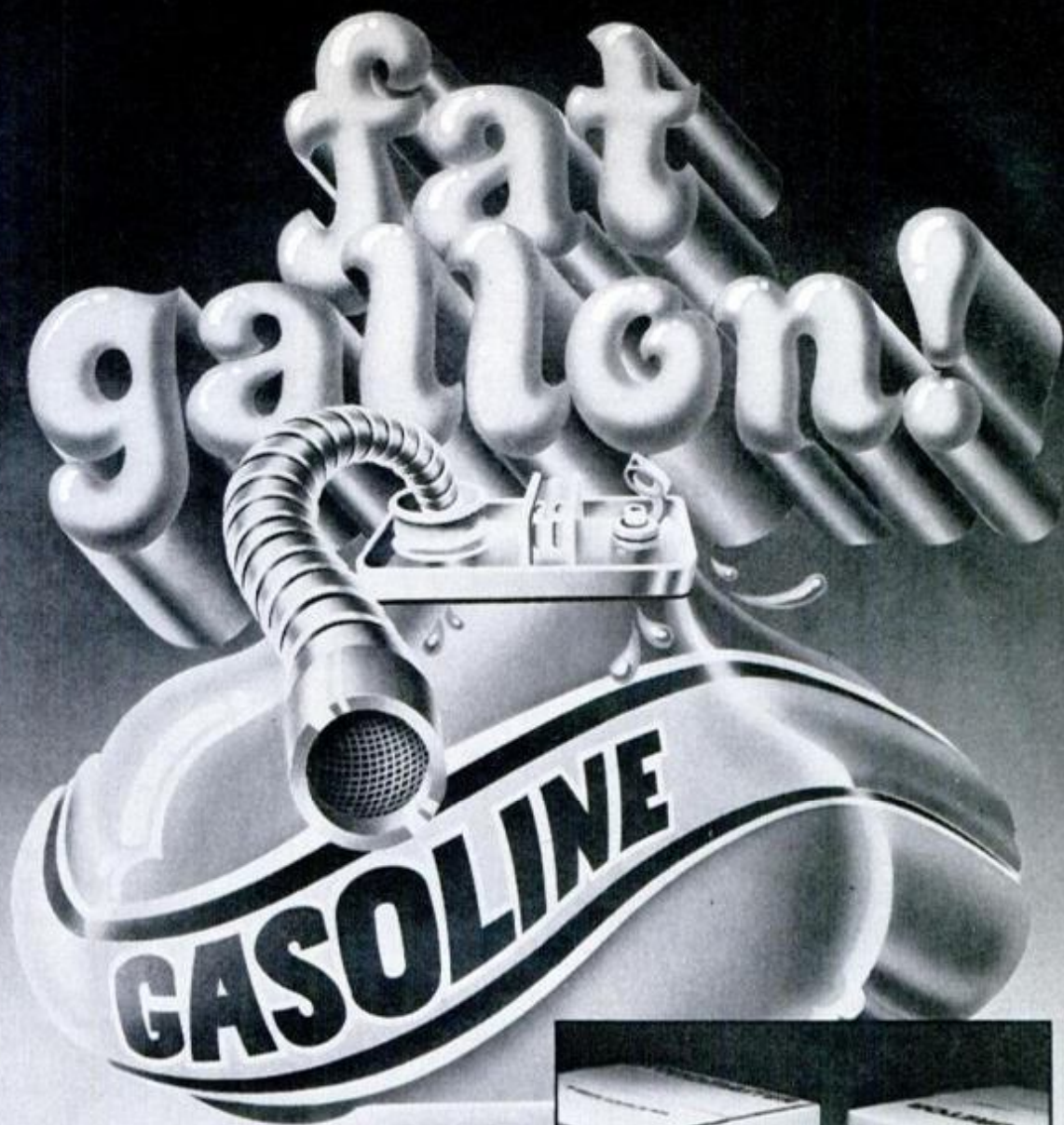
We have been looking at used RVs for more than two years now and we have yet to find one (dealer) that will guarantee a unit past his gate. The answer is always "No guarantee; where is, as is," and usually in those exact words. With prices of RVs as they are, I think that a guarantee should be required by law.

MERLIN L. STUTZ
GREENVILLE, S.C.

Drill instructions

In the March '78 issue on page 56 (*PM Looks at a Precision Drill Guide*) you didn't mention that if you have a reversible drill there is a screw in the chuck which has to be removed before you can remove the chuck. I learned the hard way—I busted the screwhead off.

DENNIS L. HASENOUR
JASPER, IND.



It's a fact. Holley's Economaster carburetors are downright miserly with every gallon of gas you buy. Each model has been specially designed and calibrated to pack more miles to every tank of gas.

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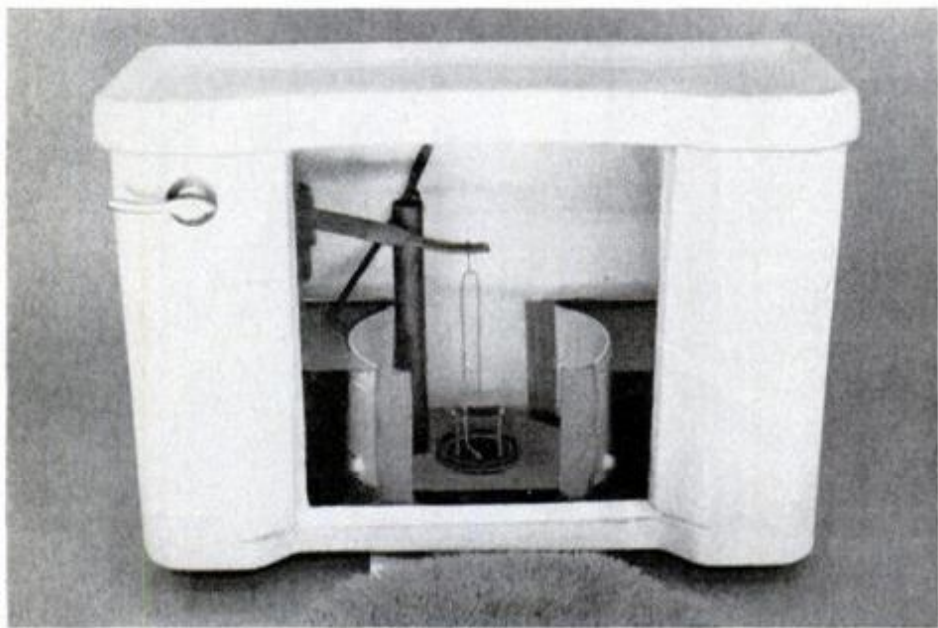
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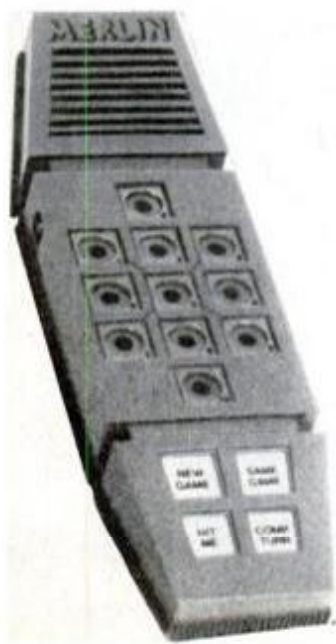
Dams save water

Royal Flush water dams save about two gallons with every flush. Installation takes only a few minutes and requires no tools. Bacteria buildup caused by stagnant water is prevented by jets that recirculate a small portion of the water. A pair is \$3.75. RV Associates, Rt. 1, Box 205C, Sanford, Fla. 32771.



Game talks back

Merlin has six games in its library and can talk to players in synthesized sounds. Games range from tic-tac-toe to Mindbender and employ chance, memory, logic and strategy; one allows players to compose and play back music. About \$33 from Parker Brothers, 50 Dunham Rd., Beverly, Mass. 01915.



All-in-one phone center

The Code-A-Phone Model 1500 combines a telephone and an answering machine. Reel-to-reel tape system is said to increase reliability. Remote control beeper allows message play-back from any phone. It's \$300 from GRS Instruments, 8730 King George Dr., Dallas, Tex. 75235.



Buckle up for safety

Store valuables, medicine, or whatever in this hollow, chrome-plated steel buckle. About \$6, \$7 with initials. Stash 'N Cache Buckle, 448 11th St. East, Prince Albert, Sask., Canada S6V 1A7.



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With NRI's basic course, you concentrate on the big world of lawn and garden equipment, with 30 lessons covering ignition, lubrication, cooling, and starting systems, and overhaul. The 45-lesson master course includes additional training in other motors like generators, industrial equipment, even motorcycles. And you build the engine and get your working tools to start a rewarding new career.



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*Summary of survey results on request.

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JULY 1978 11

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DETROIT LISTENING POST

'79 models on the way

For the first time in several years General Motors will be upstaged by Ford at new-model time this fall. The industry giant's luxury coupes—Eldorado, Toronado and Riviera—will get the efficiency treatment (GM hates the word “downsize”) to a 114-in. wheelbase, and all three will boast front-wheel drive; but the entirely-new fwd Nova / Phoenix / Omega / Skylark compact series is not scheduled to be unveiled until quite late in the spring of next year as 1980 models.

Meanwhile, Good Old No. 2 will have fresh entries at both ends of its size scale. LTD and Marquis are pared down to a 114.4-in. wheelbase and will retain their traditional boxy profiles, while Mustang and the new U.S.-built Capri get a wheelbase boost to 100.5-in. and crisp European-type styling.

Insiders at Ford say that the '79 big cars, although squared-off in overall shape, have received an unprecedented amount of wind-tunnel massaging to help with highway fuel economy. The LTD looks very “GM” in front, with a Buick/Olds-style grille and headlamp arrangement and a bit like Chrysler's Cordoba around the back.

Marquis will be the only '79 Ford Motor Co. product with the company's second-generation Electronic Engine Control (EEC II), which includes a three-way catalytic converter, exhaust-gas sensing and electronic carburetor control (ala Sweden's Volvo/Saab “Lambda Sond” emissions system). We'll explain the system next month in Saturday Mechanic.

Lincoln-Mercury also has another trick up its divisional sleeve in addition to Marquis and Capris. It's called the *new*, new Versailles. The Versailles, Lincoln's belated answer to both Mercedes and Cadillac's Seville, has suffered from its too obvious resemblance to the Granada/Monarch sedan on which it's based.

So L-M for '79 will unveil an updated version in August with an all-new and distinctive roofline, plus several other features to set it

farther apart from its less lofty brethren. Among other things, it will be the first U.S. car with the newly-legal quartz halogen headlamps. It will also have a brand-new electronic stereo radio with “tremendous sound quality.”

Chrysler Corp., too, will have plenty to show at new-car time, including a new series of “big” cars to replace the aged Fury/Monaco and a sexy coupe version of the very efficient front-drive Omni/Horizon. The latter resembles its 4-door chassis-mate about as much as VW's Scirocco resembles the Rabbit. The new sport coupe's low, rounded nose is a bit Monza-like in appearance, while the profile reminds one Chrysler man of the Toyota Celica hatchback. “A great-looking piece,” says he.

And American Motors will demand its own share of the new-model spotlight with a nicely-styled Gremlin replacement (probably called “Spirit”), plus the addition to its showrooms of the French-built LeCar, thanks to a cooperative agreement reached between the two companies last spring. The fwd “LeFrog,” as some call it, is well-built, spirited, roomy for its size, economical to drive and funny-looking enough to become the next decade's VW Beetle-type cult car. AMC could have done a lot worse in picking this little foreign “skateboard” (as it's affectionately called in Europe) to round out its lineup.

Future styling

GM's Chuck Jordan, who sits at the right hand of styling boss Irv Rybicki, says not to worry about “efficient” being synonymous with “dull” or “boxy” in future U.S. automotive design. Because of the great importance of aerodynamics in milking the last tenth of an mpg out of cars in highway driving, says he, “We can work with all sorts of really beautiful, sexy, exciting shapes—low, wind-cheating front ends and smoothed-out rear contours, flush glass and smooth, flowing fender shapes.”

It isn't much more difficult or expensive to bend the sheet metal into a beautiful, exciting shape around a given interior package

than it is to make it into a dumb-looking shape. And this sort of thinking applies as well to luxury, family-type and economy cars as it does to sports cars and sporty coupes.”

Camaro/Firebird remake

The battle raged for a time between front-drive and rear-drive advocates, but the question now seems to be settled in favor of the traditional front-engine, rear-drive setup for GM's very popular Camaro and Firebird sporty coupes.

The temptation was to go with the same engine/drive train package that the '80 Nova series compacts will get, i.e. a choice of a four-cylinder or the upcoming V-6 mounted transversely and driving the front wheels. This would have been expedient from cost and parts-commonality standpoints, but there are still some sporty-car buffs in GM's hierarchy (thank God!), who said no.

Explains GM's Dr. Craig Marks, technical assistant to the corporation's engineering staff vice president, “You're better off with rear drive for higher-powered cars because of the rearward weight transfer. Space utilization in such cars is less important, and I think the sporty-car market will react more favorably to rear drive.”

The fact that Camaro/Firebird is scheduled to share a 103.5-in. wheelbase with Monza/Sunbird/Starfire/Skyhawk when all six are freshly designed for the '81 model year gives rise to speculation that the formerly Vega-based Four may also remain rear drive in configuration and may share basic componentry, engines, drivetrains and body pieces as well.

Camaro and Firebird, ultra-successful survivors of the “pony car” era, will make do with styling updates until the 1981 redesign, making the 1970-vintage Camaro/Firebird “F-body” one of the longest-lasting designs in recent industry history. Only the Corvette, which has been changed but little since 1968 and is not due for a redo until at least 1983, can boast greater styling longevity.—
Gary Witzenburg

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QUALITY NEVER GOES OUT OF STYLE.

SCIENCE WORLDWIDE

Does secrecy slow technology?

Yes, according to well-known physicist Edward Teller. "In the last third of the century the United States has lost its position in all military fields, most specifically in those where we practice secrecy," Teller told the Stanford University News Service. "But in one field—which is not military but which has military applications—we are ahead of the world and way ahead of the Russians. This field is electronics, especially computers, and it is in this field that we do *not* practice secrecy."

There are those who would dispute Teller's assertion that the United States has lost pre-eminence in all military fields, but his point is well taken. For example, alchemy was displaced as a science by chemistry, he says, because while alchemists did much useful research, almost all was done in secret so no one could build on the work of others. Chemists, however, communicated openly and progress was rapid.

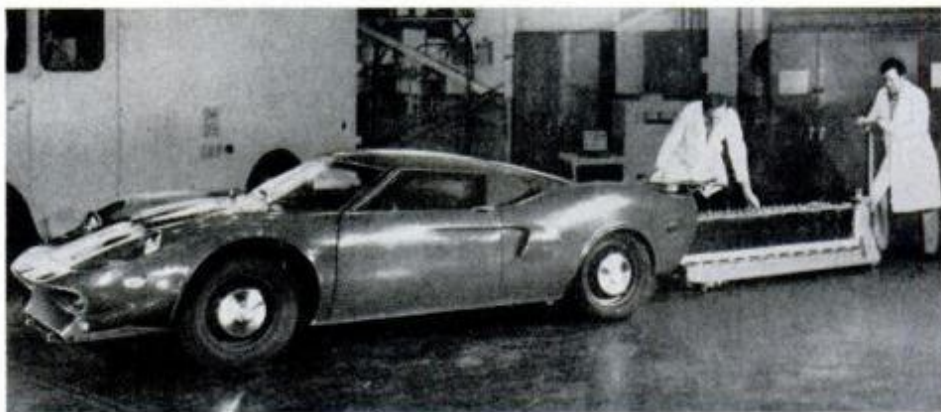
Teller did say that work on nuclear fusion is now on the international level and that it is the one field where there is "decent cooperation" between the United States and the Soviets.

Plugging in the electric car

Recent developments in battery technology hold promise for electric vehicle (EV) applications. While no one is claiming a major breakthrough yet, there is reason to be optimistic about EV success in the next decade.

According to a NASA study of driving habits, an EV with a 100-mile range at 40 mph will satisfy 95 percent of daily driving needs. To reach that goal, a battery with twice the energy density at comparable cost and rechargeability of current lead-acid cells is required. According to Dr. Louis Rosenblum of NASA's Lewis Research Center in Cleveland, it has made good progress.

The NASA battery is the well-known nickel/zinc type, which had been plagued by rechargeability problems. During recharging, thin needles, or dendrites, would form on the zinc electrode and short it to the nickel electrode in 200 charging cycles or less. (Lead-acid cells can withstand 400 to 500 cycles.)



NASA scientists slide a 52-cell nickel/zinc battery pack into test vehicle.

NASA has now developed an electrode separator material that inhibits dendrite growth and makes more charging cycles feasible. According to Rosenblum, it hopes to have a cost-competitive battery that will last five years "soon"—perhaps within the next five years.

Meanwhile, Argonne National Laboratory has come up with a lithium/iron sulfide battery with performance characteristics similar to those of the NASA battery. But the Argonne device operates at about 425° C., not at room temperature.

Bell Laboratories, Exxon Enterprises, Inc. and Boston-based EIC Corp. are working on room-temperature lithium/vanadium disulfide or titanium disulfide batteries for several applications. Such batteries have a potential for even greater energy density but cost and dendrite growth problems have yet to be overcome.

According to EIC's Dr. Barry Brummer, substantial EV use of lithium/metal disulfide is at least a decade away. "There's a real prospect for lithium batteries in EV's," he says, "but they need very substantial development."

Quakeproof concrete joint

A concrete joint that's able to withstand the stress of severe earthquakes was recently patented by Battelle Pacific Northwest Laboratories. It's made of concrete which is reinforced with short metal fibers.

Conventional concrete joints must be reinforced with steel bars and hoops that increase fabrication costs. The new joint eliminates the need for many hoops. Reinforcing fibers increase tensile strength and impact resistance

and result in a flexural strength two to three times greater than regular concrete.

Where there's smoke . . .

The reliability of smoke detectors has become a matter of some concern. The devices have been shown to work well when new, but sometimes factors beyond a manufacturer's control can reduce their long-term effectiveness. Now a National Bureau of Standards scientist has developed a method to test any detector in less than a minute, using a portable unit that emits an aerosol spray of dioctyl phthalate, a substance with a particle size distribution similar to that of smoke.

The instrument will first be used to test detectors at health care facilities, with possible residential testing later.

Airtight house can kill

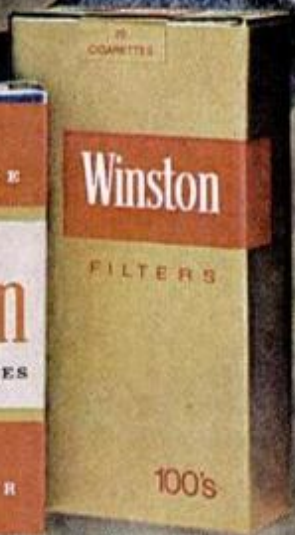
Houses so well built and insulated they have no cracks through which to "breathe" may allow potentially fatal levels of carbon monoxide (CO) to build up.

Drs. James Kelley and Gregory Sophocleus report in a recent issue of the *Journal of the American Medical Association* that "the increasing number of cases (of CO poisoning) may be related to the fuel crisis and the change in heating and insulation methods." They said adequate airflow must be provided for complete ventilation of the heating element.

The symptoms of CO poisoning—nausea, dizziness and headache—are common to many other illnesses. Flame-shaped surface hemorrhages on the retinas of patients exposed to dangerous CO levels for more than 12 hours may provide a clue in diagnosing the disease.

—Tom Sahagian

**“Winston has
the one thing I want
in a cigarette, and
that one thing is taste.”**



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

King

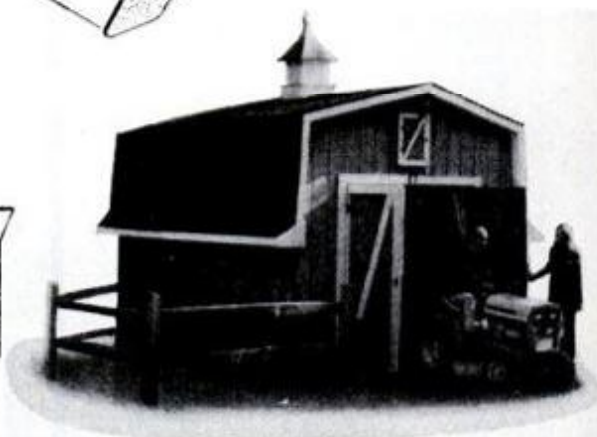
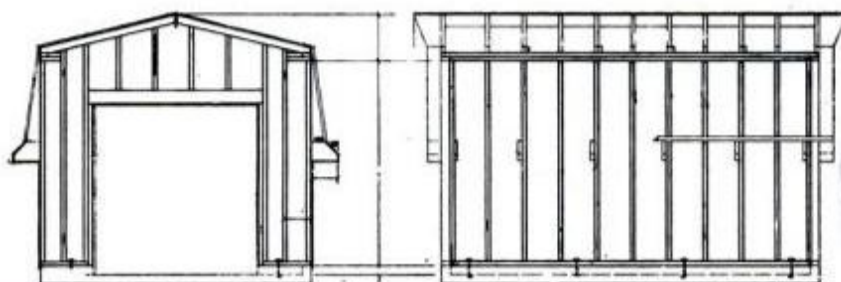
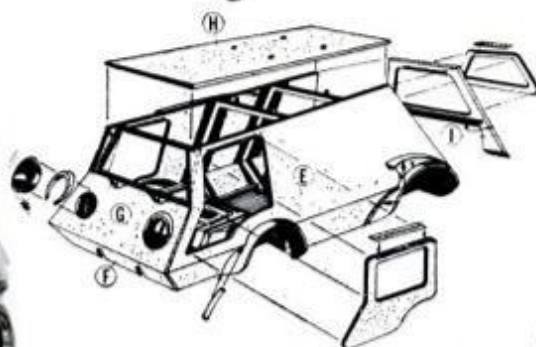
100's

IN THE AIR, ON LAND



SCAMP

BOONIE BUG



DUTCH MINI-BARN

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SCAMP—A revolutionary all-metal, VW-powered acrobatic biplane that puts you in the air for less money than you'd think possible! With PM plans, man's dream of solo flight is easily attained.

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(Featured in Dec., 1973 issue)

BOONIE BUG—A dynamic, new vehicle concept! Constructed from a VW bus chassis, the 'Boonie' offers the go-anywhere ruggedness

of an ATV, the sleeping and camping facilities of an enclosed van and the smooth-riding quality of a conventional station wagon at highway speeds—all rolled into the slickest looking vehicle ever! Do-it-yourself with PM plans. **\$14.95**

(Featured in March, 1974 issue)

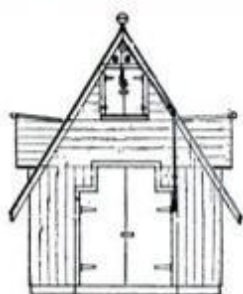
DUTCH MINI-BARN—You can erect our most popular backyard storage structure for under \$600. The roof design is somewhere between gambrel and mansard but it reminds us of Dutch colonial architecture. With 8 ft. of headroom inside and 10 ft. by 13½ ft. floor space it's fairly large although

it looks small. More than enough room for bicycles, lawn furniture, garden tools or use it as an office workshop or potting shed. Two sets of plans included, one for yourself and one for your building department. **\$5.95**

(Featured in August, 1972 issue)

STORYBOOK PLAYHOUSE—Put up a shed and the neighbors may hate you, but build this handsome little house and you'll be the hero of the neighborhood—especially among the small fry! This compact structure looks more like a storybook cottage than a tool-house—but you can readily use it for storage. In fact, wide barn-type

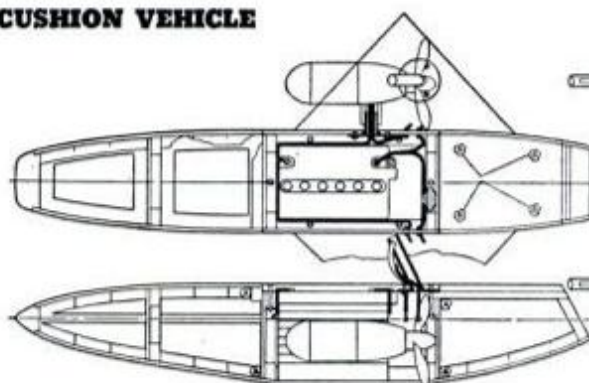
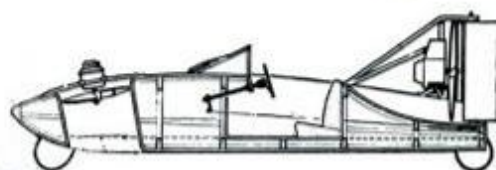
AND UNDER THE SEA



STORYBOOK PLAYHOUSE



LAND & WATER AIR CUSHION VEHICLE



SCUBA-TOW



doors in the back lead to a special tool-storage room walled off from the playrooms. You can hang a lot of garden tools inside and still provide plenty of play space. An extra set of plans is included for a building permit. **\$5.49**

(Featured in July, 1973 issue)

LAND AND WATER AIR CUSHION VEHICLE—A go-anywhere air-prop craft, the exciting Cobra ACV skims land or sea at speeds up to 60MPH. 14 ft. long, with room for two passengers this innovative vehicle will cost you less than \$800 to build. A unique project for the serious do-it-your-

selfer (caution must be paid in following all operating instructions). The joys of owning and operating this futuristic hover vehicle are truly inestimable. **\$12.95**

(Featured in Sept., 1975 issue)

SCUBA-TOW—The electric-powered sea scooter that performs like costly commercial models! Motorized Scuba-Tow will pull you on or under the water for hours of effortless snorkeling or scuba diving. Rugged, light weight and dependable—you can build Scuba-Tow in a weekend or two from PM plans. **\$7.95**

(Featured in July, 1974 issue)

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PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

How to buy brick

Since we are smack in the middle of yard-fixup/projects time, a lot of the mail these days asks about brick basics; how to estimate and buy them. This advice is from the Brick Institute of America:

1. The most economical way to buy brick is by the pallet (550 bricks).

2. When estimating quantity, figure on using standard-size brick that measure $2\frac{1}{4} \times 3\frac{3}{4} \times 8$ in. Laid flat on sand, each covers 30 sq. in.; pallet covers 110 sq. ft.—roughly a 10x10 ft. patio.—*H.W.*

Welding torch uses propane fuel

A new-generation torch from the Bernzomatic Corp., Rochester, N.Y. is ideal for most homeowner repair jobs because it uses low-cost propane fuel. The Jet Torch II kit sells for \$19.95, includes braze-weld head, a spark lighter, two



New torch from Bernzomatic can braze and weld; uses low-cost propane fuel.



Fixing a bike frame is an easy, inexpensive shop task with Jet Torch II.

brazing rods and a 14.1-oz. propane fuel cylinder. The unit can also be used for soldering. At hardware stores.—*H.W.*

Sprayer anyone can use



Handy sprayer comes with reusable bottle, powerheads can be reordered.

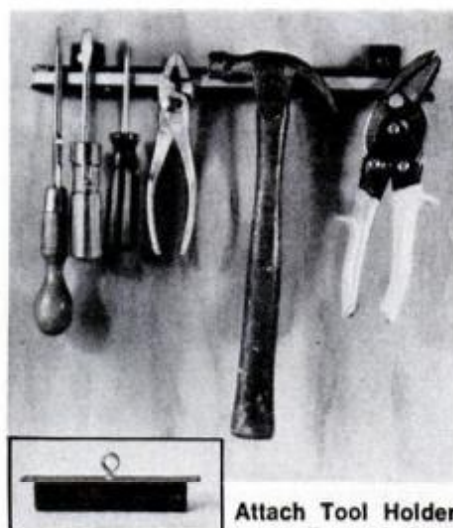
A number of sharp-eyed readers spotted this sprayer in a recent Workshop Minicourse and wrote in asking where it can be bought. The answer is in hardware and paint stores. The tool is a dandy for small shop spray jobs; in fact, I use mine so often that I buy the replaceable power units by the case (12). A chart on the package gives accurate mixing quantities to assure a smooth spray job. Complete sprayer, \$2.49; power-head alone, \$1.89. Precision Valve Corp., Box 309, Yonkers, N.Y. 10702.—*H.W.*



Compact unit delivers a fine, even spray pattern and an unusually smooth finish.

Magnetic toolholders

The versatility of these magnets makes them worth considering for home and shop. The 13-in. Tool Holder, \$10.70 ppd., keeps tools visible and close at hand. You can suspend the Universal magnet (\$7.70 ppd), inset, or fasten it to a

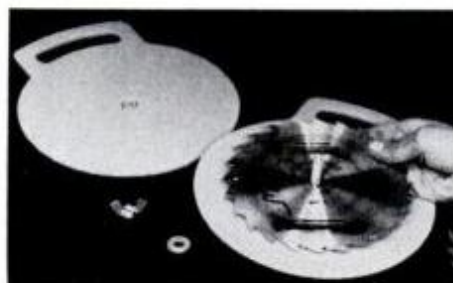


Attach Tool Holder to wall, tool box, truck bed; mount to a wall or suspend Universal Magnet to hold many items.

wall. Also comes in handy for lifting and retrieving metal articles. Both are from Tem Gam Corp., Box 156, Castle Rock, Colo. 80104.—*P.A.*

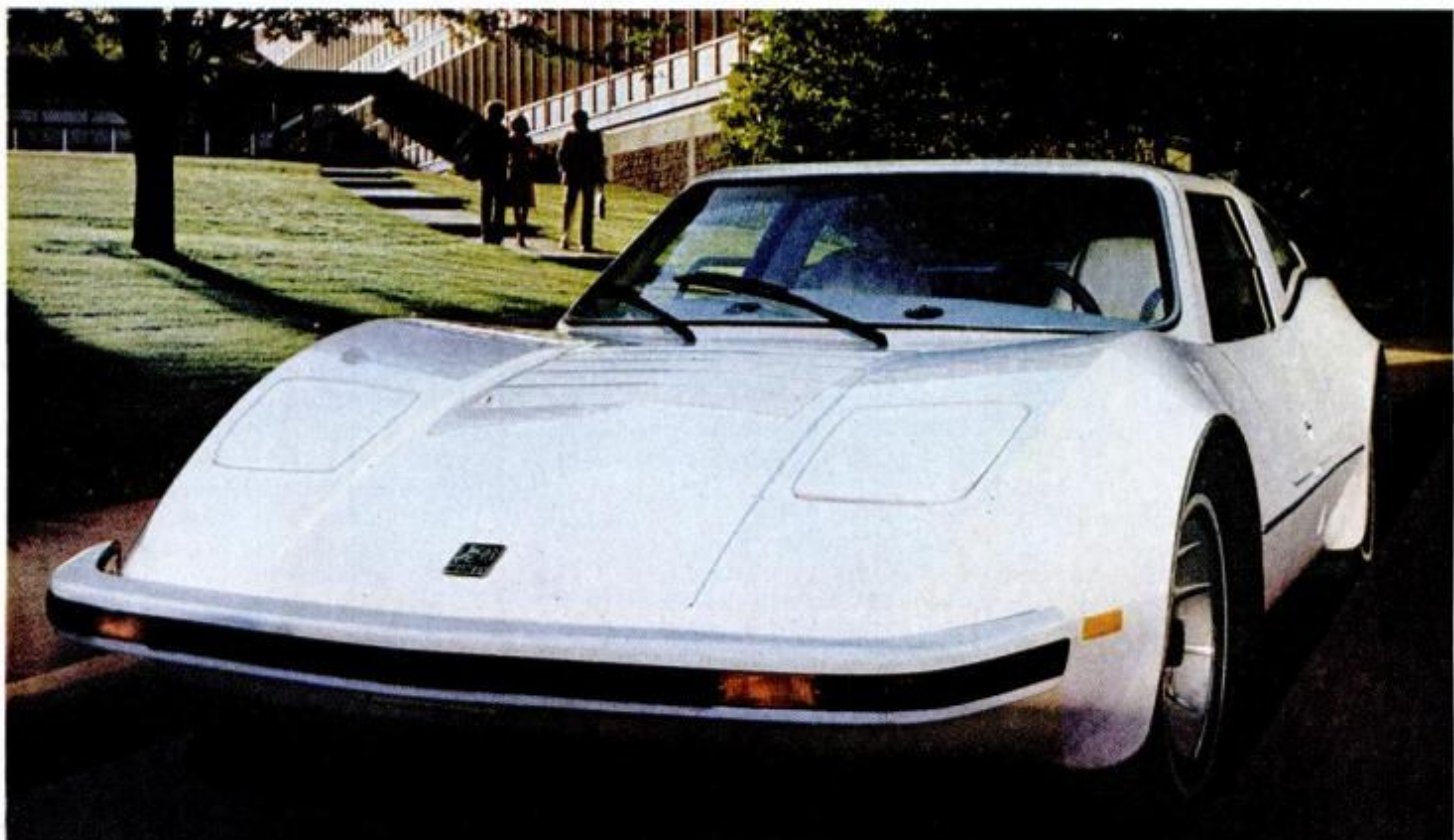
Handy blade carrier

This clever carrier for saw blades does what it should—it corrals your saw blades neatly in one spot and makes it easier and safer to carry them from shop to job. The



one that I tested is still in use in my shop and will be there for some time to come. Blade-Saver is \$4.75 ppd. from Wantland Enterprises, Box 66530, Scotts Valley, Calif. 95066.—*H.W.*

If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.



Introducing an exciting new concept in autodynamics.

The Bradley GT II.

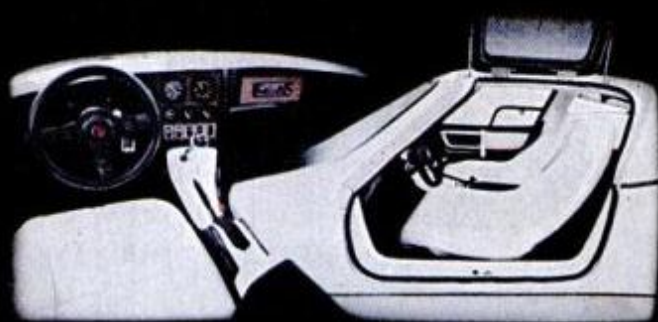
Nothing in the motoring world so dramatically combines the style and performance of the finest European sportscars with the economy and dependability of a VW. Each component of the GT II car kit is custom-designed for precision fit and easy assembly on a Volkswagen chassis. The totally-engineered, finely-crafted finished product is a reflection of your own good taste and individuality. A product with unique autodynamic properties that provide significantly improved performance. And with styling so reminis-

cent of the most expensive and lavish European sportscars.

Its many amenities include fiberglass gull-wing doors and hatchback rear door. A steel reinforced roof and fiberglass body. Tinted safety glass windows. European-styled instrument cluster. Electrically-powered pop-up headlamps. And so much more.

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PM-7

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ALL OUTDOORS

Action near home

Campers used to head for the farthest corner of a wilderness area. They still can, but this year a lot of city families will find they can live it up outdoors near home. Country folk can also visit cities on a modest vacation budget by camping on the outskirts. In many cases, RV owners may leave their big rigs at the campsite and take public transportation into town for more convenient sightseeing.

Among metropolitan areas that have campgrounds within half an hour's drive of center-city, the KOA chain lists Los Angeles, Miami, New Orleans, Nashville, Tampa-St. Pete, Boston, Minneapolis, Seattle, San Francisco and San Antonio. In a couple of cases, these campsites are within the city limits. You won't find the forest primeval but you can save a lot of motel money. The KOA Handbook that lists them all is available free at 830 Kampgrounds, or for \$1 by mail from KOA, Box 30558, Billings, Mont. 59114.

Campers in the Midwest who enjoy the color and excitement of country fairs can now combine activities. Fairs that will have campsites and/or trailer parks adjoining fairgrounds this summer will include the Wisconsin State Fair in Milwaukee; Du Quoin State Fair in Illinois; Minnesota State Fair, St. Paul; Nebraska State Fair, Lincoln; Missouri State Fair, Sedalia; Tulsa State Fair, Tulsa, Okla.

Action afield

Fishermen, hikers, nature photographers, river rapids runners, climbers, explorers at heart—all can take a crack at their favorite sport or try something new by checking the adventure trips now available. To get away from the crowds this summer, a good start is a booklet from the U.S. Government Printing Office called "Visit a Lesser-Used Park." State by state, it lists parks, seashores, national monuments and memorials that deserve special attention but are not yet well known. Try the Trip Department of The Wilderness Society, 4260 East Evans Ave., Denver 80222, for backpacking, horseback, canoe and rafting tours. Climbing challenges are arranged by Mountain Travel, 1398 Solano Ave., Albany, Calif. 94706,

and sea-level specialists, PanAngling Service, 180 North Michigan Ave., Chicago 60601, plan fishing safaris. And for action between Alaska, Canada and the tip of South America, from Easter Island to the Bahamas, there's "Outdoor Adventures—Beyond the Expected," which is available from Braniff International, Box 35001, Dallas, Tex. 75235, for \$1.

RV crystal ball

A look into the future for recreational vehicles recently by two industry experts indicates that some trends in passenger cars may appear as well in the rigs we drive for fun. Gas shortages won't kill off RVs and smaller tow cars aren't about to end the demand for big comfortable trailers. This year's projected sales of 580,000 RV's are a 96-percent increase over the low point of four years ago, Ford's recreation vehicle division sales manager, Bob Honke, notes. And he sees nearly that much gain again by 1981. Smaller cars will encourage the development of smaller trailers, he predicts. Larger rigs will be towed by vans and light trucks. Ford, he told us, will be spending over \$600 million developing more fuel-efficient pickups and utility vehicles by 1980.

But already the fun potential of trucks and vans is apparent. Bob Honke's survey figures indicate 87 percent of pickups today are used some time for personal transportation, 45 percent for vacations.

Uniroyal Tire's president, Herb Schmalz, calls vans, 4x4s and pickups the fastest growing segment of the automotive industry. Uniroyal, as a result, is introducing what they call the first complete line of RV tires designed for performance on all types of terrain by all light, heavy-service vehicles. The RV line of 14 different tires is called the Laredos, and while testing them recently over the rocky hills and desert of Uniroyal's endurance test base near Laredo, Tex., we found they now have both bias and new radial belted RV models suitable for sand, gravel, mud and on- or off-road performance. Herb Schmalz estimates the present replacement market for RV tires at about 12 million and growing, and says new radials will offer better durability, ride, handling and fuel economy.

Rails-to-trails

Some of those fine old abandoned railroad rights-of-way are going to come to life again for conservation and recreational use. The secretary of the interior has announced 10 projects have been selected for federal funding right now and 125 more have been under consideration.

New uses will range from biking, jogging and horseback riding to commuter and wheelchair use. Rail segments in Arkansas, California, Maryland, Missouri, Nebraska, New Jersey, New York, Ohio, Pennsylvania and Virginia are being converted and will, it is hoped, become demonstration models for future similar projects.

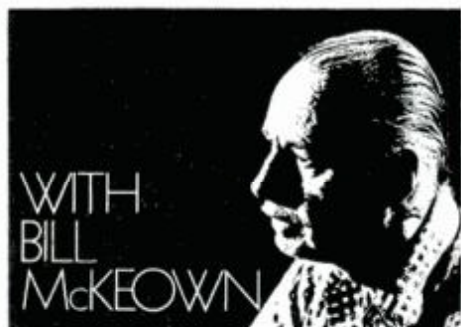
Fish finders

The argument about the best fish has been tackled again by Uncle Homer Circle. In a new manual, *How to Catch America's Terrific 13 Sport Fish*, (free from Evinrude dealers or \$1 from Evinrude Motors, Box 663, Milwaukee 53201), he picks a baker's dozen: large-mouth bass, white bass, crappie, bluegills, muskies, northern pike, walleye, rainbow trout, channel catfish, coho salmon, striped bass, snook and tarpon. And he also tells how to catch them, and for a bonus, shows the way to tie the Brinson knot.

The best new state guide for one of the best fishing states is probably *Florida Chartered Saltwater Fishing Holes*. It's \$3.95 from the Bureau of Maps, Box 5317, Tallahassee, Fla. 32301.

Biking it

Group touring by bicycle isn't a monopoly of the American Youth Hostels. Welcome Swiss Tours, 7 Ave. Benjamin Constant, 1003 Lausanne, Switzerland, arranges group summer cycling around Lake Geneva, and rents you the bike for it. **PM**



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CAR BIZ

“A gasoline miser..”

The Seattle Times

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HINTS FROM READERS

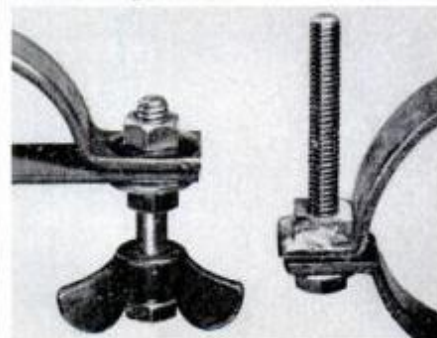
Soldering aluminum



Tin aluminum so you can use soft solder to join parts. First heat the metal so the solder will melt when placed against it. Then melt a small pool of solder. With the aluminum still hot enough to keep the solder melted, scrub molten solder onto the surface with steel wool to tin it. Then solder the area. Solder will stick as it does on other metals.

—H.E. Moody

Fastening nuts



Reinforce a hole in thin metal by permanently fastening a nut over it. This is a particularly good procedure to use when a bolt is to be tightened and loosened frequently. To mount the nut:

In an unthreaded hole through which the bolt passes freely, temporarily clamp a nut over the hole and permanently secure it by welding, brazing, soldering or running epoxy glue around it, being careful that the fastening material doesn't get into the hole.

In the case of a threaded hole, run the bolt through the hole until the bolt projects the thickness of the nut or less. Screw the nut on the bolt until it makes light contact with the metal surface. Braze, weld or solder at two or more points.

Hex nut, above left, is glued over threaded hole. Square nut is brazed over unthreaded hole.

—Walter Burton

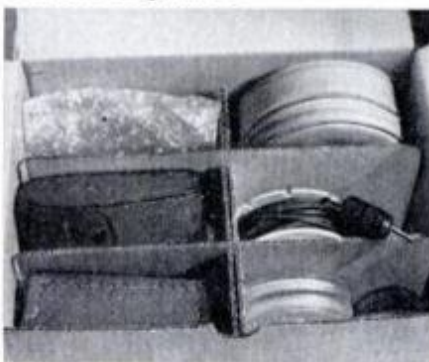
PHOTO HINTS

Rx for limp clamp



If a photo clamp starts to lose its grip, cut a small piece of wood as shown and force it into the handle after the clamp is attached to its support.—*Ken Patterson*

Carton organizer



Cardboard boxes with dividers from drug and health-food stores, are great for keeping the gear you don't always need but want to find quickly for special shots.—*Grace B. Weinstein.*

Convenient reflectors



Shiny aluminum pie pans and TV-dinner trays can lighten shadows and create highlights in small-object photos. Flat areas can be dimpled with a ball-peen hammer to give more uniform light distribution.

—*Walter E. Burton*

All New Interiors. Beautiful!

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"War injuries left me badly handicapped, but now I'm a financial success as a Locksmith, thanks to your training. Besides, the work is fascinating. If I can do it anybody can." — Glen Johnson, Larned, Kan.

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FREE

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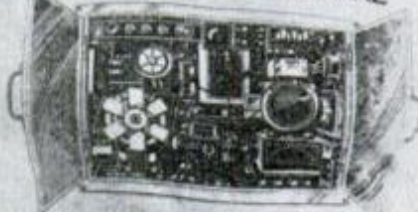
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HINTS FROM READERS

Paint aid for small items



To paint small, hard-to-handle items, press them into a lump of clay to keep them stationary.

—Charles B. Crow

Nylon net prevents clogs

When you shampoo, prevent hair going down the drain necessitating costly repairs. Remove the drain strainer, place some nylon net over the drain overlapping it and replace the strainer. Hairs caught on the net can be removed with the net.—Helen LeMunyon

Easy-to-make dolly

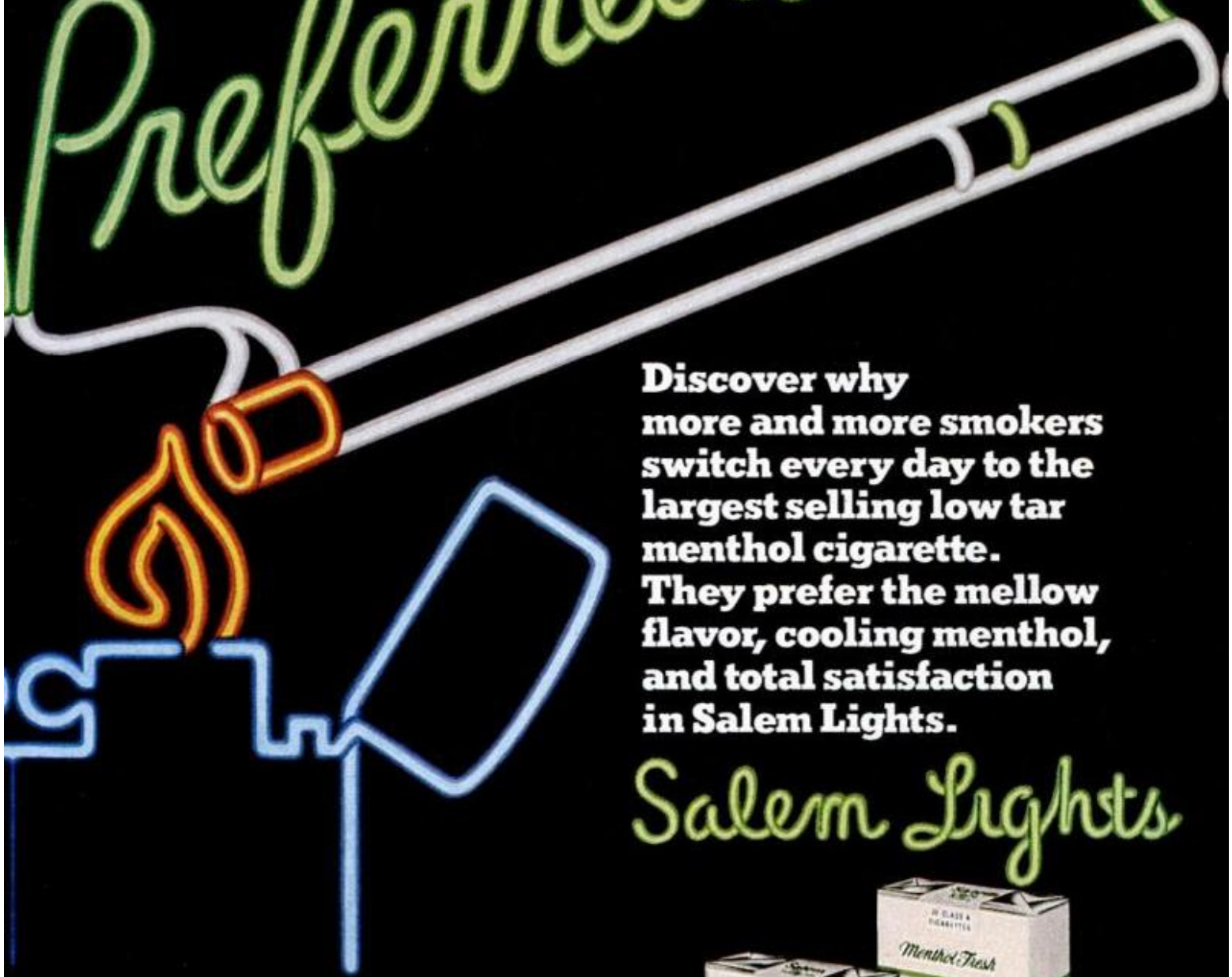


Move heavy objects around the shop or home with this maneuverable dolly. It's made of a 10¼-in. square of ¾-in. plywood and two hefty, swiveling casters.

Place the dolly under one end of a heavy storage box, for example, and steer it much like a wheelbarrow. Or position the load in the center and balance it with your hands as you move.

The 5-in.-dia. center opening makes the dolly easier to pick up, handle and hang. Casters are positioned opposite each other, centered on two sides of the plywood and mounted with hex-head screws.—Walter E. Burton

The Preferred Taste



Discover why more and more smokers switch every day to the largest selling low tar menthol cigarette. They prefer the mellow flavor, cooling menthol, and total satisfaction in Salem Lights.

Salem Lights

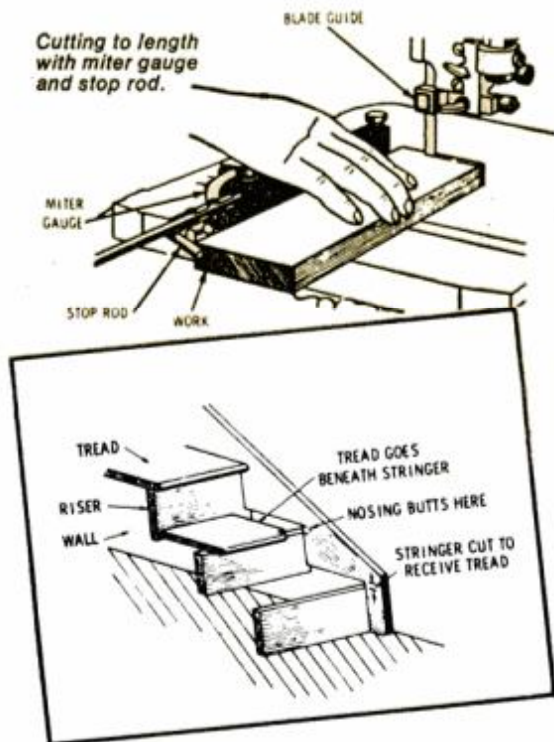


Light 100's: 11 mg. "tar", 0.8 mg. nicotine av. per cigarette, FTC Report AUG. '77; Light 100's: 11 mg. "tar", 0.9 mg. nicotine av. per cigarette, by FTC method.

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You get a complete how-to book on all standard specs of every element in house construction, including how to read plans and make your own... how to lay out a home workshop... and more.

You get a complete how-to book on laying out the foundation, how to do concrete block construction, house framing, chimneys, fireplaces, porches, patios, insulation... and more.

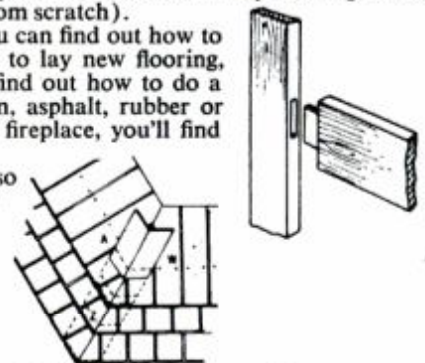
You get a complete how-to book on every aspect of roofing, flooring, doors, windows, stairs, plus how to use stationary and portable power tools, plus tips on painting, maintenance, repairs, termite protection... and more.

You get step-by-step instructions on everything from reading a building plan to building a house (including the foundation), doing all the carpentry in it—and keeping the house in A-1 shape for a lifetime. And thousands of show-how pictures make it all amazingly easy, even for a novice. Let's look at a few of the remodeling and fix-it jobs you learn how to do... You learn how to replace worn or missing shingles. How to fix chimney flashing leaks. How to repair stairs (or build them from scratch).

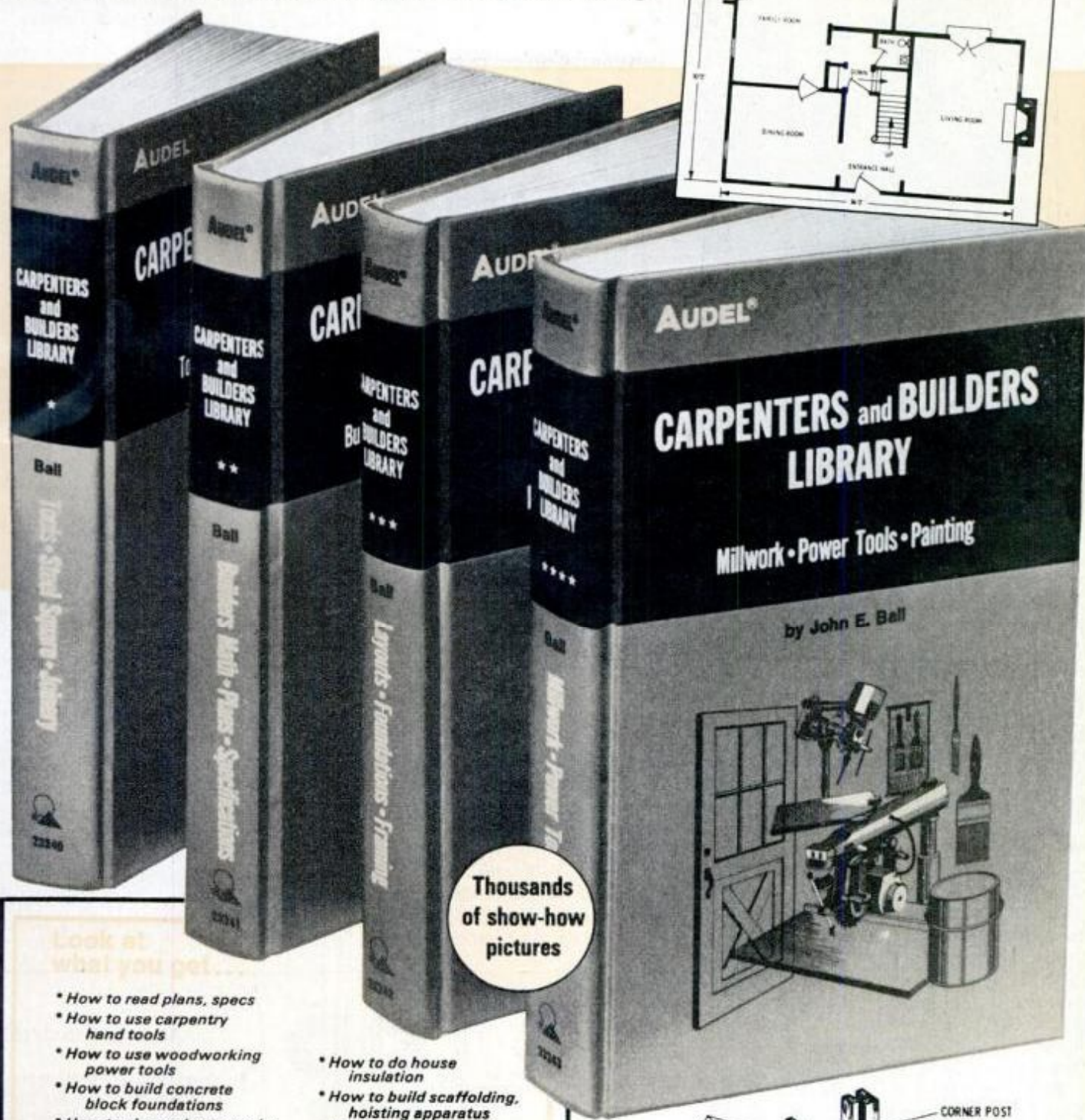
If doors need fixing or fitting, you can find out how to do it from these books. If you want to lay new flooring, you can just turn to these books to find out how to do a first-rate job with wood-tile, linoleum, asphalt, rubber or ceramic tiles. If you want to build a fireplace, you'll find out exactly how from these books...

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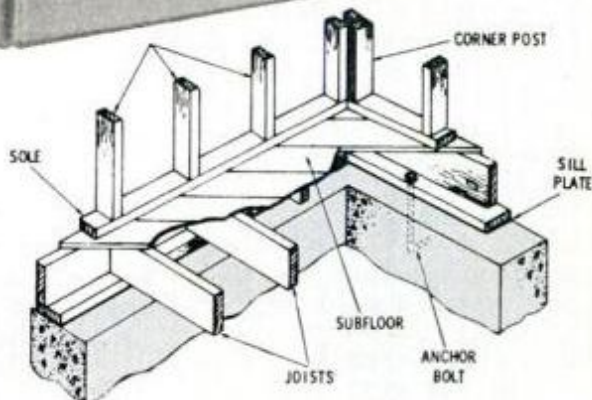
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a foundation, installing new paneling,**



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pictures

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what you get...**

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- * How to build stairs
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- * How to do cornice construction
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CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES

BY MORT SCHULTZ



Warped humor

Some idiot at an amusement park plastered the rear bumper of my new Monarch with bumper stickers. I don't want to advertise this bird's business. How do I get the stickers off without disfiguring the bumper?—Allen Pearl, Hartford, Conn.

Grease, my man, grease—that's what it will take. Any kind—motor oil, cooking oil, shortening. Apply the grease to an edge of a sticker and keep adding as you pull the sticker away from the bumper. When you are through, wash off grease residue with hot water and soap.

Tale of the whale

I own a 1977 Oldsmobile cutlass that has a 350-cu.-in. engine and Positraction rear end. At about 6000 miles, the rear started making terrible rumblings. The dealer sat on the problem a couple of months, and ended up having to replace the spider gears.

At 11,500 miles, the noise reappeared. The dealer now says that the reason for the problem is that Positraction oil no longer contains whale oil. He says I will have to drain the rear every 6000 miles. What should I do?—Sheldon Munt, Orangeburg, N. Y.

Tell the dealer to back off. There's a cheaper way. What the dealer probably wants to do is drain fluid, add three bottles of lubricant, drive the car to flush the rear, drain it again and add three more bottles of fluid. If you okay this, the lubricant alone, at \$3.10 a bottle, will run \$18.60. When you add labor, you will have yourself a whopping expense every 6000 miles.

The less expensive way is this: If the rear is chattering now, drain, flush and refill it as I've described. If the rear is not making noise, there is no reason to do this. Add a can of GM Limited Slip Oil Additive (Part No. 1052258) to the fluid. The additive costs \$2.75 and will fortify the fluid so

the job won't have to be done again for about 30,000 miles.

Locking on target

I think you missed the mark in "Keyed off" (Car Clinic, March '78). As you said, it is possible that excessive resistance on the ignition lock cylinder of Ms. Haynes' 1978 Ford Fiesta could cause the trouble. However, I think that one of the wafer tumblers in the lock is bent, causing a drag, or one of the tumbler springs is missing, which would allow the tumbler to return slowly by gravity.

She should first flush the lock with a product such as WD-40. This is a Volkswagen lock, and VW locks are heavily greased. If this doesn't work and Ford can't help her, she should have a locksmith who is familiar with foreign cars disassemble the lock and repair or replace the tumblers.—Henry H. Printz, Vice President, Cy Drake Locksmiths, Inc., Morristown, N.J.

I don't mind being "picked on" by a lock expert because Fiesta

owners who are having ignition lock problems will find the solution in either my version or yours. That's what *Car Clinic* is all about. Thanks, Henry, you're a Printz.

Chevy chase

How can I tell if my 1977 Pontiac LeMans has a Chevrolet engine? What are GM's plans for making restitution to people who got a Chevy engine in a non-Chevy vehicle?—Carl Weiss, St. Paul, Minn.

Look at the vehicle identification number plate on the top of the instrument panel on the driver's side. You are concerned with the first, fifth and sixth numerals.

The first numeral should be a 2, meaning the car is a Pontiac. The fifth numeral should be a Y, meaning the engine was produced at a Pontiac plant. If that numeral is a U, it indicates the engine was produced by Chevy. The sixth numeral should be a 7, meaning the car is a 1977 model.

GM plans to refund \$200 to those entitled to it. However, this will be delayed until legal ramifications are cleared up. GM will contact you, but if you hear nothing by the end of the year I would send a letter to the customer services department at Pontiac.

Losing control

My 1974 Dodge Dart Sport keeps blowing voltage regulators. I've put on three in three months. My mechanic says you often have to put on three or four before you get one to hold. Do you agree?—Minnie Fryer, Roach, Mo.

Half-heartedly. Your mechanic

(Please turn to page 32)

**BOLTS
-TIGHT**

**SURFACE
-CLEAN**

**GASKET
-NEW**

**THERMOSTAT
-INSTALLED
CORRECTLY**

**SURFACE
-CLEAN**

PM CAR CARE

TIP

↓

Attention to details

To keep from creating more of a problem than you are trying to rectify, make sure that your thermostat changing procedure is done carefully. The procedure should include attention to the following steps.

- See that thermostat housing surfaces shine. Use a wire brush to clean off old gasket material and other foreign matter.
- Use a new gasket even if, by chance, the old gasket isn't destroyed when you remove the housing.
- Make sure new thermostat is installed properly. This requires that you note the position of the old thermostat before you remove it, then place the new thermostat in the exact same position.
- Securely tighten the housing bolts.
- Run engine after installation is done to check for coolant leaks around housing.

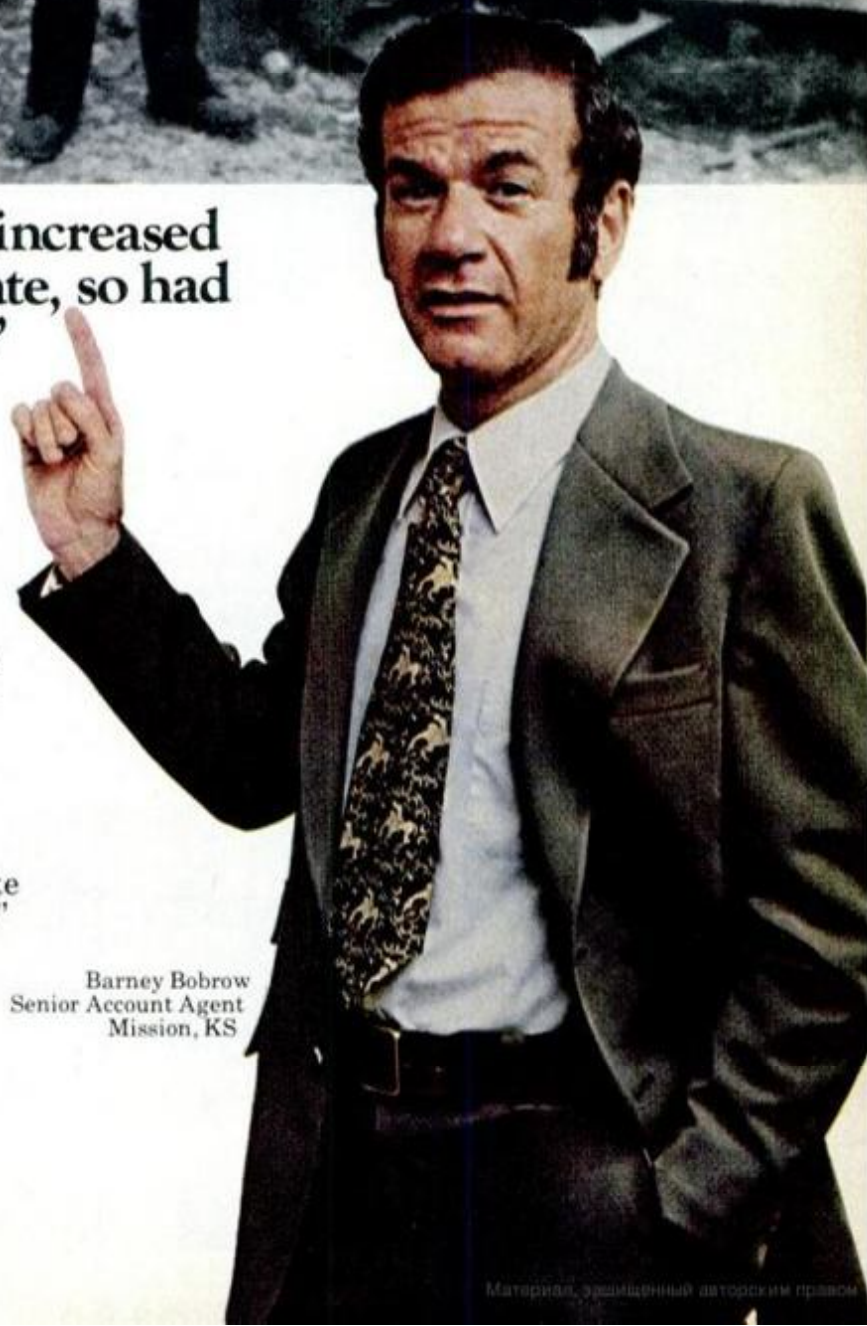


"The Enegrens' home had increased in value. Thanks to Allstate, so had their insurance coverage."

"When that tornado struck Olathe, the Enegrens' house was completely wiped out. Only six months before, I had encouraged them to increase their coverage by \$10,000 to bring their insurance closer to the value of their home.

"At that time, I called them to review their homeowner's policy. I explained that not only had the value of their house gone up, but also the cost of rebuilding it, if disaster should strike.

"After the tornado, the Enegrens used the money we paid them to buy another house. As an Allstate agent, I always try to make sure my customers keep their insurance up to date, so that a disaster like this will never leave them out in the cold."



Barney Bobrow
Senior Account Agent
Mission, KS



Help when you need it.
That's a promise from
the good hands people.

Allstate[®]

Allstate Insurance Company, Northbrook, IL

CAR CLINIC

(Continued from page 30)

may be right, but I'd rather bet on factors that have shorter odds—like the regulator's ground or the field wire going to the regulator from the alternator.

To simplify the explanation, let's just say that a bad ground or a bad wire connector can cause alternator voltage to reach a peak inside the regulator which will cause early regulator failure. If I were you, I'd work on these assumptions. It's a lot cheaper than replacing the regulator once a month.

Big deal secret

Ever since I purchased (new) my 1976 Buick (350-cu.-in. engine), I've had an unusual problem. The engine has a long oil dipstick. Approximately 8 inches above the Full mark line, 1½ inches of heavy sludge forms. It gets so heavy it becomes difficult to pull out the stick. The sludge has to be scraped off with a knife.

Buick dealers tell me to forget about it. It bothers me not to know the answer. You're my last hope.—George Toepper, Elgin, Ill.

So what's the big secret? The

sludge is being caused by an excessive amount of moisture mixing with the oil. Moisture-laden oil is splashed up on the dipstick where it sticks and hardens. There are a few reasons why this can happen:

Maybe the engine is running too cold or you drive the car short distances only, and condensation that forms overnight isn't totally burned away. If so, you may benefit by installing a hotter thermostat.

Maybe the intake manifold gasket or timing gear cover gasket is ruptured and moisture from the cooling system is mixing with the oil.

Or maybe (perish the thought) the engine is cracked internally.

After the flood . . .

Here's a good tip for used-car shoppers from Marvin Verbeck who's vice president and claim manager of the Kemper Insurance Companies: Be especially cautious because cars submerged in salt water during recent blizzards and storms may be coming onto the market. The corrosive nature of salt water's action on metal parts and on a car's electrical system

will make these autos inoperable, rusting lemons within months.

An estimated 5000 cars were judged total losses by insurance companies during the February '78 storms. The owners of these cars received the auto's actual cash value minus their deductible.

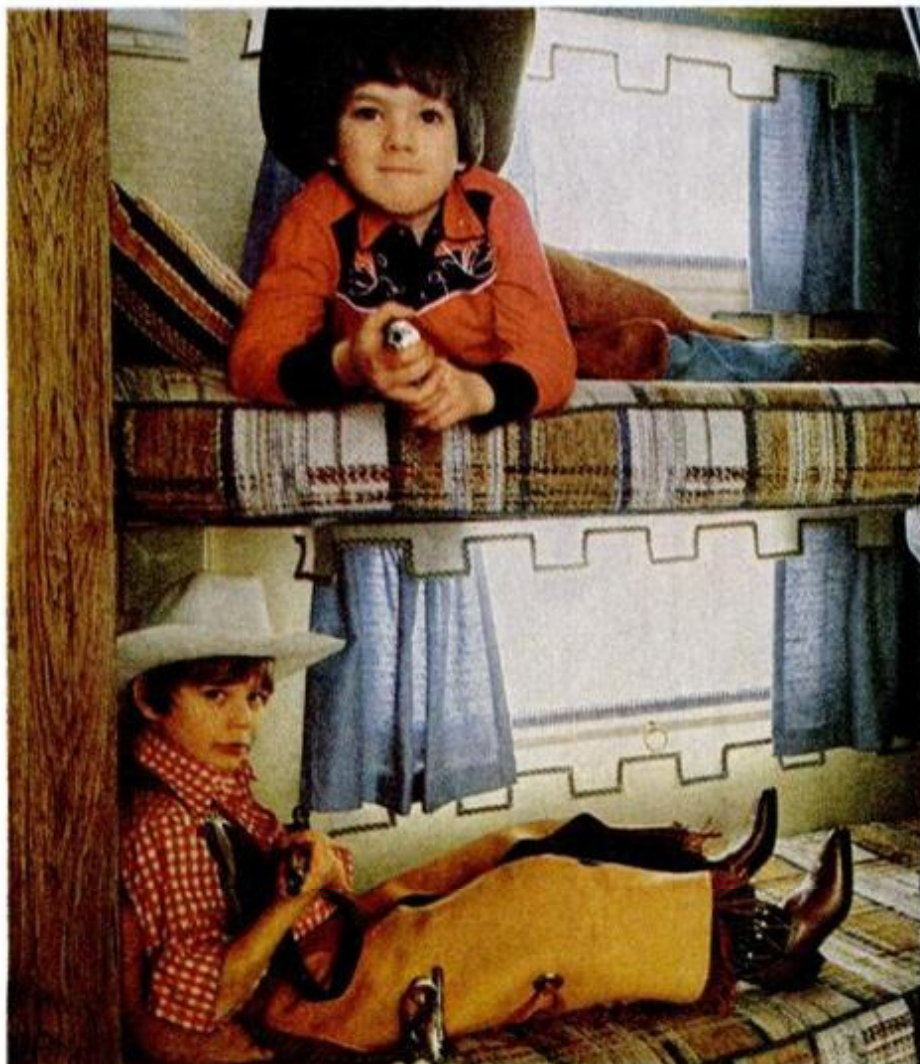
Residents in states that don't have laws requiring car titles to be stamped "submerged" or "flood car," are especially vulnerable to the sale of these autos.

To protect consumers, Kemper, and at least one other insurer, are requiring that submerged and "totaled" autos be broken up and, after reconditioning, be used only for replacement parts. Others may be selling the autos to wholesalers who may or may not break the cars up or take precautionary measures.

To spot a car that has been submerged in salt water:

1. Check for sand, silt or salt deposits under the carpeting in the passenger compartment. A stagnant odor may also be present.

2. Remove the back seat cushion (with the dealer's permission) and drop it bottom side down. If the car has been inundated with salt water, sand should fall out.



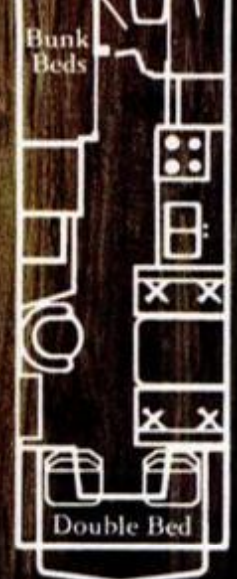
The Dunkhouse

Bath/
Dressing
Room

Tub/
Shower

Bunk
Beds

Double
Bed



24-Foot
Minnie-Winnie

3. Look into the recesses of a car's intake and exhaust manifold and other crevices for indications of sand deposits. The trunk may also have sand in hard-to-see corners or under the carpeting.

4. Remove the headlight rim and look inside for sand.

5. Examine the electrical system for signs of corrosion. (The corrosion will resemble the accumulation around the battery poles of any car brought from Massachusetts since February.)

6. Ask to see the title of the car in order to determine if it has been stamped "submerged" or "flood car." Be especially cautious of any car that has been brought from Massachusetts since February.

7. Be suspicious of any car that does not have its Vehicle Identification Number (VIN) attached. Kemper has removed the VIN plate from the cars it declared total losses. These plates, together

with the cars' titles, are being turned into the appropriate state motor vehicle departments for destruction.

SERVICE TIPS

■ Chrysler Corp., which has made it a policy to distribute service and training publications to do-it-yourselfers as well as professional mechanics, has a handy one on sale. It's a pocket-size handbook on 1978 carburetor adjustments and troubleshooting for all carburetors used on the company's line of vehicles. The handbook costs \$1 and can be ordered from Chrysler, Training Materials Dept., 26001 Lawrence Ave., Center Line, Mich. 48015. Request TM 821.

■ Hesitation, stumble and surging that are bugging 1978 Ford Granada and Mercury Monarch with 302-cu.-in. engine and automatic transmission can be snuffed out by adding a vacuum restrictor (D7AZ12A225-A) in the EGR-to-ported vacuum switch line. So says FoMoCo in service bulletin 151. Remind your dealer that the bulletin exists.

■ If while changing brake fluid you notice a threaded hole minus a bolt in the bottom of your Delco Moraine dual master cylinder, don't think for a minute that the bolt has bolted. Bolts were installed in the threaded holes of some cylinders, but not in the threaded holes of others. Don't go adding a bolt if you don't have one. You may limit the performance of the master cylinder. Let things be. **PM**

GOT A PROBLEM WITH YOUR CAR?

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

PM CAR CARE
TIP



Wash up

An important part of washing a car down is washing up—shooting under the body, that is. Road salt and mud that accumulate in wheel wells, under the chassis and in other crevices, such as behind bumpers and metal trim moldings, hasten body rot.

Aim a garden hose, with the nozzle set to deliver maximum pressure, at these areas. Do it often! The "skin" you save may be your car's.

Winnebago's family vacation plan.

Here's a mini motor home that makes family travel thrifty. Makes it comfortable. And makes it fun.

In Winnebago's new, 24-foot Minnie Winnie® bunk beds provide extra sleeping space. A separate tub/shower compartment eases bathroom traffic jams. And the rear divider curtain quickly creates a private "suite," complete with beds, bath and wardrobe.

For family meals, there's a four-burner stove and double sink in the galley. Plus a generous 66-gallon water supply.

Best of all, the Bunkhouse is affordable. With price and terms that can fit a family budget. Look up your nearest Winnebago dealer in the Yellow Pages. Look over the Bunkhouse and the whole, new, value-priced line of Winnebagos.

If you need a family motor home, you can drive a bargain with us.



There are a lot of reasons why you'll sleep better in a Winnebago.

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Want to try before you buy? Call Rent-A-Way Winnebago, 800-447-4700 for information (In Ill. call 800-322-4400)

IMPORTS & MOTORSPORTS

Volvo glows in the dark

What makes a car glow in the dark? Shorted ignition wires? Corona effect? Tankful of schnaps?

No, just reflective body side panels that light up when illuminated by headlights of cars approaching from the classic T-bone position. Being a Volvo idea, they're for safety, of course. The color-keyed, reflective panels are a feature of Volvo's Safety Concept Car (VSCC) built to show that cars can be a lot safer. The VSCC was designed to keep itself out of accidents, as far as possible, with such things as antiskid brakes, even with a loose nut behind the steering wheel. In panic stops, brake lights flash in rapid pulses and there are rear-facing fog lamps to help prevent deadly pileups. The horn changes pitch and volume as the car gains speed and, to be seen better, small running lights or notice lamps are always on when the car is running. Besides air bags and lap belts (for rollovers and secondary impacts), there are sensors to warn of low tire pressure, deicing grids in remote-controlled side-view mirrors and a rear-window wiper-washer. Headlight washers and wipers are installed, too, as on production cars in many countries.

Too cute, you say? Excessive?



Volvo 343 goes rallying in Europe.

Well, remember, every day over 100 people leave home in cars and don't come back. Many more who do make it back now get around quite safely—in a wheelchair.

Another current Volvo project is race-testing of a new, small 343 model on the European rallycross circuit. The 343 with its unique automatic transmission began as a DAF and became a Volvo when the Swedish automakers bought the Dutch company. This return to motorsports with the 343, which

Super-safe Volvo was derived from standard 244 sedan.



will someday join the model lineup here, is one way for Volvo to prove the adopted car has become a rugged and reliable family member.

Redcoat racing

The British are coming! They're after ten driver and manufacturer championships in North America. British Leyland Motors, sports-car suppliers to the colonies (not "By Appointment of Her Majesty the Queen . . ." but by popular demand!), has an extensive 1978



TR7 is after three rally championships.

program sponsoring race and rally teams, providing pace cars for Pocono, Laguna Seca, Road Atlanta and Nelson Ledges. Bob Tullius is back in the Group 44 V12 Jaguar; John Buffum and Doug Shepherd are crashing through the woods in the Triumph TR7 pursuing three rally championships.

1977 racing records

Grand Prix drivers, cars and races get most attention in this grand, colorful racing annual. But it is nevertheless a full accounting of the 1977 racing season. The British book (\$24.95) is from Motorbooks International, Box 2, 729 Prospect Ave., Osceola, Wis. 54020.



Record book.

More mopeds and motors.

Latest entries in the moped market include a line of Free Spirit mopeds from Sears and an electric bicycle motor from Pedalpower. The Sears machines, called Free



Free Spirit III is Sears' deluxe moped.

Spirit I, II or III, are \$350 to \$580.

Add an electric motor to any bike you already have and, presto!

you'll have a motorized bicycle that is q-u-i-e-t. The Pedalpower package (motor; deep-discharge, electric-vehicle-type battery; and carrier, controls) is \$160.

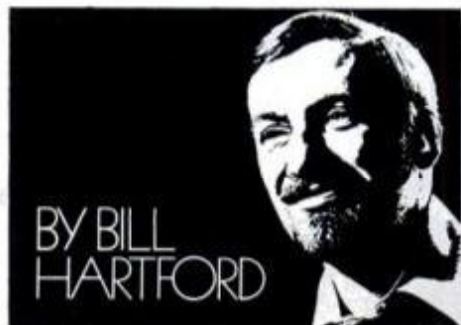


Electrified bike.

Not to be missed



A 1922 Detroit Electric is a resident of the transportation section of one of my favorite U.S. places—the Henry Ford Museum and Greenfield Village in Dearborn, Mich. When you go, say hello for . . . **PM**



BY BILL HARTFORD

'78 FORD PICKUPS. TOUGH ALL OVER.

A new Ford Pickup is built tough from the ground up. Ford's exclusive forged steel Twin-I-Beam, extensive corrosion protection, big-cube V-8 options, all-welded cab, and double-wall box are just a few of the reasons.

But what makes a new Ford even tougher to beat are this year's new options like • Synchronesh 4-speed overdrive transmission for highway driving (not available on F-350 models) • Good-looking, comfortable new Lariat interior • 40-channel CB with concealed transceiver, single AM/FM/CB antenna, and all controls in the removable mike • New tilt steering wheel for your most comfortable position.

Take a look at all the new Fords. You'll find them tough all over. And *more* than just tough.



93 out of 100 of all Ford Trucks registered over the last 12 years are still on the job. (Percentage based on cumulative total registrations as of 7/1/76.)

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Reasons Why The First Of Its Kind Is Still Best Of Its Kind

This is the ORIGINAL. The one with the smooth working, machined, undercut mating parts (1) that generate powerful leverage with no slippage. The one with the reinforcing flange (2) that practically eliminates stress breakage. First of its kind and still best of its kind. CHANNEL-LOCK. Be sure you get the real thing. Look for the trademark on the handle. Sizes from midget 4½" to giant 16".

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CHAN NEL LOCK

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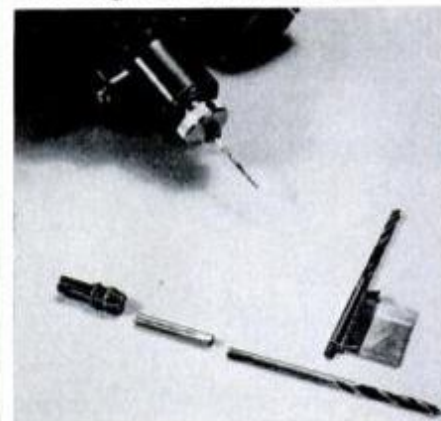
HINTS FROM READERS

Funneling liquids faster



A piece of heavy-gauge wire epoxy glued outside a funnel along its length will speed up the flow of funneled liquids. The wire allows trapped air to escape as the inflowing liquid forces the air upward.—Howard E. Moody

Bushing for a little bit



When a drill bit is loose in a collet chuck, make a bushing to keep it secure. Wrap a strip of sheet aluminum, cut from a pie pan or TV dinner tray, around the bit shank. Trim the excess metal carefully to avoid an overlap-ridge that would throw the bit off center.—Walter E. Burton

Putting back the bite

When screw holes made in wood have become so enlarged that the screws no longer fit securely, add a casing to the screw so it will fit tightly in the hole. Force plastic insulation covering stripped from a piece of electrical wire over the screw.—Henry Miller

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HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

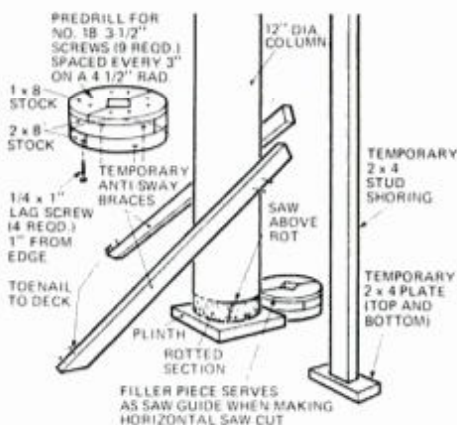
Rotting porch columns

Two of my seven wood porch columns are starting to rot about 4 in. from the bottom. They are 12 in. diameter by 7 ft. high. How can I repair them and keep the remaining columns from rotting?—Frank Rummler, Belmar, N.J.

Most wood columns are hollow, and circulation of air from the bottom (plinth) to the top (capital) is very important. Make a filler by laminating wood "half circles" together to reach the desired height of rot (see below).

Lag screws assure air circulation through a 2-in. hole cut in the center of the wood pieces. The screw heads keep the base off the deck.

Cut half circles with an oversize



Support column and replace rotted part.

radius to allow for sanding. Use pressure-treated wood. Fasten the six pieces together using waterproof glue and screws. Install lags.

Temporarily support the load above with a 2x4 stud, plates and a pair of diagonal braces to prevent swaying while you saw. Move the new filler section around the column as you saw to get a level cut. Clean up the rotted area then slide the filler piece in place. You may have to make a vertical adjustment with the existing "fastener" to keep the column from kicking out. To do it, adjust the lag screws to assure a tight fit; then attach the column to the base. Fill, sand and treat with wood preservative prior to painting.

To prevent rot on remaining columns, carefully chisel or drill four equally spaced ventilation holes at the base of each. This will lessen condensation due to temperature changes (warm days and

cool nights). You might check with your lumber dealer on the cost of cast iron or fiberglass plinths with built-in ventilation.

Removing grout

The grout between our 4-1/2-in. shower tiles has become loose and has fallen out in some places. Outside the tub area it has become discolored. I'd like to regrout, but how does the amateur remove the old grout—high speed grinder, muriatic acid, or what?—S. B. Ohrenstein, Burbank, Calif.

You've got your work cut out for you, but loose grout can be removed with a sharp tool such as an ice pick or awl. While applying pressure, repeatedly draw the tool through the joint. Leave any tight grout in place. A putty knife may be helpful in removing any bumpy or rough pieces still clinging to the joint. There are several tile cleaners on the market, since many contain some muriatic acid, wear rubber gloves and protect your eyes with goggles. I have had success with a cleaner and Brillo soap pads. Remove all traces of the pad with soap and water. Since success depends to a large part upon the age and type tile you have, experiment on a tile in an inconspicuous place first.

Camouflaging nail dimples

How do we camouflage the occasional nail dimples that annoyingly appear in the ceiling of our new home?—Sue Hall, Tipton, Iowa

Your problem isn't uncommon. In defense of the spackler, these dimples probably didn't show under daylight conditions, when he finished them. You can purchase ready mixed joint compound (it'll keep for long periods when tightly sealed), and a 4-in. spackle finishing knife. With a small amount of compound on the knife, hold the blade at a 30° angle to the ceiling and draw it firmly over the dimple. The dimple will be filled flush

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.

to the adjacent surface. When it's dry, sand patch lightly with fine sandpaper. Touch up with paint.

Old faithful is unfaithful

My old cast-iron Craftsman miter box and saw always leave me 1° or 2° off when I try 45° or 90° cuts. It's frustrating when I try to make picture frames, especially since I've had the saw sharpened and set.—Jim Smith, Mishawaka, Ind.

A clue to your problem might be in the word "old." The Craftsman products enjoy an excellent reputation, but after a period of time, normal wear will take its toll. Experienced carpenters know that a slightly worn saw guide or angle stop can easily cause a 2° error. If you feel the tool still "owes" you, check with the nearest Sears store. Or, you might invest in an ordinary hardwood miter box and a No. 404 Stanley picture frame clamp.

Tanks for nothing

When we converted from oil to gas heat, we were left with a 500 gallon oil tank buried in our front yard. Removing it or filling it with concrete would be too expensive. Filling it with water would only cause it to rust and collapse. Help!—Paul Gustafson, Saginaw, Mich.

First, I would check with a local heating contractor. Depending on the age of your tank, he may be willing to dig it up and back-fill the hole for salvage value.

I believe the tank will last as is for years. But, if it really bothers you, try this: 500 gallons is only about two and one half cu. yds. of mortar sand. Have it dumped near the filler neck and fill the tank through a large funnel. Sand pours easily and will compact well in the tank. This might be a good time to invite your relatives for a barbecue!

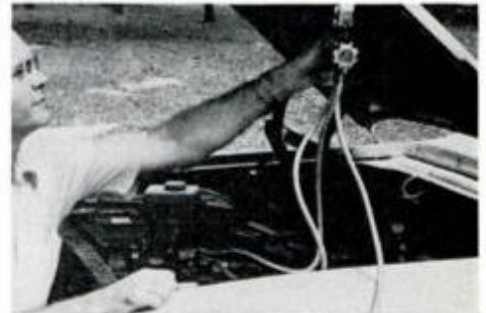
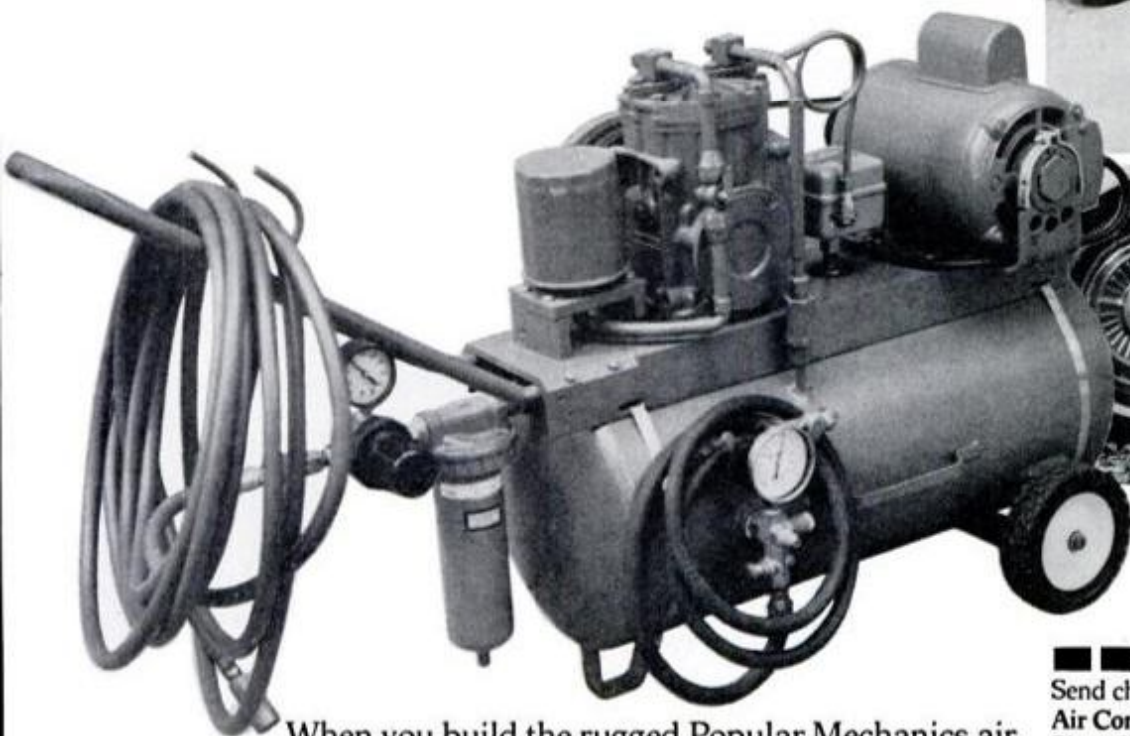
PM



BY JOHN GAVNOR

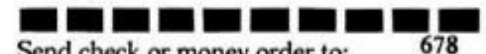
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APPLIANCE CLINIC

QUESTIONS ANSWERED

Cut and dried

Clothes no longer spin themselves dry in our Whirlpool model LA 8800 automatic washer. In fact, you can hand-wring them, they are so water heavy. I checked the high-speed relay, pump and screens, and they seem okay. The machine is only five years old. Please help.—Harry Lindell, Saranac Lake, N.Y.

Assuming the washer isn't being overloaded, the two conditions that cause this problem most often are a loose belt and a clutch not adjusted properly.

Take off the back panel and press the belt. It must be tight. Adjust or replace the belt, if necessary, to take up slack.

To check clutch adjustment, insert a dime between the clutch pads and clutch plate. The assembly is opened enough to let you do this. The dime should fit snugly. If it doesn't, adjust the clutch by tightening the bolt on top of the stud and spring assembly on the clutch housing until the gap between the clutch pads and plate is taken up. If the pads are worn badly and can't be adjusted, replace the clutch.

Parts changer

Our dishwasher doesn't pump out water. Believe it or not, I have had a serviceman here five times to see this unit. He has put in five sets of new parts. Still, water remains. We also found that the impeller had been eaten away by detergent. Can you help?—Charles B. Libasi, Dunmore, Pa.

First of all, detergent won't eat away an impeller. Food particles do that, which seems to indicate that dishes aren't being scraped enough to begin with. Secondly, why have "five sets of new parts" been put into the machine? Why wasn't the cause of the trouble found first? The usual causes of this problem are clear-cut enough—1. a clogged strainer; 2. clogged discharge line; 3. a sheared, loose or jammed impeller; 4. an inoperative pump motor. Troubleshooting is also clear cut:

1. Check the strainer. See that it's clean.

2. Find and disconnect the discharge (drain) hose from the pump to the drain. Blow through

it. If it's clogged, clean it out. When hooking the hose back up, make sure you don't bend it.

3. Do an operational test. With water in the unit, open the door, place the machine in the spin cycle and press in the door switch with a screwdriver. If the pump motor is dead, water will remain and there will be silence. Check the wiring between the timer and pump motor. Your trouble may be caused by nothing more serious than a disconnected or loose wire. Next, test the timer and motor with a VOM to find the faulty component.

If the pump motor works, uncover the impeller and again activate the machine in the spin cycle while watching the impeller. You will be able to see whether the impeller is loose on the shaft or jammed. A loose impeller or a frozen shaft will prevent water ejection. It just may be that the entire pump assembly has to be replaced.

Calculated answer

It's inconvenient to crawl under my desk every time I use my calculator. Is it okay to leave the transformer plugged in permanently? It seems to get awfully hot.—Erik DeWane, Chicago, Ill.

Itoh Electronics, Inc., in New York City, told me that it will not cause harm to keep a calculator plugged in permanently as long as its switch is in the off position.

Philip Morris Office Machines, Inc., of Miami, which is one of the largest calculator service dealers in south Florida agrees. However, a service technician suggests that if the transformer is "hotter" than warm, the battery pack may not be holding a charge, causing the transformer to overwork. In time, the battery pack may weaken to the point where it will have to be replaced.

Roll your own

To try and get our old Hoover upright vacuum cleaner to pick up dirt, I have installed a new bag and tested suction, which is strong. The unit did a great job until recently. Why not now?—Larry Berk, Newport News, Va.

The pick-up roller has either burst its belt or its brushes have become worn. Turn the machine over and look to see that the roller

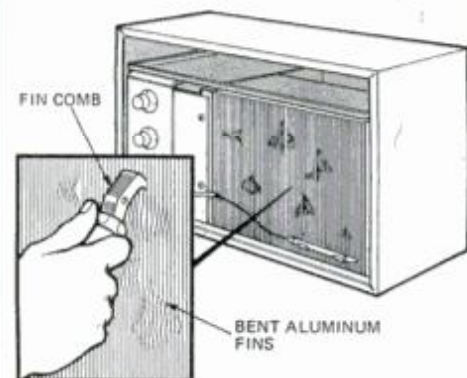
belt is not cracked. Replace a bad belt and make sure it is properly attached to the pulley. Brushes should be comparatively long ($\frac{1}{8}$ to $\frac{1}{4}$ in.) and "rough"—that is, not slick so dirt slides off them.

You can replace brushes in many units without having to replace the roller. Remove the roller from the machine. A Hoover dealer will give you the replacement brushes or a new roller.

SERVICE TIPS

■ When you clean the filter in your room air conditioner this summer, check the aluminum fins of the evaporator. If some are bent, the transfer of heat to the refrigerant will be impaired.

Fins can be straightened, but only with



Comb corrects bent airconditioning fins.

a fin comb as shown. When we priced this tool, it was selling for under \$4. For a source check the classified directory under "Air Conditioning Equipment and Systems—Supplies and Parts."

■ A good tip offered in response to our list of parts suppliers for major appliances comes from Carlyle O. Otto at Akrit Appliance Supply Co., 2820 Vassar N.E., Albuquerque, N.M. 87107:

"... the greatest problem in filling mail order parts requests is the lack of sufficient information... admonish your readers to be sure to furnish the exact and complete brand name, model and serial number as well as a description of the part and of its function. Sketches are often very helpful."

Another tip: The manufacturer of your appliance is a good place to check for parts replacement. For example, Whirlpool has a number of factory-owned parts divisions. **PM**

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

"Nuclear plants in New England saved customers \$380 million."

Meredith D. Persson, Nuclear Cost Accountant

"It would have cost customers of the New England electric companies \$380 million more, in one year, if those companies had used oil instead of nuclear energy. In Illinois, nuclear power saved customers \$125 million; in the Carolinas, \$138 million; in Iowa, \$16 million."

"Did you know that electricity from nuclear plants kept 257,000 people from losing their jobs when the coldest weather in history caused shortages of coal, oil, and natural gas?"

"Even if nuclear power plant construction can overcome the serious delays, America will still need to depend heavily on coal as a major source of electricity."

The time to build power plants is now.

By 1988 America will need 40% more electricity just to supply all the new people and their jobs. New power plants—both nuclear and coal—are urgently needed and must be started at once to be ready in time. For facts on your energy options, just send in the coupon.

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THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS BY THE EDITORS

Look, Ma. No Freon

Can't count all the aerosol cans you've thrown out because they lost their propellant charges? And you always find out about the lost propellant when you're in the middle of a job. Right?

With this manual, adjustable-nozzle spray can you can have anything from a solid stream to a fine mist.



Pump sprayer has adjustable nozzle tip.

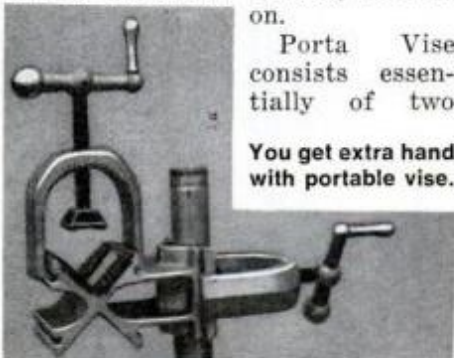
The manual sprayer will handle solvents, light oils, kerosene, insecticides and so on. You can use almost any low-viscosity fluid except water (this would work, but would corrode the pump). We tried it with a can of nonaerosol Gum-out and it did a fine job of spray-cleaning carburetor linkage. Most of what you can buy in an aerosol can is much cheaper bought as a liquid, so the sprayer will pay for itself. From \$5 at Dutton-Lainson Co., 1515 West Second St., Box 729, Hastings, Neb. 68901.—B.H.

Multi-angle pipe

That third hand you've so often needed is here now. Called Porta Vise, it's for the serious constructor/welder who's into engine swaps, homebuilt chassis, and so on.

Porta Vise consists essentially of two

You get extra hand with portable vise.



strong clamps that can be swivelled at nearly any angle and held there. It accepts square, round, or angled stock, $\frac{3}{8}$ to 3 inches in diameter. You can also fasten one end to anything solid and use the Porta Vise as a conventional vise.

Made basically of aluminum, with steel jaws and threads, it weighs only 12 pounds and costs \$166.50 from Lodi Porta Pipe Vise Co., 1223 South Hutchins St., Lodi, Calif. 95240.—M.L.

Go lock your nozzle

Trying to hit an inaccessible fitting with a manual grease gun can be an exercise in frustration. You've got to use a flexible line to get the nozzle on the fitting nipple, and unless you hold the nozzle in place with one hand, it pops off. This means you have to operate the grease gun with one hand, a possibility with a professional air-operated type, but not with the Saturday Mechanic's manual design.

Now, for \$3, you can have a



Grease gun with new locking nozzle tip.

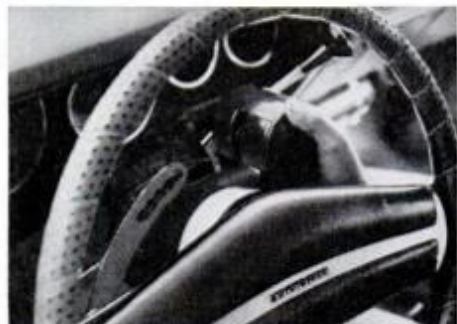
nozzle tip with a knurled locking device. Once you have the nozzle on the nipple, just turn the knurled dial and the nozzle locks on. *Voila!* You've got two hands clear to operate the grease gun. From Thexton Manufacturing Co., 7685 Parklawn Ave., Box 35008, Minneapolis, Minn. 55435.—B.H.

Thief-foiling cuff

Professional auto thieves most often steal cars by either using a master key or by ripping out the ignition tumbler with a slide hammer.

To foil thieves, Car Cuf Industries offers a heavy steel guard

that clamps and locks over the ignition switch on your steering column. Car Cuf is adjustable, has a plastic coating to prevent scratching, and locks on in sec-



Steel guard locks over ignition switch.

onds. Its own lock tumbler faces toward the dashboard, so it's very difficult to open without the right key. I hope to reduce my car insurance premium by using this device.

Car Cuf fits all 1969 and later U.S. cars and retails for \$34.95. Order from Car Cuf Industries Inc., 285 Newtonville Ave., Newtonville, Mass. 02160.—M.L.

Buzzy car cushion

If long-distance driving gives you an occasional sore back, here's a vibrating pillow to take along as your portable masseuse.

It looks like a conventional pillow, but inside are two flashlight batteries (not included). It vibrates automatically when compressed by the weight of your back. You can use it to massage any other part of your anatomy.

Called Car-Brator, the vibrating cushion lists for \$19.99 from California Cushion Co. Inc., Lodi, Calif. 95240.—M.L.



Aches of long distance driving are eased with this vibrating pillow: Just insert batteries (left) and lean back on the cushion to turn it on.

Bosch reports on the Nickel-Plated Spark Plug

One of four Bosch refinements that are changing the way spark plugs are made.

1 Nickel-Plating

Plugs can "seize" or stick fast in some engines due to a chemical reaction between the alloy cylinder head and the metal plating on the plug threads.

The harder the metal used to plate the plug, the better it resists this chemical change. Bosch uses nickel, which is much harder than the galvanized zinc on the leading U.S. plug.

Nickel plating virtually eliminates the possibility of seizing. This Bosch refinement is now being copied by other plug manufacturers.

But no other plug gives you nickel plating plus these other three Bosch refinements.

2 Gapped at Factory

Only Bosch pre-gaps its full line of plugs to the *exact* engine specifications determined by the car manufacturer. Bosch plugs come ready for immediate installation.

3 Angular Rib Design

The ribs on any spark plug insulator serve to minimize current leakage along the outside of the plug. Bosch engineers designed ribs with corners instead of the usual curves to reduce leakage even further.

4 Crack Resistant

To withstand cracking from compression and high temperatures, insulator ceramics contain aluminum oxide. For improved protection against fracturing, Bosch

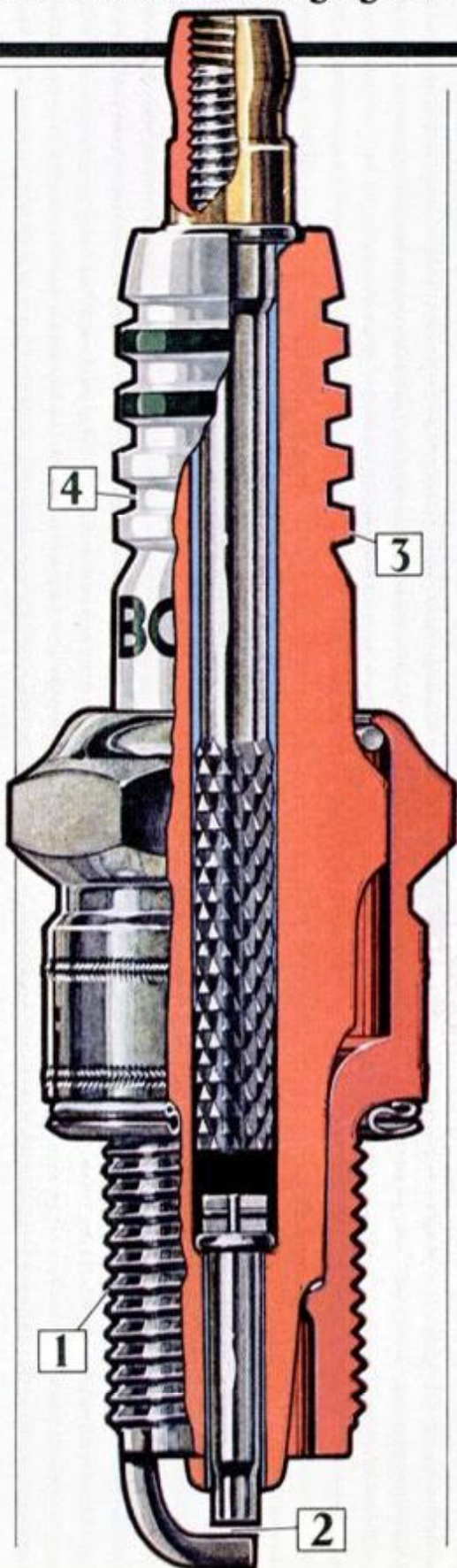
insists on an industry-high proportion of 95% aluminum oxide vs. 91% for the leading U.S. plug.

Try a set of Bosch plugs—the quality plugs that burn clean and run smooth to save gas.

Spark Plug Pioneers

Bosch is one of the world's oldest spark plug manufacturers. Since 1902, we've developed over 20,000 different plugs. The four refinements described here are just the latest in a long line of Bosch innovations.

Bosch spark plugs are available only in professional automotive outlets.



ROBERT BOSCH
CORPORATION

How to make a good drink great.



Make any drink with Seagram's 7 and make it a great one. For a smooth, refreshing 7 & Cola, pour 1½ oz. Seagram's 7 over ice in a tall glass. Fill with cola and garnish with lime.

Seagram's 7 Crown
Where quality drinks begin.

Why do these cars blow horns at each other?

Some cars have it, some cars don't. If yours has the cult mystique... honk.

by Wade Hoyt

To many people, cars are just "wheels," transportation, a way to get to and from work, something to haul groceries in. If it's got four wheels and runs, it's perfect.

Others take a far different view, less practical and more emotional perhaps, but also vastly more satisfying. These people *like* cars, or at least certain cars. They appreciate them for the way they look or the way they operate. When a large number of people find a particular car desirable, it is sometimes referred to as a "cult car." The Corvair is a perfect example. The Edsel is close, but no cigar.

The guy with an "I Love My Corvair" sticker on his bumper really *does* love it. To hell with Ralph Nader... he wouldn't know a good car if it ran him down and backed over him twice! The Corvair owner knows that his car goes and handles better than the contemporary Falcons and Valiants that Nader deemed suitable for public consumption, and he also knows that his car has more *flair*, more of that certain indescribable *something* that makes it stand apart from the crowd of '60s economy cars. There are still companies making replacement parts, racing parts and restoration parts for Corvairs, long after General Motors gave up on a good idea. There are even owners' clubs—groups of similarly afflicted individuals who hold rallies and meetings, publish news letters, swap parts, and write pen-pal type letters to one another. That's the sure



Renault LeCar owners toot and wave because...?



PM Photo:
George Ancona

is missing. Owning an Edsel is rather like being the fat lady in a circus. Sure, it's a curiosity. But so is a go-go girl, and who would you rather be seen with on a date? Okay!

sign of a cult car. You don't find owners clubs for Falcons and Valiants.

Edsel owners have a club too. Their Rangers and Corsairs go up in value over the years, rather than down but somehow it's not the same as it is for a Corvair owner. A certain *enthusiasm*

There seems to be no rhyme or reason to cult cars. Some are great automobiles, recognized as such from the moment they were first introduced. Others are sleepers, like the '55 Chevy, becoming the "in" thing only a decade after its introduction, and growing in popularity ever since. Some are limited production supercars, like the Shelby Cobras. Others are mass-produced economy cars, like the Corvair, VW or Honda Accord. But almost all of them attract attention and praise

Behold! A covey of cult cars in color...

PORSCHE SPEEDSTER

With lines smoother than a baby's bottom, mid-1950s Porsches like this 356A Speedster 1500 inspire a slavish devotion.



from the time they are introduced.

Most cult cars have one thing in common: More people like them than own them, and that's what keeps their prices up over the years. They needn't be collectors' cars in the six-figure price bracket. Some are rare and getting expensive. Others are brand new; all you do to own one is sign on the dotted line at the local dealership. Still others are obviously on their way to stardom, and you can



FORD THUNDERBIRD

Some cars like the mid-1950s two-seater T-birds didn't drive all car buffs wild when introduced, but, oh, to have one now!



SHELBY COBRA

Ford V8 engines were shoehorned into the aluminum-bodied Cobras of the mid-1960s by racer Carroll Shelby. Slick, slippery, and fast. Very fast.



FIREBIRD FORMULA

You won't see the '79 Firebirds until September, but here's exactly how the Formula will be decked out. Among the tricks for '79 will be blackout taillight lenses. The Trans Am, cultiest of the F-birds, will get special anniversary treatment and lucky buyers will get them powered by the last 400-cu.-in. V8s that Pontiac will make.



CORVAIR MONZA SPYDER

There are plain Corvairs and then there are turbo-charged Monza Spyders—like this '63 convertible—and rare, modified Fitch Sprint coupes... and Corvair cultists know them all.



CORVAIR

With rear lid lifted to show off engine, '64 Spyder is on display for the faithful.

pick a winner off the corner used-car lot.

How much should you pay for a cult car? It's strictly a matter of supply and demand, but a little common sense goes a long way. An Atlanta dealer is currently offering a "ground-up restoration" of a '57 Chevy Bel Air for \$8500 and a "rare" '62 T-Bird for \$12,500.

You could probably buy similar models from a migrant farm worker for under \$300, although they would most likely be rolling wrecks. The car you want should fall midway between these two extremes, both in price and condition. Avoid expensively "restored" cars if you can and look for sound, unmodified cars in good running condition, with little or no rust, just as you would with any used car.

A cult car is fun to own. If you go to auto races, car shows or other places where car-wise people gather, it's nice to be in a car that attracts admiring glances. It's also handy if, when the time comes to sell it, you can easily get back what you originally paid. Considering the way the average car depreciates, that may be more than half the fun of owning a cult car!

I've had two cult cars—a Cobra and an Accord—and I'm willing to own more. There are pluses and minuses to cult-car ownership. You

HONDA

A legend in its own time, the Accord has dazzled drivers who have put it through its paces. If you want a brand-new 1978 model like this, you will have to get in line.



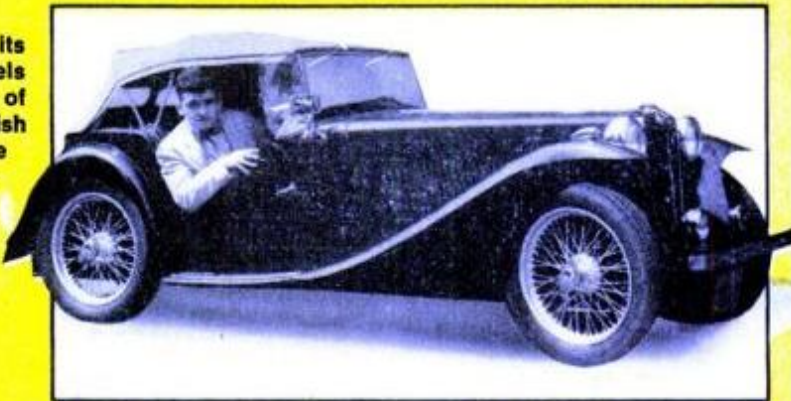
VOLKSWAGEN

See the Beetle? See the Beetle multiply. See it surpass Model T in production. See the owners honking, waving and carrying on. See the split rear window. See the rear-engine 1951 VW Beetle!



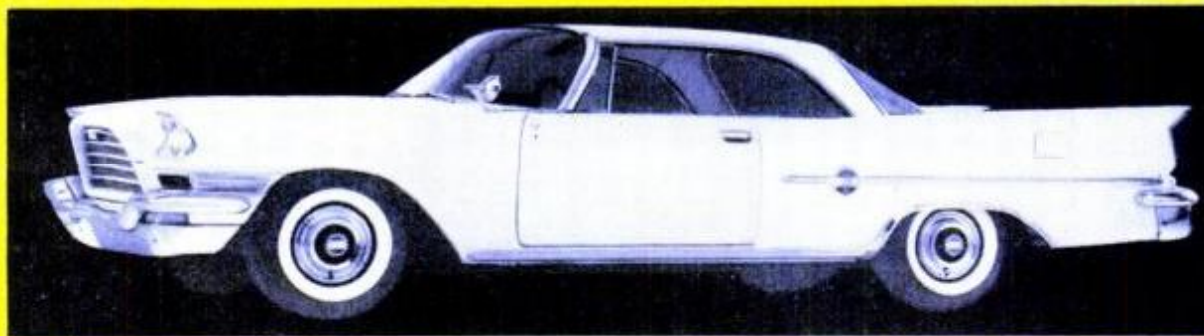
MG

1948 MG-TC with its chromed wire wheels is a fine example of the classic British sports car. Price that you pay for romantic wind-in-the-face ride is a pounded posterior.



CHRYSLER

Oh, mourn a great, lost leviathan of motoring days gone by. Mourn the Chrysler 300 but praise persevering souls who keep Mr. Rust from cars like this. Generations unborn will see what it was like to drive to the corner in mid-20th century.

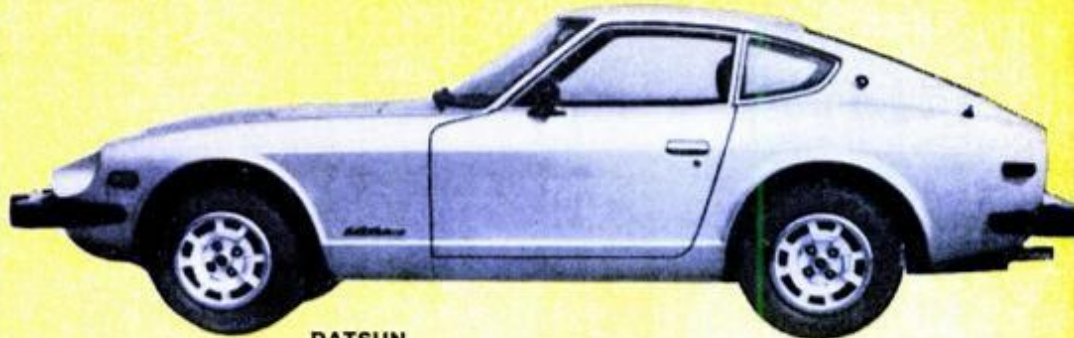


may wait months for delivery on a new one. Parts for older cars may be scarce and expensive. But there are compensations. Your insurance agent will think you're nuts, but his computer will give you the best rates in town on a '55 Chevy. Try that with a Ferrari!

For several years, I insured my Cobra as a "1964 Ford convertible." It wasn't exactly a lie, but it wasn't the whole truth either. Sure, it was dumb. If the car had been wrecked or stolen, I couldn't have collected anything near what I paid for it, much less what it was becoming worth. But, on the other hand, I could

afford to insure a '64 Ford. The company's computer would have gagged had I tried to whiz through that little roadster's whole real name: "Shelby-Ford AC Cobra."

I finally turned honest when I found a company willing to insure such "special-interest cars" at low rates because they realized that cult-car owners: (a) take better care of their cars than the average guy, and (b) usually put comparatively little mileage on them. I discovered this thinking man's insurance company on the pages of *Old Cars*, a weekly publication out of Iola, Wis. 54945. It and *Hemmings Motor News*,



DATSUN
The Z car. A 240? 260? A cultist will tell you: This one is a 1978 280Z. A shape with staying power.



VOLVO
Say you want a real sporty station wagon? Your chance was in 1973 when you could have an 1800ES Sports Wagon.



AVANTI

Studebaker lives! Avanti II is latest production version and little changed from this early '60s model.

CORVETTE
The year was 1953 and you could buy a Vette in any color—so long as it was white.

Box 100, Bennington, Vt. 05201, are both packed with classified ads for all sorts of oddball vehicles.

The definition of a cult car is a highly personal thing; my list of favorites starts below.

Cult cars from the recent past

Early VW Beetles were among the first cult cars. You had to be a little odd to own one, so owners tended to band together into car clubs and similar mutual-admiration societies. When two Bugs passed on the road, their owners would wave, honk or flash their headlights—a sure sign of a cult car. Neat VWs to own today are the split rear window models of 1949 to '52 and the oval window jobs of '53 to '57. After that they all started to look alike and became just



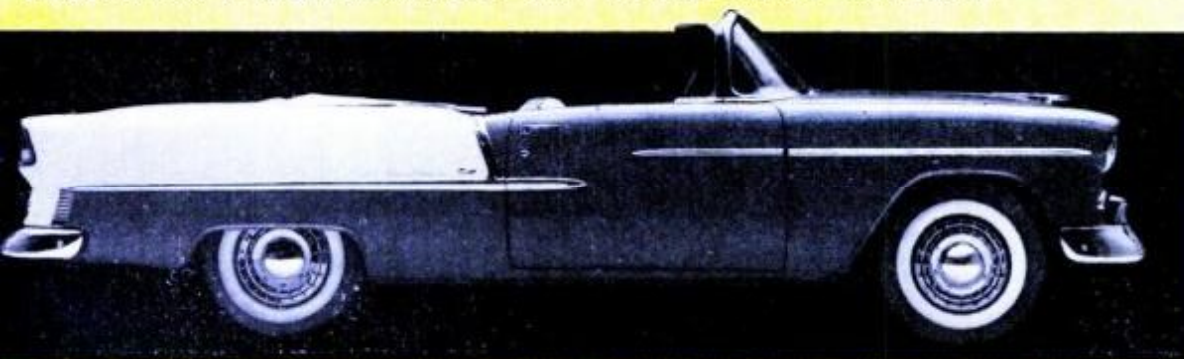
"wheels." Owners stopped tooting and flashing and joining clubs. Too bad!

T-Series MGs, those early English sports cars with the old-fashioned fenders and running boards, were produced from 1945 to '54 in three different models: the MG-TC, -TD and -TF. Their owners were known

to wave and toot and form clubs, too. Now that these MGs are approaching collector status, with prices to match, there are firms selling fiberglass replica MG-TC bodies you can bolt onto VW Beetle chassis!

Two-seat Thunderbirds of '55 to '57 are now real head-turners. In their day, there was some controversy about their not being "true" sports cars, and Ford proved its detractors right by the direction the

(Please turn to page 108)



CHEVROLET

The Chevy. In the '50s. Smack dab in the middle. It's a '55 Chevy Bel Air convertible. A '54 or '56 model is nowhere—it's gotta be a '55—or a '57 as second choice. It was merely a nice car in those days but now a real do-wa-diddy—to dudes who dig it, that is.



Now you can try those mid-air tricks that daredevils do when schussing down a mountainside of snow. Freestyle hot-dogging has hit water-ski level and, with practice, you can take off from a towboat wake for the new sport of aqua-acrobatics. Even if you never achieve championship form (it takes years of practice), you'll have fun trying.

A mistake on water skis is more likely to end up in a splash than in

traction at a local hospital, but Ricky McCormick, considered the country's top trick skier, recommends perfecting your water-ski fundamentals before taking to the air. For this ultimate test of your technique, there's the challenge of the Spread Eagle—where skis are spread wide apart and then brought back together just in time for graceful touchdown. Then try the Daffy—scissoring the legs by lifting one ski up in front of you while

Now hot-dog skiing goes overboard

Acrobatic skiing started on snow; now it's on water. Want to try? Here's how.

By Bill McKeown OUTDOORS EDITOR



Up and over as the towboat cuts away from the jump ramp, Carl Lyman performs his somersault specialty, a feature of his ski show clown routine at Cypress Gardens.



Properly outfitted in life vests and helmets, freestyle show-skiers practice trick Spread Eagle maneuvers that are part of introduction to aerials.

the other points down and back. The Back Scratcher swings the aft end of the skis up to touch your back while the front tips point straight down—with legs tight together, please. (Hit the water before recovering from this one and you're almost guaranteed an unplanned cartwheel.)

Front Flips and Back Flips are forward and back somersaults that end in skiing position, sliding along as if nothing had happened. (Don't

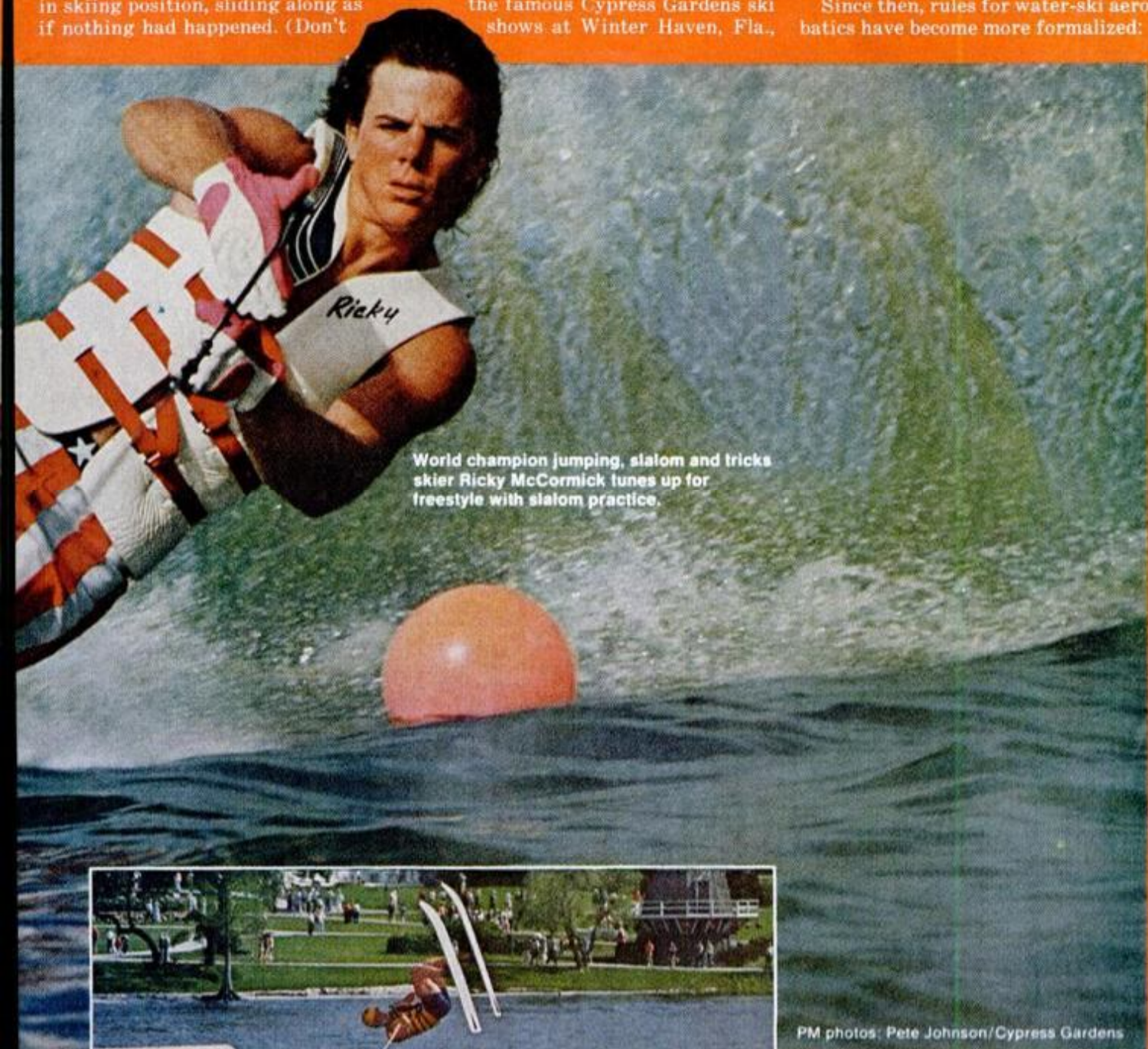
forget—you *keep* the tow-rope.) A flip sounds like a routine form of gymnastics? Then go around in the air twice before you land, making it 720° instead of 360°. For graduation exercise, there's the Worm Turn.

Freestyle's water-borne birth

For years, water skiers have been inventing new stunts. Audiences at the famous Cypress Gardens ski shows at Winter Haven, Fla.,

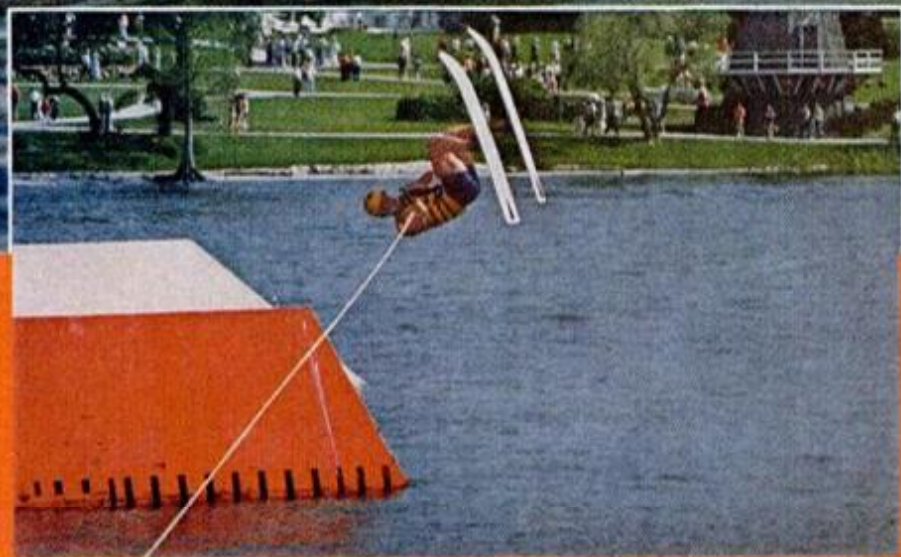
and at other performances, have seen trick and clown acts that incorporated hot-dogging basics. But spectators at the 1975 midsummer Masters Water Ski Tournament at Callaway Gardens, Ga., probably viewed the first organized freestyle competition as Mike Suyderhoud, Bruce Lockburn from Australia, Wayne Grimditch and Ricky McCormick introduced the sport.

Since then, rules for water-ski aerobatics have become more formalized:



World champion jumping, slalom and tricks skier Ricky McCormick tunes up for freestyle with slalom practice.

PM photos: Pete Johnson/Cypress Gardens



Before trying Forward Flips and Back Flips riding up outside of one tow wake and landing on the other, hot-dogger Lyman performs ramp jump flip at 30 mph.

- Tow rope length must exceed 46 feet, and a safety jacket may be required.
- A skier will get three jumps per pass, and be allowed three passes. Between jumps, the skier may perform one double-wake or surface trick.
- Skiers may execute aerial tricks from a ramp at 20, 25 or 30 mph.

Early hot-doggers used 42-inch trick skis without rudders and little bend in the ends. Newer freestyle

models have turned-up tips, and may be wood, fiberglass or graphite laminates. Back ends are squared off and lengths run from 45 to 49 inches with widths ranging from 8½ to 9½ inches. Small 4-inch rudders



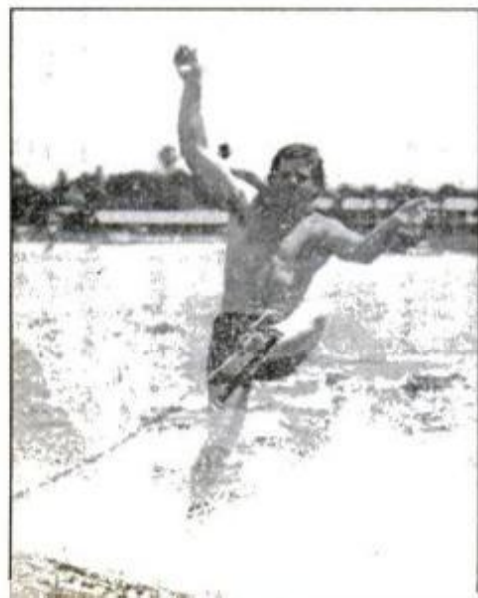
Back-to-front one-ski stepover is practice preliminary for forward or backward spins.



Getting more difficult, trick requires the proper toehold on towline for 360° turn.

help the hot-dogger to cut sharply. First step is to decide which foot comes first. As you graduate from two skis to one, try lifting one foot to determine which gives better balance. McCormick suggests standing on land with eyes closed and leaning forward. The foot that keeps you from falling will be your front steering foot.

One-ski deep water starts, slalom



Practicing ashore, freestylist Carl Lyman shows Aquamaid Callie Beatty the towline and balance position for front-to-back stepover, to develop control for hot-dogging.



Practicing correct form for skiing backwards, Aquamaid Beatty leans her weight away from boat's direction of pull. Such dry runs on beach simplify things on the water.

runs and wake jumps all deserve extensive practice. A boat speed of 20 to 25 mph should give the sharpest wake. Tricks and ramp jumps can take years of work before you achieve championship form. Carl Lyman, 1977 freestyle champion, started skiing near Sturbridge, Mass., when he was four. Overall world champ Ricky McCormick began on Missouri's Lake of the

Ozarks at five. He holds the world tournament jump record of 171 feet.

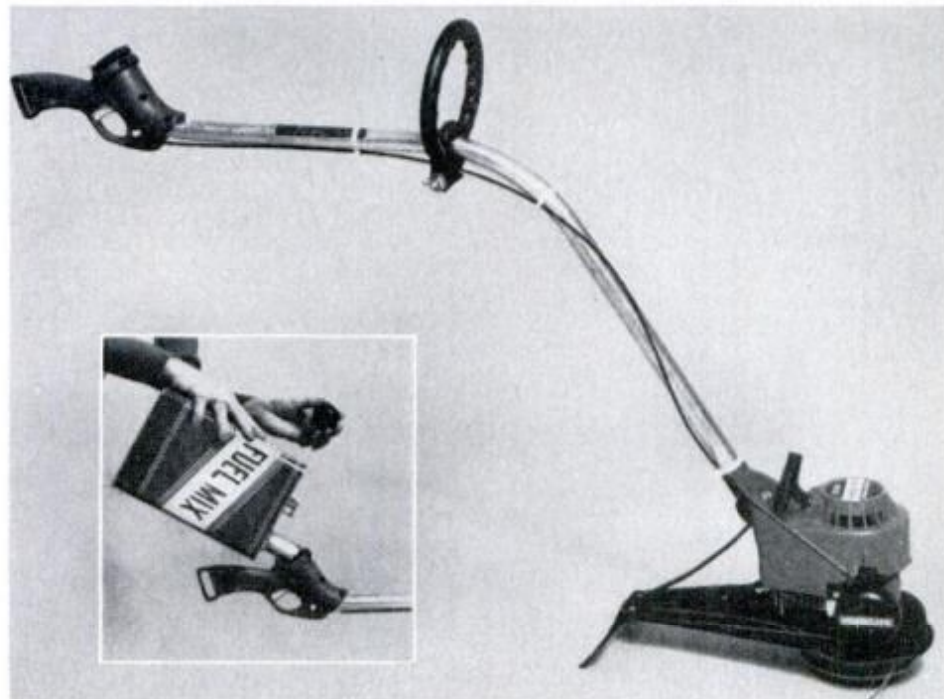
Tricks over wakes and off the jump ramp are the final hot-dogging tests. And now you think you're ready for the Worm Turn? Simply fall on your back at 35 mph in a shower of spray. Ride there a moment, spin upright and leap to your feet again as if nothing had happened. **PM**



After tuning up (left) with toehold spin, Ricky McCormick performs hot-dog full wake-jump forward, then back flips. He's using Cypress Gardens graphite laminate trick ski.



IT'S NEW NOW

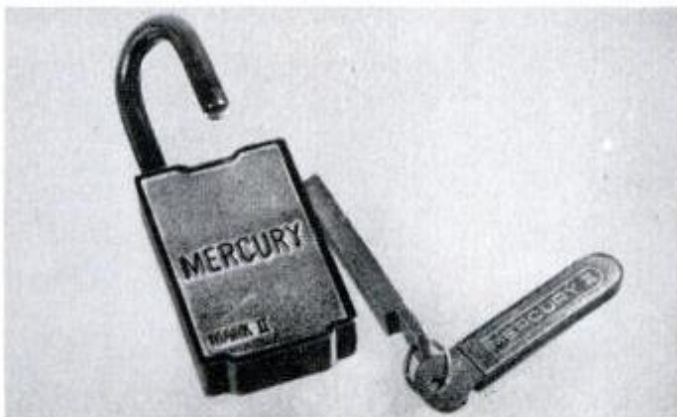


Strung out

Homelite says its ST-100 string trimmer, at 7¼ pounds, is the lightest gas-powered model. The automatic string-feed system feeds only when new string is needed and only when the two-stroke engine is idling. The \$150 unit comes fully assembled. Homelite, Box 7047, 14401 Carowinds Blvd., Charlotte, N.C. 28217.

Magnetic padlock

There's no keyhole in this magnetic lock, thus making it pick-proof, the maker claims. A magnetic key with one of 10,000 combinations must be inserted in a groove on the side to open it. It's \$10 from World Wide Trade, 80 School St., Watertown, Mass. 02172.



Energy-saving dishwasher

GE's Potscrubber III uses 40 percent less water in its normal cycle than its predecessor. The convection dryer needs no fan motor, and can be turned off to let dishes dry themselves. Wash arm with eccentric hub gives better wash coverage. Model GSD 1200 is about \$500.

Play cassettes in your 8-track

The MK-703SR Stereo Cassette Adapter turns an 8-track machine into a cassette player. It has its own controls; an AA battery powers the preamp. About \$33 from Promotion Warehouse, 2775 Mesa Verde Dr., Box 1702, Costa Mesa, Calif. 92626.



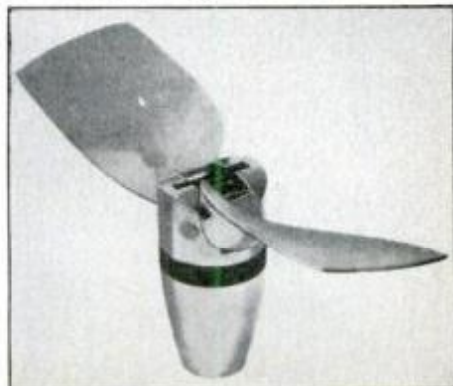
Leak detector

Controversy still surrounds the subject of microwave oven safety. Guard-Rod is a hand-held electronic instrument designed to serve as an initial check for potentially dangerous radiation leakage from those ovens. The \$20 unit needs no batteries or AC power. Tanray Associates, Box 99, Elberon, N.J. 07740.



Sailboat propeller

This folding propeller is opened and closed via a mechanical linkage, not centrifugal force as is conventional. Its thinner blades operate more efficiently, lock in reverse. From \$424. Hasselfors Stainless, Lansing, N.Y. 14882.



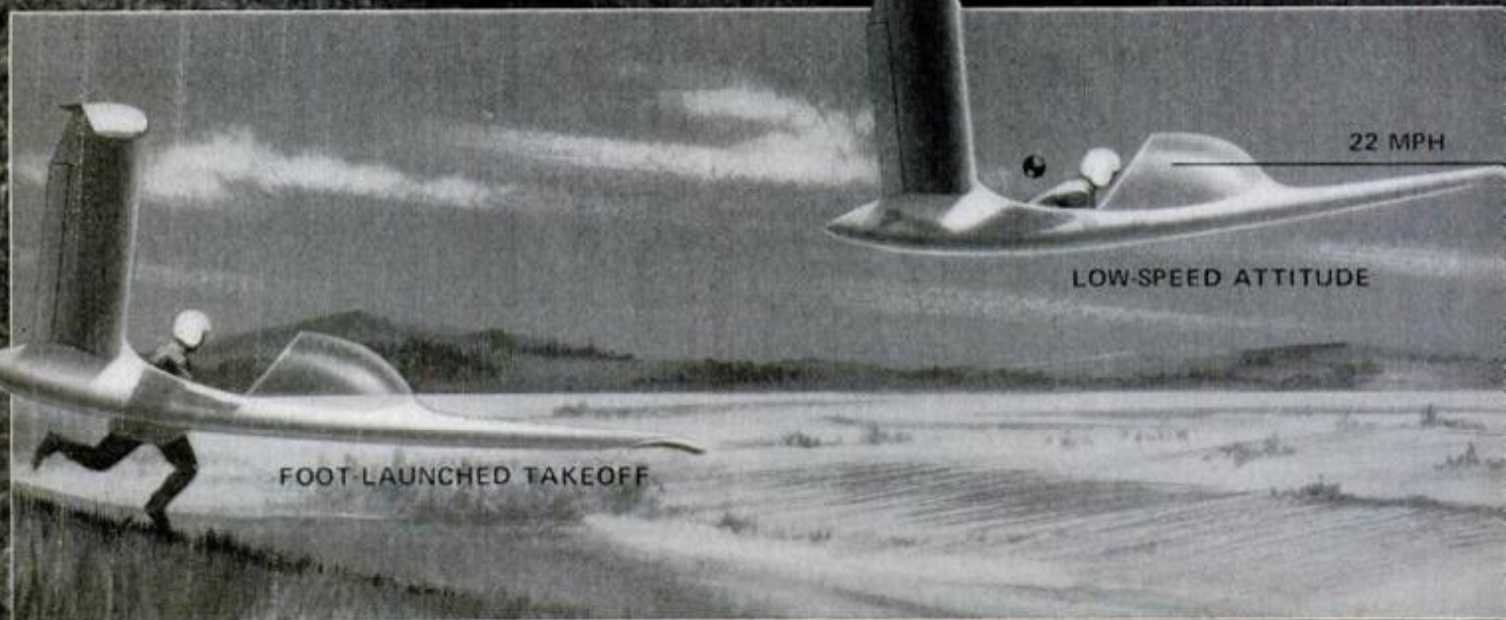


Hoist on your own canard

New Swiss design bridges the gap between hang-glider and sailplane.

Light construction, use of Kevlar will keep canard's weight down under 90 lbs.

by Bill Allen



FOOT-LAUNCHED TAKEOFF

22 MPH

LOW-SPEED ATTITUDE

Half hang-glider, half sailplane, and claiming the best features of both, the new Canard-2FL, built by Aviafiber AG of Switzerland, looks like something from *Star Wars*. Vacuum molding makes exotic fuselage shaping possible while the wing and its connecting V-section are optimized for structural integrity and aerodynamic advantages.

Is it biplane or monoplane? "Single wing on pylons," says its 57-year-old designer, a sailplane pilot and aeronautical engineer named Hans Farner, who lists Lockheed among his clients. High above the fuselage and canard nose, the 44.4-



Heavier-than-planned prototype had to be wheel-launched on fairly steep slope.

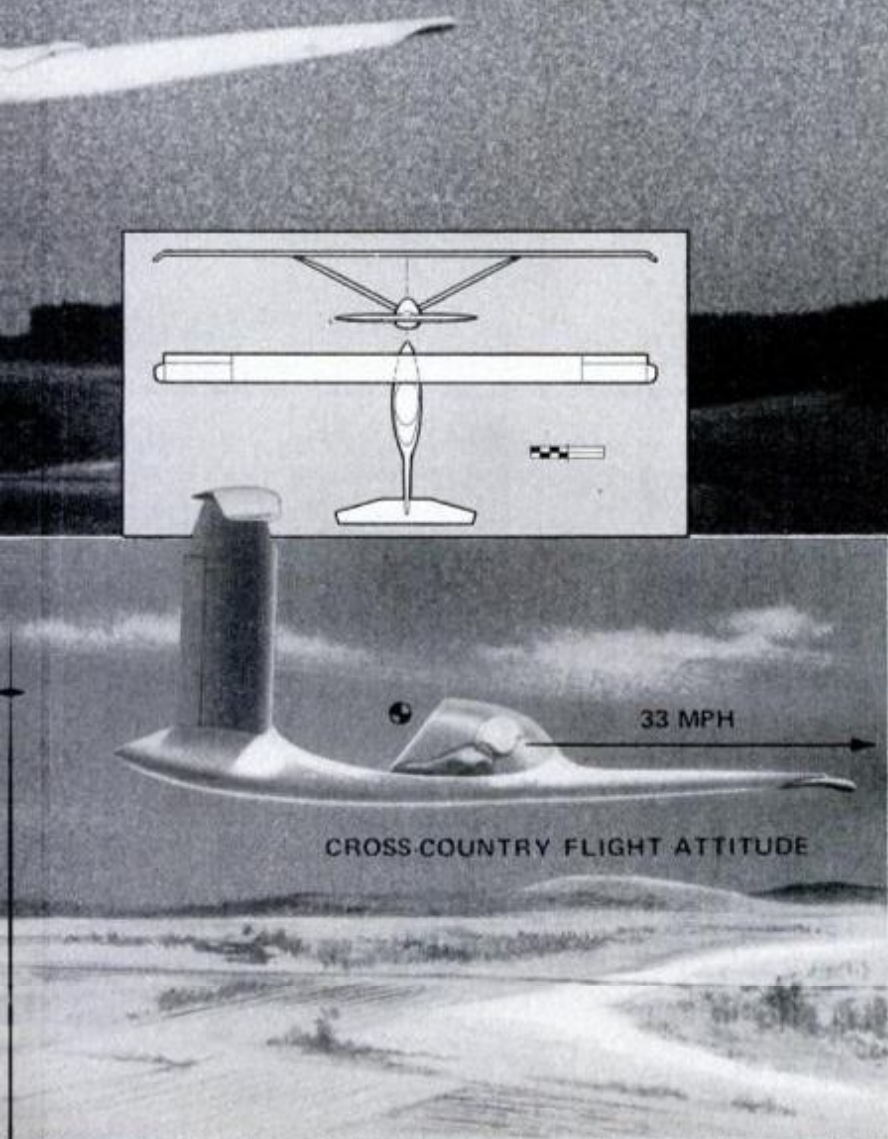
ft. wing is almost completely free of airflow interference and thus can achieve close to its maximum design performance. It's also well clear of obstacles during ground handling.

The craft's pylons are also lifting and stabilizing surfaces, contributing a third of the 140-sq.-ft. total wing area. Airbrakes (spoilers) along the V-section's trailing edge can increase sink rate by 120 f.p.m. for landing approaches.

Its shell-and-spar construction uses fiber and resin laminations formed in precise female vacuum molds. Core sections are made of preshaped Styrofoam. Du Pont Kevlar will replace glass fibers, saving, says Farner, more than two-thirds in weight. Fiberglass in the prototype gets his blame for the hang-glider's exceeding its anticipated 95-lb. empty weight. Thus, the several test flights to date have had to utilize optional wheel launches, rolling down 20-percent slopes.

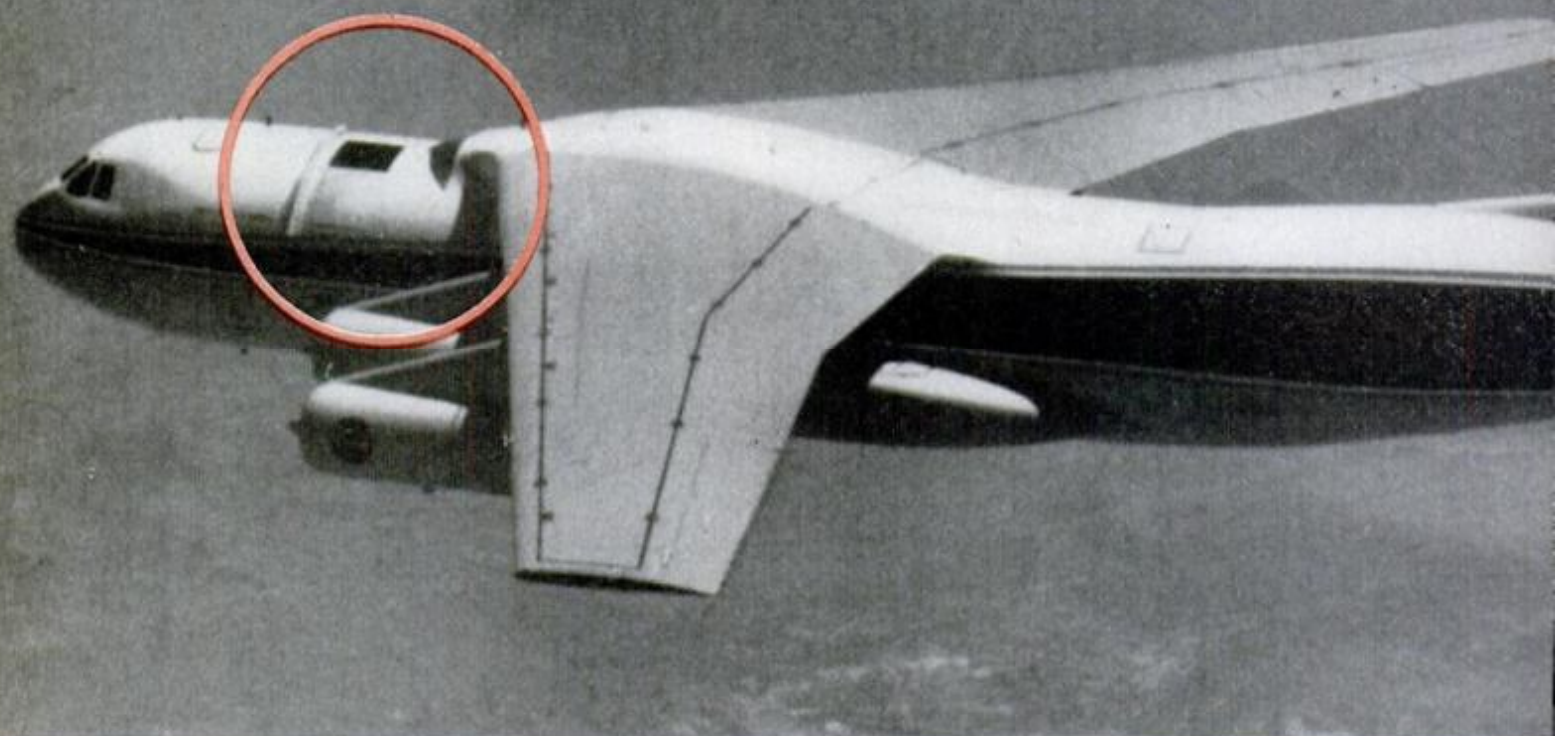
The unusual canard configuration balances the glider's center of mass at the pilot's position. Standing unaided, ready to foot-launch, the flyer supports this weight on shoulder straps. The body harness also connects to a "stomach board", which rotates the pilot into his prone position at liftoff. This board slides fore and aft 32 inches

(Please turn to page 122)



NASA'S eye in the sky

Aloft in high-flying jet planes,
astronomical telescopes can see farther and better
than their earthbound counterparts.



Though in operation only since '75, the Kuiper Airborne Observatory (KAO) has played a key role in at least two major astronomical discoveries.

by John F. Pearson

Hheavy with 153,000 pounds of fuel—its full capacity—the big Lockheed C-141 jet eased into the night sky over Perth, Australia, for a rendezvous with a celestial shadow. It was exactly 10:37:03 Western Australia time, Mar. 10, 1977.

There was a crackle of anticipation in the air as scientists and technicians settled down to their tasks. Jim Elliot, head of the scientific group, was surprised to see telescope technician Don Oishi, who had not been scheduled to fly.

"I have a feeling something big will happen tonight," Oishi explained, "and I want to be part of it."

The men were aboard an unusual aircraft—a flying astronomical observatory equipped with a 36-inch infrared telescope (the world's larg-

est airborne 'scope), and an elaborate control console and computer system. The highly modified transport is the Kuiper Airborne Observatory (KAO), named for the late Gerard P. Kuiper, a pioneer of airborne astronomy.

The KAO is part of a new generation of astronomical instruments that have opened up the whole radiation spectrum—from radio waves to gamma rays—for man's inspection. In the process, our menagerie of space objects has been enlarged to include things called quasars, pulsars and "black holes."

Radio telescopes have long since proved themselves. Now much of the excitement centers about orbiting space telescopes and multiple-mirror, Earth-based instruments. (For a description of the new terrestrial

'scopes of radical design, turn to page 61.)

A NASA aircraft, the KAO operates from the Ames Research Center, Moffett Field, Calif. Commissioned in '75, the plane is the latest in a series of NASA airborne observatories which dates back to 1965. The first one was a modified Convair 990 transport and then came a Lear Jet. Though of limited capability, they proved the value of the airborne observatory. At 39,000 feet, a plane is above more than 99 percent of the atmosphere's water vapor, the main barrier to infrared radiation from space.

Before the advent of these special craft, there was doubt that any plane could ever provide a platform stable enough for astronomical observation. The fact that several now



can is due in part to the smoothness of operation of the modern jet engine. No plane is vibration-free, however, so special measures must be taken.

Aboard the KAO, the 36-inch telescope is mounted on four pneumatic shock absorbers. In addition, the whole telescope assembly swivels from a spherical compressed-air bearing that provides nearly frictionless support and allows for three-axis movement. Three gyros, one for each axis, generate correction signals for the air bearing.

The 'scope rides just forward of the wings and peers up at the sky through a completely open port, since a glass window would absorb infrared radiation. Spoilers located ahead of the cavity cut down airflow across the port.

Behind the telescope, along the starboard side of the fuselage, stands the control console with its array of TV monitors, meter displays, digital readouts, switches and push-buttons. From this position the telescope is maneuvered by an operator using a three-axis joystick mounted on the desk before him. The mission director occupies another chair at the console.

Another major element—the "brain" of the observatory—is the ADAMS unit (Airborne Data Ac-

quisition and Management System). This computer has the coordinates and magnitudes of more than 250,000 stellar bodies stored on tape. When scientists are trying to zero-in on a single target among the thousands of stars speckling the TV monitor, ADAMS can produce a properly scaled map of the chief area of interest.

Key information—the time, the plane's position and heading, the target's coordinates—is automatically fed into the computer to make certain that the map it produces is correctly oriented for the mission. In addition to this function, ADAMS also sorts and collates real-time data, and is used to generate the KAO's flight path and logs operational data for both the aircraft and the telescope.

A highly sensitive autopilot guides the plane during a mission and also does its bit to maintain overall stability. According to Robert M. Cameron, chief of the Airborne Science Office at Ames, the autopilot reduces pitch and yaw to about 0.25° and roll to within 0.5°.

Another aid in putting and keeping the 36-inch telescope on target is a tracking unit, made up of a small telescope fixed alongside the big one, a TV camera, a computer and a batch of electronic gear. Ideally, the system locks on to two stars simultaneously. Using them as points of reference, the tracker generates signals that are fed to the gyros to correct for drift in relation to the big telescope's line-of-sight axis.

All in all, the KAO's telescope and electronics packages make up a highly complex system, one that requires many more people to operate than a big land-based telescope.

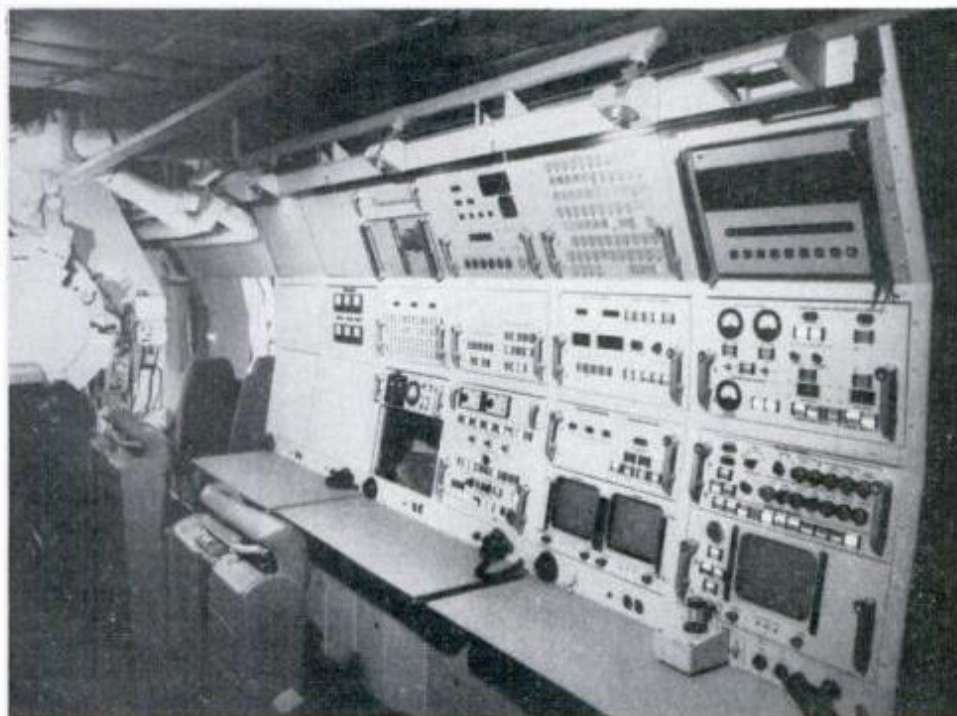
On the mission that left Perth on March 10, there were 19 men aboard the KAO. Three Cornell University scientists—Jim Elliot, Ted Dunham and Doug Mink—made up the observing team. They bear little resemblance to the chairbound astronomers of old. They're young (Elliot, at 34, the graybeard), bouncy and enthusiastic about their work.

The same could be said of the NASA group, headed by mission directors Carl Gillespie and Jim McClenahan. It also included three telescope operators, Don Olson, Milo Reisner and Al Meyer, Don Oishi, telescope technician; Tom Matheson, computer operator, and Pete Kuhn, meteorologist.

A flight crew of five and three observers completed the roster.

The mission had its genesis back in 1973 when an astronomer at Britain's Royal Greenwich Observatory predicted that the 1977 occultation of star SAO 158687 by Uranus would be visible from around the Indian Ocean. (The SAO number is the star's listing in the Smithsonian Astronomical Observatory *Star Catalog*.)

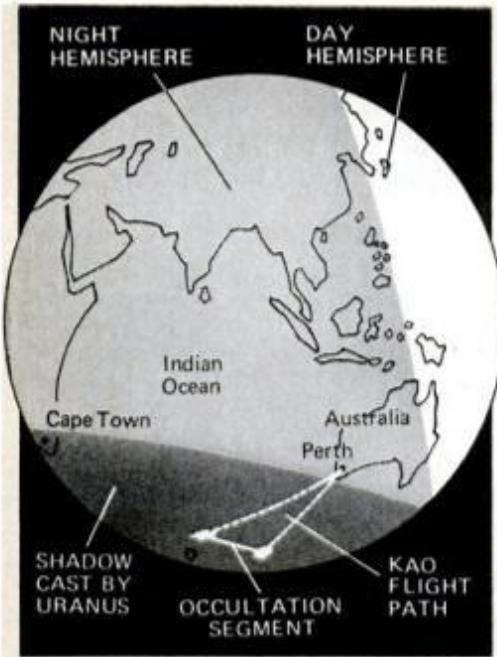
With the planet occulting (eclipsing) SAO 158687, measurements of the star's light streaming past



Telescope looks at stars through open port (left, in circle) as glass window would absorb infrared radiation. Note spoiler, which protects telescope by reducing airflow, in front of port. At the control console (above) operator uses joystick—seen, lower right, on console desk—to maneuver the 'scope.

quisation and Management System). This computer has the coordinates and magnitudes of more than 250,000 stellar bodies stored on tape. When scientists are trying to zero-in on a single target among the thousands of stars speckling the TV monitor, ADAMS can produce a properly scaled map of the chief area of interest.

HOMING IN ON A SHADOW



Southwest of Perth, the KAO turned east—and the puzzling observations soon began.

Uranus could provide important information. Jim Elliot and his colleagues hoped to determine the diameter of the planet and how the temperature and other properties of its atmosphere change from height.

Counting out from the sun, Uranus is the seventh planet. It's some 1,782,700,000 miles from the sun, about 19 times that of the Earth's distance, and is weakly illuminated by sunlight, making observation difficult. The planet orbits the sun every 84 years and is known to have five moons, the last of which, Miranda, was discovered only in 1948 by Gerard Kuiper. That Uranus had at least one other outstanding feature was not suspected when the KAO set out on its March 10 mission.

But the plane couldn't do the job

alone. To get valid readings, it was essential also to have ground-based observations. Robert L. Millis of the Lowell Observatory (Flagstaff, Ariz.) would attempt to make them from Perth and other astronomers from Cape Town, South Africa.

After leaving Perth, the KAO flew southwest for 5 hours and 23 minutes. (With a full fuel supply, the plane had a maximum flying time of 12½ hours.) Then, following a course plotted by navigator Jack Kroupa, the plane took an easterly heading to begin the tracking of Uranus. It was flying at 41,000 feet.

There was a final check of equipment, including the all-important recording devices. A reading was taken of the sky's brightness. Then Al Meyer announced: "The object is centered. I've identified it."

"You see it, Al?" asked Elliot.

"Yeah, looking right at it." *It*, of course, was Uranus.

The continuous recording of data now began. "Well, according to the best prediction, it should happen about half an hour from now," observed Elliot.

"Don't hold your breath," said Doug Mink.

But minutes later Ted Dunham spotted a sharp dip in the incoming star signal. "What was that?" he said.

When Elliot joined him, Dunham pointed to the dip on the recorder chart. It was too early for the occultation to have started. Besides, the signal level had swung up again.

"Was there a tracker glitch?" asked Elliot. (A glitch is scientist talk for a malfunction.)

"No, nothing here," Al Meyer responded.

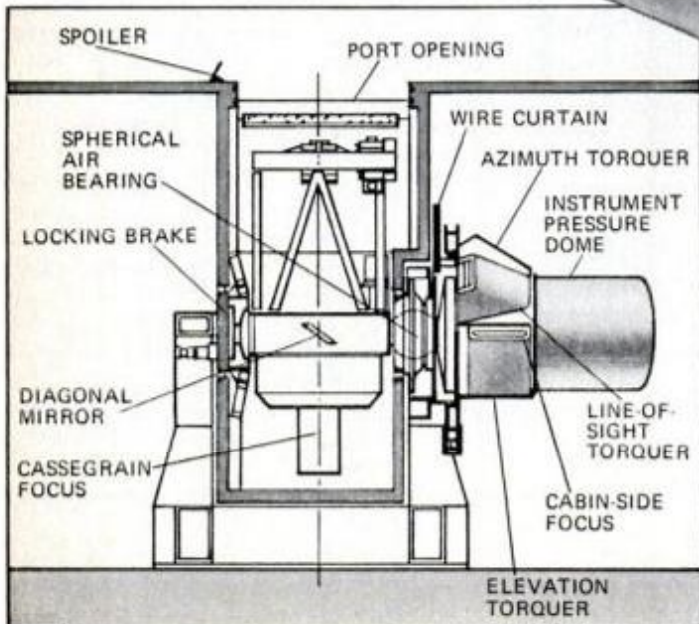
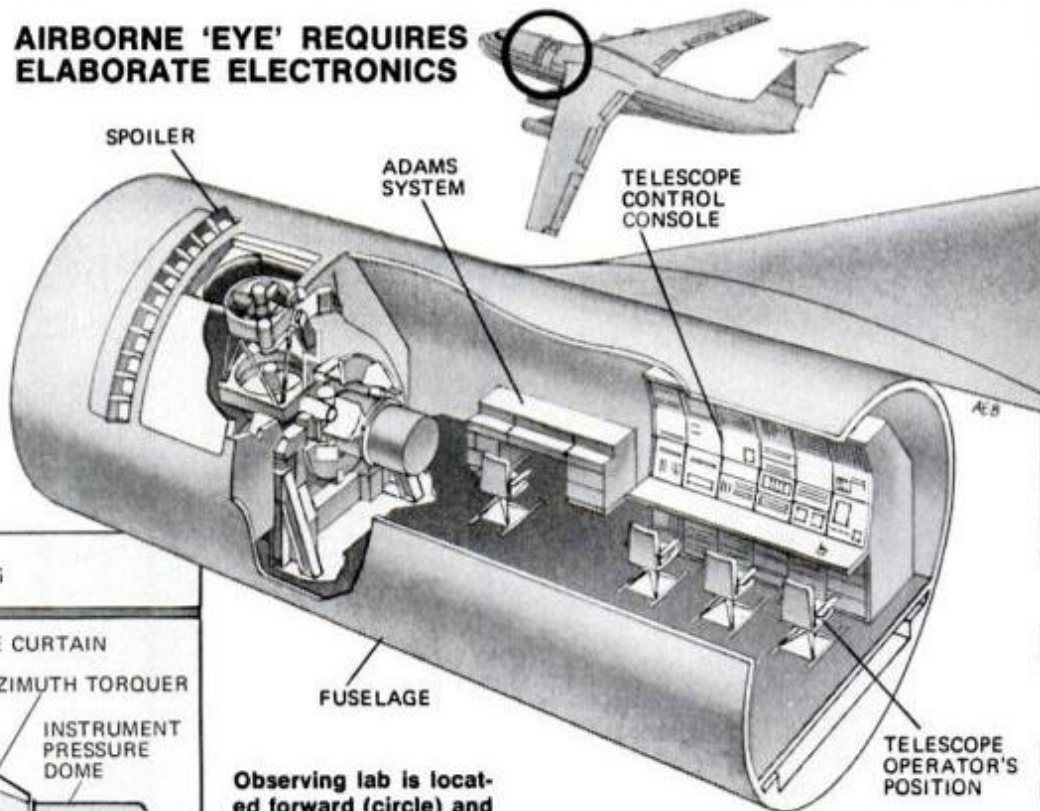
Dunham asked for a water-vapor reading. (The KAO is equipped with a radiometer that measures water vapor above the aircraft; water vapor attenuates infrared signals.)

"Eight point nine," responded meteorologist Pete Kuhn. This relatively low reading was not the answer.

"Well, we got a dip in the signal," Elliot said, "and it was either due to a loss or momentary glitch in the tracker, or a cloud whipping through."

The scientists were still puzzling over the situation when they saw another dip on the recorder. Then,

AIRBORNE 'EYE' REQUIRES ELABORATE ELECTRONICS



Observing lab is located forward (circle) and is separated from the 'scope mount by pressure bulkhead. ADAMS unit (Airborne Data Acquisition and Management System) incorporates computer, data displays and recorders. Drawing of telescope assembly (left) shows unusual air bearing that provides almost frictionless support.

at intervals, three more. Something other than the planet itself had intermittently blocked the light from SAO 158687, causing brief occultations.

There were cheers aboard the KAO when the planetary occultation finally began. Uranus blocked the star's light for the next 25

(Please turn to page 124)

NEW GENERATION OF TELESCOPES IS HERE



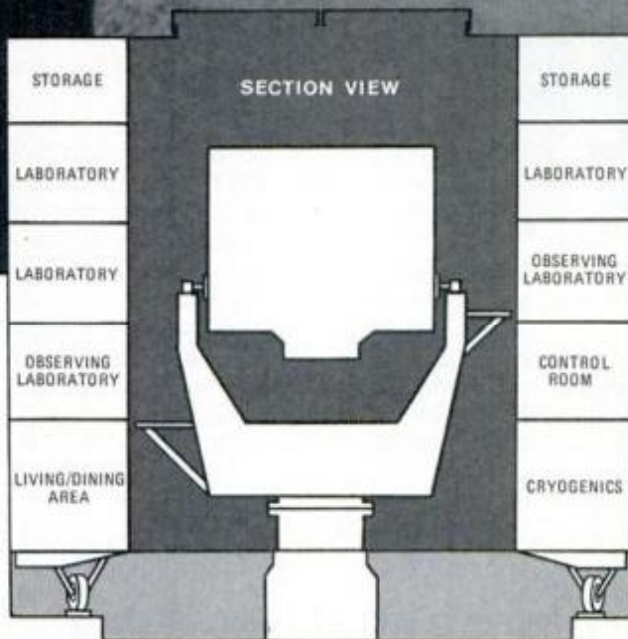
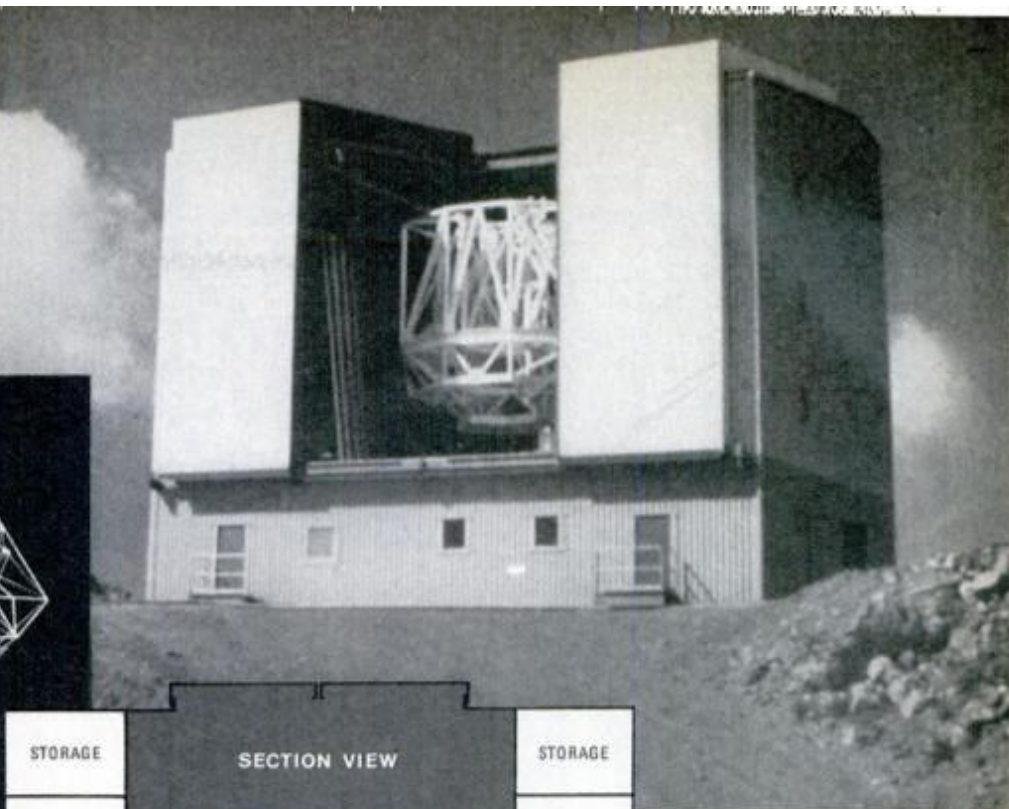
The Multiple Mirror Telescope is the first of a new generation of powerful land-based instruments of radical design. Instead of having a single large mirror to gather light—the conventional method—the MMT employs six 72-inch mirrors mounted around a central axis.

The MMT's separate mirrors give it the light-gathering capability of a single 176-inch reflector, making it the world's third largest optical telescope. It is topped only by the 200-inch Hale telescope at Mount Palomar, Calif., and a 236-inch instrument recently built by the Soviets.

The MMT represents a joint effort of the Smithsonian Astrophysical Observatory and the University of Arizona. Its site is the 8550-foot summit of Mount Hopkins, 40 miles south of Tucson, Ariz. At about the time this magazine reaches the newsstands, the MMT is slated to see its first light.

As optical telescopes have grown in size to bring in fainter objects at the far reaches of space, the massive single-mirror design has created enormous structural engineering problems. The multiple-mirror configuration gets around some of them and comes in at a much lower price.

In the MMT, the individual mirrors are made of thin fused-silica front and back plates that sand-



Because it doesn't follow conventional design, the Multiple Mirror Telescope is housed in rectangular building rotating on steel wheels, as in cross section (left). Model (extreme left) shows how six 72-inch mirrors are mounted around central axis. Laser sensing system controls focus.

wich an 11-inch thick "egg crate" core. The weight of each mirror is about one-third that of a conventional solid-glass type.

The separate images are brought to a common focus by means of secondary reflectors. Precise focus is maintained by a laser-guided sensing system that controls the tilt and position of the secondary mirrors.

The MMT has an altazimuth mount, which allows it to move in two axes—up and down (altitude), and from side to side (azimuth)—like a naval gun. In contrast, in the equatorial mount—conventional with big, single-mirror instruments—the telescope moves around an axis parallel to the Earth's polar axis.

Building rolls on track

The equatorial mount is big—and expensive. The altazimuth type makes for a compact package and lower price. Instead of

requiring the traditional astronomical dome, the altazimuth system can be housed quite simply. The MMT building is rectangular—55 feet high, 44 wide and 64 long. The barnlike structure rolls on four 36-inch steel wheels that follow a flat steel track, allowing the entire 500-ton building to turn as the telescope tracks. It can turn in either direction.

Laboratories, a control room and service rooms flank the telescope, which is in the center of the building. Metal siding is used on the exterior walls. The steel panels that enclose the telescope chamber have a polyurethane core; the insulation is needed to provide interior temperature control. Engineers say the structure can operate in winds up to 45 mph and will withstand blows of 140 mph.

Under ideal conditions, the operator sits in the control room and

(Please turn to page 126)

The flourishing mini-ponycar market greeted the arrival of three new faces for 1978. And 1979 will usher in at least two more.

New faces for 1978 include the totally restyled Toyota Celica and the introduction by Dodge and Plymouth of the 1978 Challenger and Sapporo coupes.

For 1979, Ford and Mercury will



Adjustable steering column, five-speed trans, complete gauges grace both cars.

launch entirely rebodied versions of the Mustang II and Capri.

So rivalries in the mini-ponycar market are heating up. Not only is

PM OWNERS REPORT: CHALLENGER AND SAPPORO

this category one of the fastest growing in the industry, but the cars themselves tend to be image builders and showroom traffic generators for the less glamorous economy models offered by the same automakers.

For instance, customers drawn into dealerships by, say, Toyota's sleek Celica or VW's hot Scirocco often leave in a Corolla or Rabbit.

Until this year, Chrysler Corp. dealers lacked a hard-core mini-ponycar. The Plymouth Arrow and Dodge Colt, good as they were and are, didn't quite qualify. Dealer demand prompted the factory to begin importing another pair of coupes from Mitsubishi—varia-

tions of a car that had been sold in Japan as the Galant Lambda GSR.

This automobile's basic design had been laid down by Mitsubishi stylists along a silhouette reminiscent of the Chevrolet Monza coupe. Members of the Chrysler design staff, under Bill Brownlie, were sent over to Americanize the car. Major changes were made in the interior. Grilles were also revamped, and Brownlie's people came up with such touches as the Sapporo's brushed stainless B-pillar and the Challenger's gilled quarter windows. Thus changed, the Mitsubishi coupes became naturals for the American mini-ponycar market.

Differences between the Challenger and Sapporo are minor.

Buckets for two in back give enough legroom. Grab handles mount on roof.



Photos by the author

BY MICHAEL LAMM WEST COAST EDITOR

Perfect ponycars but too gentle to be 'muscle' cars

CHALLENGER

To clean glass underneath, Challenger's louvers should be removable, say owners.

Many owners wish they'd ordered power steering. Column adjusts for height.

Both coupes share 1600- and 2600-cc ohc Fours. Most buyers chose the smaller.



Right-hand mirror adjusts with electric motor.

Cast aluminum wheels come standard on Challengers.

Familiar MacPherson struts contribute to good handling.



Silent Shaft MCA-Jet engine has hemi-head; counters pollution, vibration.

Distinguishing features include slightly altered grilles and roof/window treatments. Paint and trim also distinguish the two. But mechanically and structurally they're identical, even to dimensions and engines.

In surveying Challenger and Sapporo owners, we found—not surprisingly—that styling led as the primary reason for buying these coupes. No owner didn't like the way the cars looked, and many raved about their styling.

Economy ranked second among buyers' prime motivators, with size,

comfort and handling third, fourth and fifth respectively.

Here are some typical answers to our question, "Why specifically did you buy your Challenger or Sapporo?"

A North Carolina civil engineering technician: "Because the Sapporo's looks are far superior to competitors' counterparts."

A Georgia camera salesman: "Challenger offered me the most standard features for the price, is very good looking and will last a long time because it's Japanese."

A California waitress: "I

Trunk accepts valises but won't stow shopping bags upright, say purchasers.



What the twins share

Chrysler Corp. has drawn on its Japanese Mitsubishi connection for captive imports since 1971. Dodge dealers have long sold the Colt, and Plymouth dealers added the Arrow for 1976.

One of Mitsubishi's most successful cars in Japan, called the Galant Lambda GSR there, comes to these shores as the Dodge Challenger and Plymouth Sapporo.

Differences between the two U.S. versions are minor, the most recognizable being the Challenger's gilled rear quarter windows. Mechanically, both cars are the same.

Each offers 1600cc and 2600cc MCA-Jet engines, a four-cylinder sohc unit with crossflow hemi-head and a counter-rotating vibration damper called Silent Shaft.

The MCA-Jet uses a small third valve in each combustion chamber that lets in extra air at low rpm. This, combined with a catalytic converter built into the exhaust manifold, reduces pollution and gives better gas mileage—3 to 9 mpg, according to Mitsubishi.

Aimed at a market shared with the Celica, Capri, Scirocco and Mazda Cosmo, Challenger/Sapporo option packages include four-wheel disc brakes, five-speed overdrive transmission, power steering, and total instrumentation.

A NATIONWIDE SURVEY BASED ON 2,206,041 OWNER-DRIVEN MILES

SAPPORO

Revised grille and trim distinguish Sapporo from Challenger.

Headroom tends to be tight for people taller than six feet.

Sapporo comes with brushed stainless pillar, running lamps.



Unusually large tires on both cars aid handling and ride.

Five-speed overdrive gearbox with 0.85:1 high comes standard in both cars.

Soft rub strip effectively wards off most parking dings.

thought the inside paneling was something special and fell in love with the Challenger's body style."

A Wisconsin grocery store manager: "I purchased my Sapporo almost entirely for economy reasons. I wanted a good car that was fairly cheap to drive."

A Michigan IBM engineer: "Gas mileage ratings sold me on the Challenger. I haven't been disappointed. There's also sufficient trunk space for all my tools and parts. I like the luxurious interior, full instrumentation, good handling, and gadgets. I also found it to be the best riding car of its size. And quiet."

And a California auto insurance branch manager: "The Sapporo sold me with its good gas mileage and total looks; it's sporty, yet luxury oriented."

We then asked owners to list everything they like and dislike about their cars now that they've had time to live with them. Again, here's a sample cross section:

California production control manager: "I like my Sapporo's smooth, economical engine; its solid, luxurious feel; the styling; good ventilating and heating system; the five-speed transmission (including the whine in fifth, which I like!); and the engine accessibility and ease of servicing. Items I don't like include heavy, imprecise steering; lack of power from the 1600-cc engine; and the fact that the front-fender extremities aren't visible from the driver's seat."

A Texas computer analyst: "Here's what I really like about my Challenger: The handling ease, the bell instead of a buzzer



Optional overhead console (above) on Challenger and Sapporo contains big interior light plus reading spotlights, digital liquid crystal display (LCD) clock. The levers located beside the driver's seat (left) are remote releases for trunk lid and flap door over the fuel-tank filler neck.

to remind you to fasten your seatbelts, the good gas mileage, smooth and quiet ride, fairly roomy back seat and trunk, good lighting and clock console in the roof, adjustable steering column. Here's what I don't like: Brake squeal, rear seatbelts are hard to use, and the front seatback cushions sometimes pull loose."

A New Mexico truck driver: "The Plymouth Sapporo handles wonderfully, is good looking, economical, and very comfortable riding. I have no dislikes at all at this time."

A Minnesota advertising manager: "My Challenger handles well on the highway, the seating arrangement is exceptionally comfortable front and back (for fairly short people), the car gives

good fuel economy, handles well on snow and ice, the overhead digital clock is very convenient, and the trunk has proved deceptively large. Complaints? If I had to buy it again, I'd order the 2600-cc engine with five-speed instead of the 1600 with automatic. My car is unbelievably slow off the line. I also feel the many gadgets, nice as they are, will mean dollars for repairs later."

Turning now to the question of workmanship, a whopping 59.3 percent and 56.3 percent rated their Challengers and Sapporos nothing less than excellent. That's the highest praise we've recorded for any car recently except the 1977 Honda Accord. Here are some comments:

"We have not had to take the Sapporo in for any adjustments or repairs in 5300 miles. Workmanship and detailing are excellent."—Arizona high school principal.

A Michigan mechanical engineer: "Excellent workmanship on the Challenger. Everything fits neatly. No rattles or vibration noises."

A Texas miniature golf course operator: "Marvelous workmanship and quality. With the exception of a tiny tear on the shift boot, everything's great. This is my first new car in eight years that didn't fall victim to the streets of Laredo and start rattling."

"This Challenger exceeds the quality of any U.S. car I've looked at and even that of the two previous Colts we owned."—New York metallurgical engineer.

"I'm really impressed with the

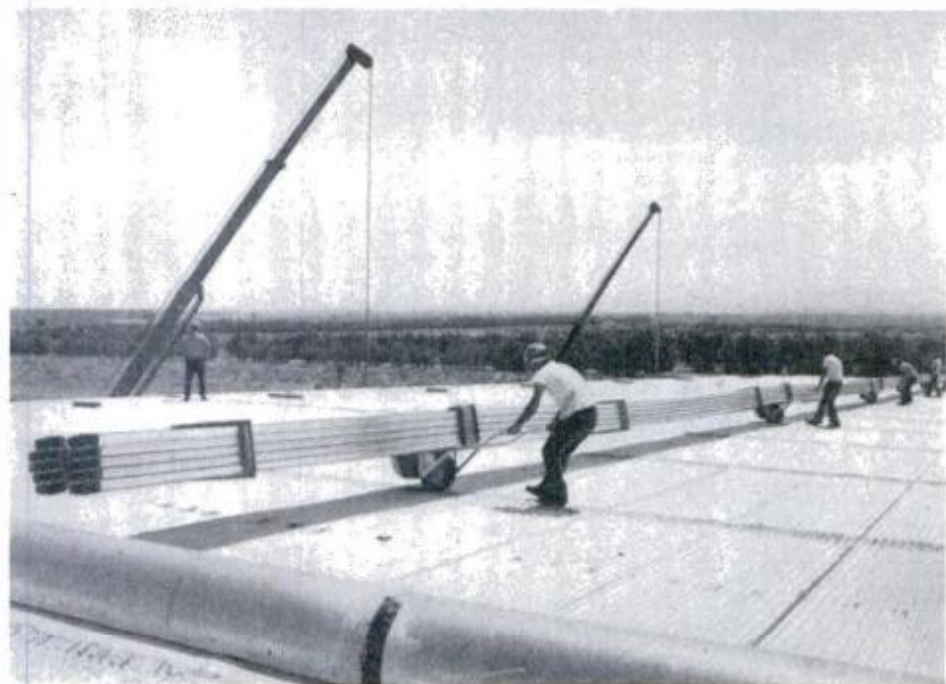
(Please turn to page 135)

SUMMARY OF 1978 CHALLENGER AND SAPPORO OWNERS REPORTS*

		Challenger Sapporo				Challenger Sapporo				Challenger Sapporo	
Total miles driven		1,255,255	950,786	Economy		52.1	55.3	Poor		1.8	0.5
Average miles per gallon				Handling		43.4	38.0	Comfort opinion (front seats):			
1600-cc Four				Comfort		34.7	35.2	Excellent		56.9%	52.8%
In town (EPA				Ride		16.4	14.0	Very good		33.3	33.9
29 manual)		24.9	24.3	Specific dislikes:				Good		7.6	11.1
Long trips (EPA				Lack of power		19.5%	14.0%	Fair		2.2	1.7
40 manual)		30.4	30.8	No complaints		17.6	20.9	Poor		0.0	0.6
2600-cc Four				Less-than-expected				Comfort opinion (rear seats):			
In town		21.8	...	mpg		12.2	18.0	Excellent		24.5%	22.5%
Long trips		27.4	...	Squeaky brakes		7.7	14.0	Very good		28.2	27.8
Engine choices:				Poor dealer service		7.2	...	Good		27.8	26.6
1600-cc Four		92.4%	94.8%	What changes would you like?				Fair		16.7	17.2
2600-cc Four		7.6	5.2	No changes		15.1%	23.1%	Poor		2.8	5.9
Transmission choices:				More horsepower		10.6	9.4	Had any mechanical trouble?			
Five-speed manual		71.9%	69.6%	More headroom		8.3	17.5	No		53.6%	52.2%
Three-speed automatic		28.1	30.4	More trunk space		...	10.6	Yes		46.4	47.8
Why did you choose this car?				More distinct styling		6.9	...	What type of trouble?			
Styling		77.8%	73.9%	Bigger engine		...	11.3	Carburetor		23.1%	18.4%
Economy		52.0	52.8	Better gas mileage		6.9	...	Transmission		19.2	10.3
Size		15.1	11.7	Workmanship opinion:				Noisy brakes		17.3	29.9
Comfort		7.1	7.2	Excellent		59.3%	56.3%	Electrical		13.5	6.9
Handling		6.7	7.2	Good		33.2	38.3	Clutch		6.7	...
Specific likes:				Average		4.0	3.3	Dealer repairs satisfactory?			
Styling		65.8%	70.9%	Fair		1.8	1.6	No		60.7%	56.2%
								Yes		39.3	43.8
								Number of vehicles owned:			
								This car only		41.2%	40.4%
								Two cars		45.1	41.5
								Three cars		7.1	16.4
								Four or more cars		6.7	1.6
								Makes of other cars owned:			
								Dodge		27.1%	13.8%
								Ford		18.8	12.8
								Chevrolet		15.8	16.5
								Oldsmobile or Buick		11.3	10.1
								Plymouth		9.8	18.3
								Age distribution of owners:			
								15-29 years		50.3%	28.7%
								30-49 years		37.9	55.7
								50-plus		11.9	15.7
								Would you buy another of these cars?			
								Yes		73.8%	74.5%
								No		26.2	25.5

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

IT'S NEW NOW

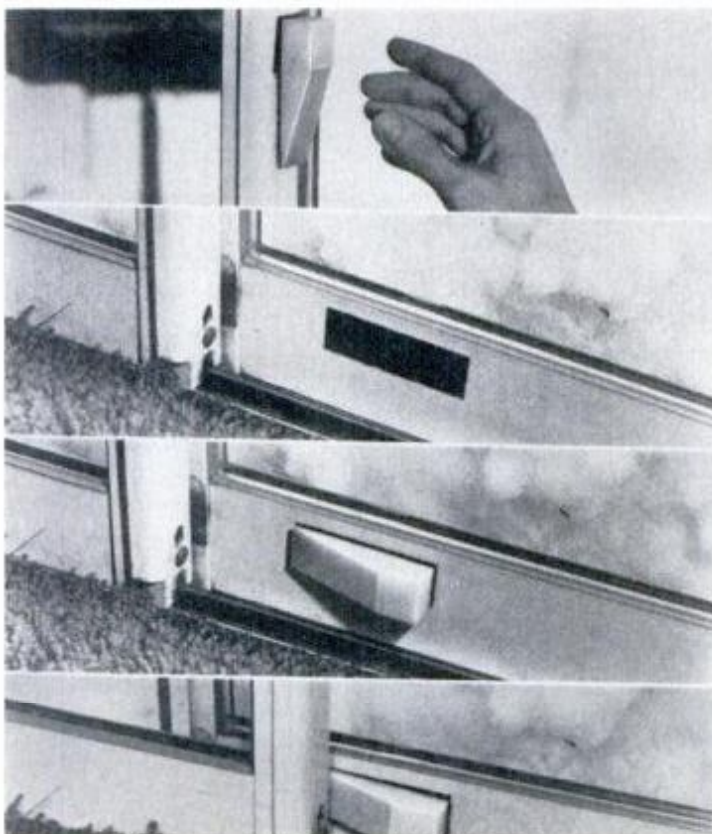


World's longest roofing panels?

An Air Force warehouse that had a leaky roof for over 20 years was recently reroofed with 2000 panels, each 241 feet long. The panels, made by Kaiser Aluminum, were formed onsite from aluminum rolls. Two cranes lifted the panels to roof level; seven men rolled them into place. A special electric tool joined the panels with hidden fasteners. Where once a slight rain would have resulted in numerous leaks, the new roof remained watertight during recent heavy rains.

Plastic wedge blocks door

Sliding glass doors are among the spots most vulnerable to unauthorized intruders of your home. Wedg-Guard is said to prevent such doors being opened from the outside. An ABS plastic wedge is mounted on a Velcro strip glued to the doorframe; no drilling is required. Another strip glued to the stationary part of the door stores the wedge; with proper installation, neither strip will interfere with normal door operation. It's \$3 from Better Way Products, 21330 Center Ridge Rd., Rocky River, Ohio 44116.



Versatile rasp

The Stripper is a rasp that can be used for shaping, sanding, deburring and other do-it-yourself jobs. It comes in five shapes and can work wood, plastic, some metals and other materials. About \$1.30 from X-Acto, 45-35 Van Dam St., Long Island City, N.Y. 11101.



Renew dead sump pumps

The hermetically-sealed Some Switch clamps to the pump pedestal when your old switch has failed. It's said to be able to handle more than a million cycles of operation at a 15-amp. load. About \$18 from Genova, Inc., 7034 East Court St., Davison, Mich. 48423.



Heavy-duty variable-speed saw

The Super Saw model 7755 is a double-insulated, heavy-duty reciprocating saw with variable speed control up to 2500 strokes per minute. Saw, blade wrench, 9 blades, grease and case cost \$160. Ingersoll-Rand Tool Group, 2350 East Devon Ave., Des Plaines, Ill. 60018.



OUR CRUMBLING INTERSTATES:

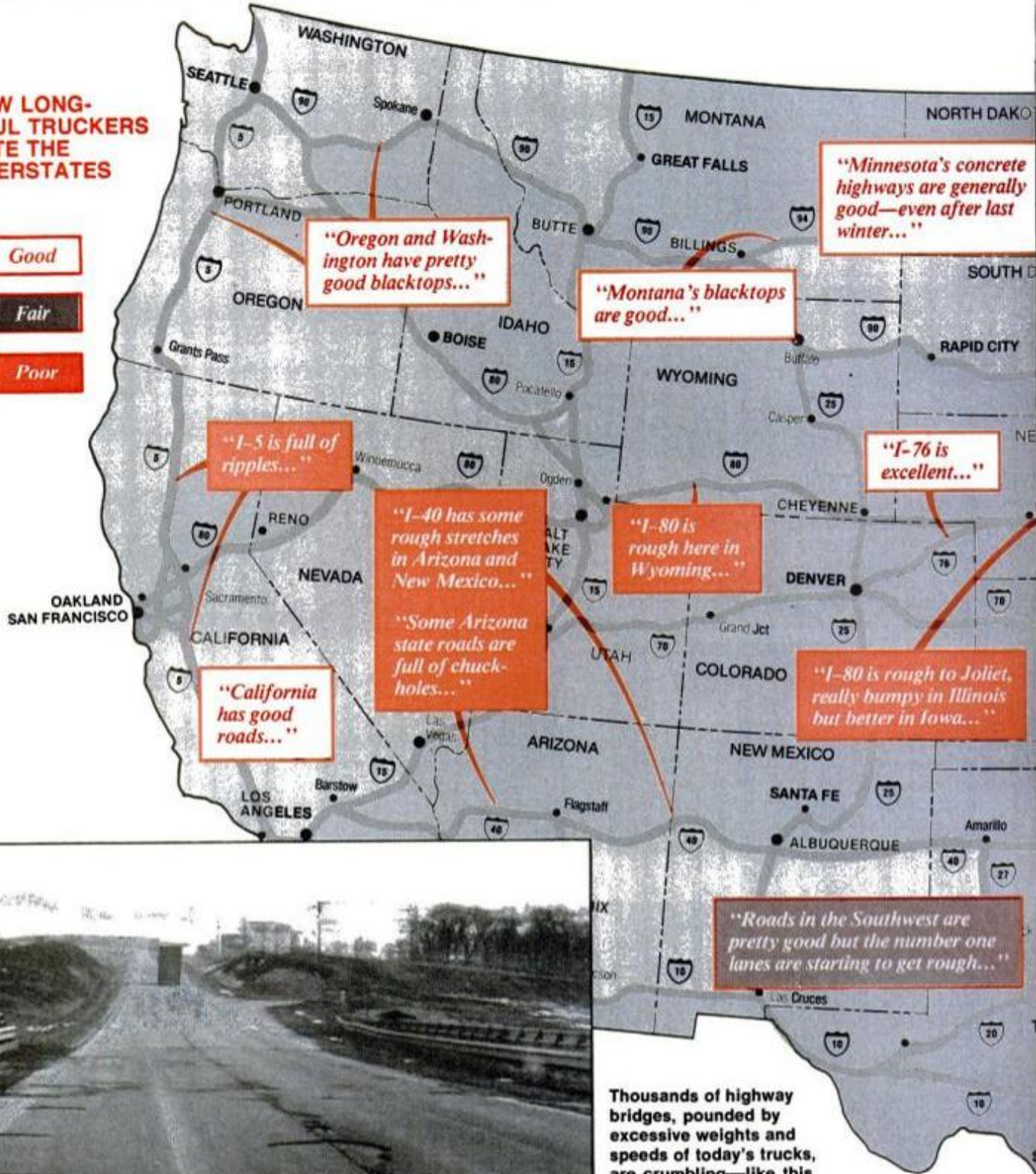
A NATIONAL DILEMMA

The 'dream highways' of a few years ago are now decaying, destructive and often downright dangerous. Repairing them will cost billions!

by E. D. Fales Jr.

HOW LONG-HAUL TRUCKERS RATE THE INTERSTATES

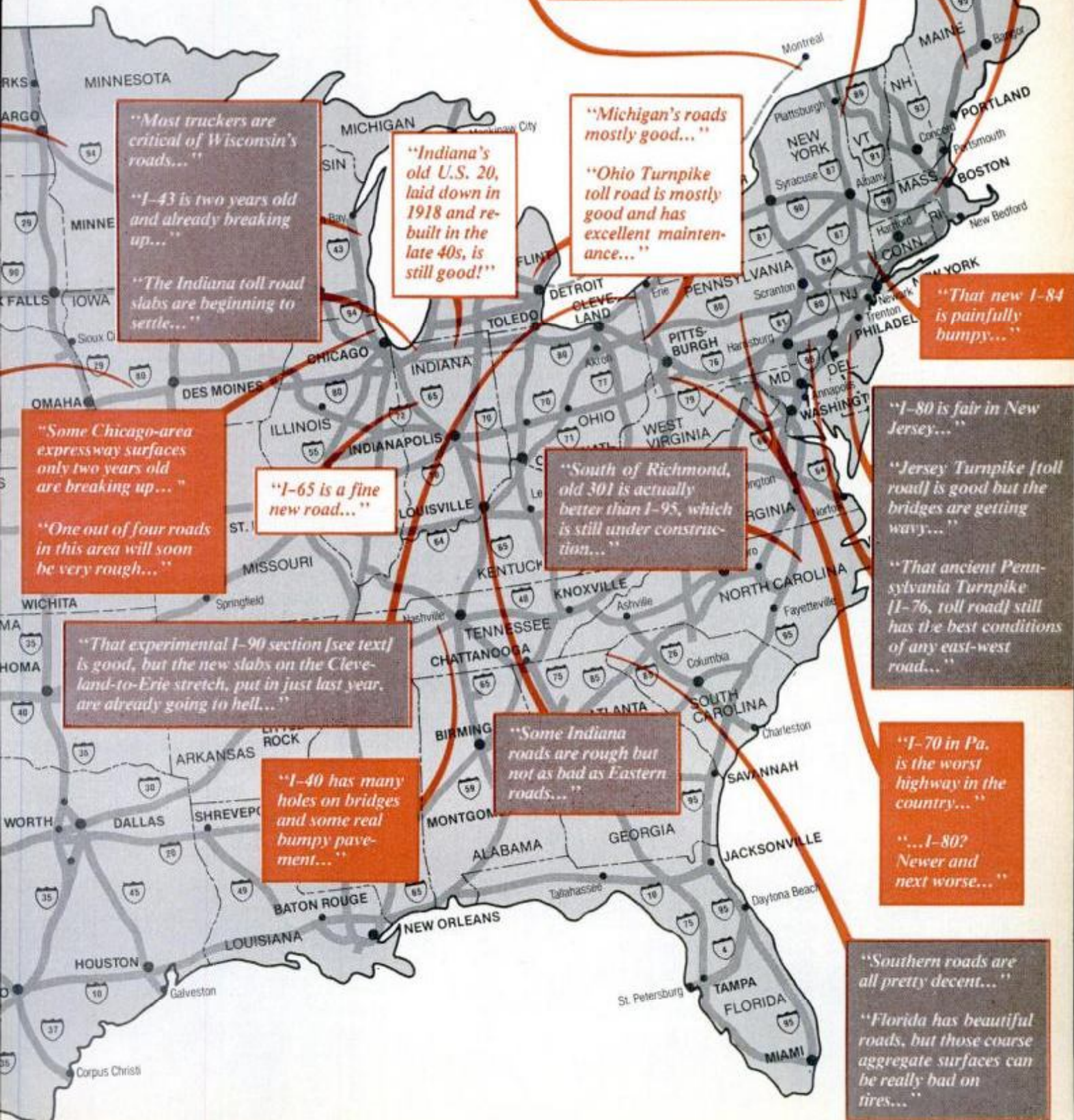
- Good
- Fair
- Poor



Thousands of highway bridges, pounded by excessive weights and speeds of today's trucks, are crumbling—like this one on I-81 not far from Shenandoah, Pa.

Get ready to shell out for new shocks, busted springs, broken tailpipes, blown tires. Prepare for delays on trips as motorists pick their way along rough and shattered road surfaces. Watch out for bumps so severe they can bounce you against the roof of your car. Beware of the wildly-weaving-pothole-dodger who could endanger your safety.

Exaggerations? No. The fact is, our whole, vast 3,800,000-mile national highway system is in trouble—wearing out, breaking up, becoming in some places downright dangerous. Pennsylvania Congressman Bud Shuster, who heads the Congress-White House Transportation Policy Commission, has warned that American's high-





The Interstates are literally strewn with tons of broken treads, tailpipes, mufflers, etc. This is I-80 near an Allegheny peak.

ways are going downhill to destruction—just as many railroads did—for lack of care. They are becoming, in his words, “a series of interconnected potholes”—a description more literally true than facetious.

The problem is, we've been pouring billions of dollars into building magnificent superhighways over the past 20 years, and now these once-grand marvels of the paver's art are getting heavy use. But with initial construction costs so high, little gets spent on road maintenance and repair. Even some of the newest Interstates are already showing premature wear. This is due in part to increased traffic and heavier truck loads, but much of it is also the result of neglect.

Like driving on the moon

To get a firsthand idea of road conditions, PM made three inspection trips totaling 8000 miles through 22 states coast to coast.

Here are some of the things we encountered:

- Many Interstates were so filled with cracks, jagged potholes and violent bumps that they required extreme driving care. In some cases, it was not possible to safely achieve and maintain the 55-mph speed limit. It was like driving on the craggy surface of the moon.

- On I-90 (Boston to Seattle) a truck driver told us he was twice thrown against his cab roof by vicious road jolts.

- On a bumpy blacktop in Massachusetts two of us in the PM car were ourselves hurled against the roof by jarring shocks—with our seat belts on!

- On I-84 near Newburgh, N.Y., we saw a Chevy that had a wheel torn off by broken pavement.

- Near Scranton, Pa., we watched a near collision occur on a badly potholed bridge.

- We saw cars bottoming so hard

on some rough roads that their transmissions gouged the blacktop.

- At gas stops all over, attendants showed us piles of blown-out tires and bent rims removed from the cars of pothole victims.

- And along the roadsides almost everywhere were strewn those tell-tale signs of other victims' mishaps—shreds of tire treads, broken-off mufflers and other car parts. In Chicago, one man, in four days, had collected 50 costly wheel covers, all jarred loose at a single pothole.

Government officials estimate that there are now some 116,000,000 potholes in major U.S. highways; I think we hit most of them. At one service station, a repairman nodded toward a young woman looking sadly at the battered front end of a brand-new Cadillac. In traversing just one crater-sized pothole, she had blown a \$125 radial, lost two \$85 wheel covers and smashed a wheel. “That’ll cost her over \$300,” the re-

I-70 in West Virginia is a shambles of crater-filled shoulders. Lesser roads (right) like this in Connecticut, are in sad shape too.



pairman said. The total yearly cost for tires and front-end alignment jobs caused by poorly surfaced roads must be staggering.

Truckers tell of woes

Truck drivers have their own sad tales to tell, and they know what they're talking about. (See map on pages 66 and 67.) At the superb little George Port truck stop—on I-90 near Stockbridge, Mass., we compared notes with long-haul drivers. "A cracked frame cross member cost me \$500," said one. "Busted springs cost me \$600," added another disgruntled driver.

In general, highway damage is worst in the East and North. Roads in the West and South are better. Yet even on the Southwest's fine I-10 and I-20—through Arizona, New Mexico and Texas—we counted 55 "slab-jolts" a minute. That's rough riding even in cowboy country. I-80, which runs westward from New York City, gets most truckers' votes as "the worst Interstate," especially in reference to its Pennsylvania section. (In fairness to Pennsylvania, it should be pointed out that this state has been saddled with the tremendous expense of maintaining many through roads.) But if I-80 is the worst, I-70 comes in a close second. This long Interstate runs all the way from Maryland to Utah. The western portions, along with the initial stretch in Maryland, are good, but there are eastern sections that are an unbelievable shambles.

New types of highway damage are beginning to show up, too. For the first time, the right-hand, so-called "slow" lane—theoretically subject to less road punishment than the fast lanes—is deteriorating along many Interstates. This, of course, is traditionally a truck lane, and it may be that the recently imposed 55-mph speed limit has

HOW TO SURVIVE THOSE 'MOON CRATERS'

- Look sharp! Even at 55 mph, they sneak up on you with only one or two seconds' warning.
- Be extra careful at night. Potholes and sudden dips are hard to see after dark. Keep your headlights clean.
- Wear your seat belt at all times—not only for general safety but to lessen the chance of your being bounced against the roof by a bad bump.
- Beware of the "pothole dance"—cars or trucks suddenly weaving into your lane to miss a crater.
- If you hit a crater, stop at once and

inspect for damage. Check particularly for tire blowouts, rim dents, sudden loss of wheel alignment, and broken mufflers, tailpipes, springs.

■ Watch out for potholed bridge pavement. Because bridges are elevated and freeze more readily than on-grade highways, they are especially susceptible to dangerous road damage.

■ Don't venture into fast traffic lanes without good tires all around.

■ Never wait to see a "Warning: Bump" sign. Many are misplaced by the time you see one you've hit the bump.

automatically forced more motorists into the slow lane. Still, whatever the reason, the damage is there and becoming serious.

Many widened state highways are now cracking along the old edges because the extended pavement was improperly laid down or can't take the stress. We found concrete roads split down the middle with cracks so wide they could trap a wheel.

Who's to blame?

Highway officials cite a number of reasons for the seemingly sudden, epidemic outbreak of road damage—age, unusually severe winters, increasingly heavier truck weights, sloppy repair crews and something called "deferred maintenance," which is merely a fancy term for neglect. All appear to be contributing factors, but many truckers and others dispute the importance given to some.

"It's old age," says one federal highway spokesman. "Suddenly our roads are 20 years old and going to hell." Congress' investigating arm, the General Accounting Office, warns our roads are falling apart 50 percent faster than we're fixing them.

But if age alone were the prob-

lem, how come the toll-supported Pennsylvania Turnpike is claimed by truckers to be "the best east-west road" in existence, far superior to its new rival, I-80? The Pennsy (now I-76) is the *oldest* superhighway in the United States. It was opened nearly 30 years ago. Truckers also say that old U.S. 20 in Indiana, built in 1919 and rebuilt in 1947, is still good. And many stretches of old U.S. 301 south of Richmond, Va., surpass parallel sections of supposedly much better, much newer I-95.

As for winter damage, truckers declare that there have always been tough winters but never roads as they are today. "If winter is to blame, why are Maine blacktops still among the best?" asks one driver.

Many truckers told us that privately operated toll roads are better maintained than state-run highways. As one put it: "When cracks begin, they have crews out there with patches before water can get in to freeze and do more damage."

One villain: overweight

Truckers are suprisingly frank in admitting that heavier cargo loads are a prime cause of crumbling

(Please turn to page 118)

Station owner on I-80 shows dented rim from impact. Crater (right) on I-84 awaits unwary drivers.



New photo optics: traveler's aid

Zooms and a new extender can give you more and better vacation shots with less gear.

by Stephen Walton



A 70-to-150-mm zoom lens adds variety to your pictures of people, and lets you add or remove background as you choose.

Vari-Zoom plus standard 100-mm lens makes zoom lens. All shots were taken with same subject and camera positions.



From top of World Trade Center, 70-mm-lens length shoots midtown New York.



At 150 mm, you've begun to zero in on a distant object of interest.

A collection of half a dozen lenses for your 35-mm SLR is fine when you're working close to home—it gives you versatility and flexibility. But what a burden when you travel.

Fortunately, newer zoom lenses can reduce the load and still give you the shots you want. One or two, carefully chosen, can become the equivalent of a bagful.

When *PM's* executive editor, Robin Nelson, went to the Galapagos Islands, he took just one lens for his SLR. All the photos opposite were taken with a Vivitar Automatic 35-105-mm TX close-focusing zoom (\$415 list). Says Nelson:

"Eastman Kodak will undoubtedly be happy to hear that, for photographers like me, a zoom lens like the Vivitar 35-105 makes one shoot a lot more film. I was able to shoot a specific subject and then put it in the context of its locale for the folks back home. In the Galapagos, for which the word 'exotic' may have been coined, this usually meant an unusual or unique species of wildlife would attract the lens's moderate telephoto capability, then I'd immediately zoom out to a fairly wide view of the habitat, which was often otherworldly.

"Yet the ability to frame a scene precisely in the mid-range focal lengths probably saved me a few shots, as well as the scurrying around that would have been necessary to be sure of getting the 'right' picture with a single-focal-

(Please turn to page 120)



Add Matched Multiplier for 300 mm and you have tight closeup of distant subject.



35-TO-105-MM ZOOM LENS

T-MOUNT ADAPTER

VARI-ZOOM

SERIES VII ADAPTER

70-TO-150-MM ZOOM LENS

2X MATCHED MULTIPLIER

Zoom lenses (left, right) plus multiplier, give continuous 35-to-300-mm range. Vari-Zoom makes 100-mm lens a 75-to-125-mm.




At 35-mm focal length, Vivitar zoom lens shows Pacific comber breaking over tourist launch on the island of Bartolomé in the Galapagos. Zoomed in to its 105-mm setting, lens catches the waterlogged aftermath from the same vantage point.

Three-frame sequence at 35-70-105-mm focal lengths shows location of sea lion beach at Punta Espinoza, Galapagos, then zooms in to get the tenants' reaction.



When skittery "Sally Lightfoot" crab finally held still, Vivitar zoom's close focusing capability proved useful at 105-mm.



The Soviet theory of air superiority has stood the test of 40 years.

by Murray Rubenstein

MiG:

The ultimate airplane killer

Throughout the annals of what we have come to know either as the Cold War or Detente, depending on whether there is a crisis or lack of one, perhaps no other one-word label has become so immediately associated with a sense of threat as has the term MiG. In fact, as a worldwide household word, it may even rival Coca-Cola. Why the products of one aeronautical design "bureau" within the Soviet Air Ministry have achieved this kind of brand-name notoriety (or fame, if you happen to be a pilot in the Libyan, Cambodian, Cuban, Ethiopian, Iraqi or any of a dozen other nations' air forces) is something worth pondering.

It is also an ongoing phenomenon that is currently responsible for the sleepless nights of Western military strategists who must deal, at least hypothetically, with its latest manifestation—the MiG 29 (painting at right).



PM art: Ed Valigursky

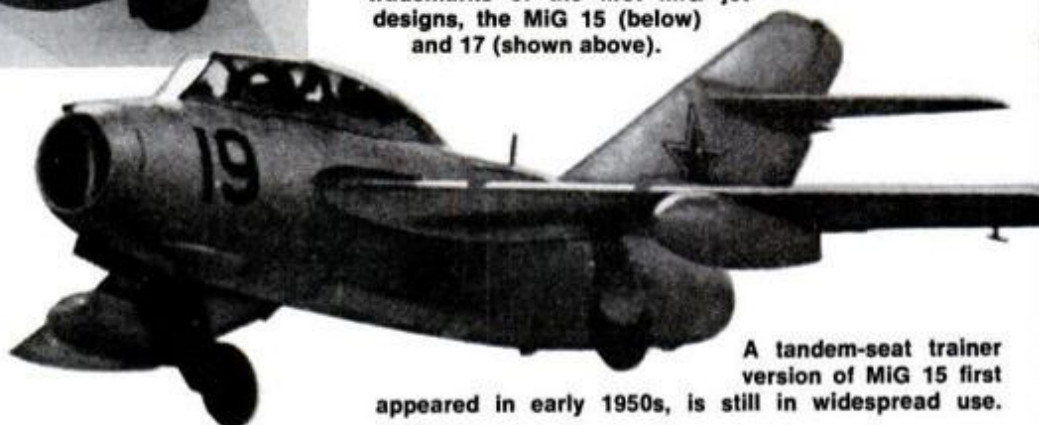
This artist's conception of the MiG 29, still shrouded in secrecy, is based on details from authoritative sources concerning its new radar, engines and armament.



World War II's MiG (above) was the evolution of the first interceptor design produced by the Mikoyan-Gurevich team.



High, sweeping T-tail and "fenced" wings swept at 40°-plus were the trademarks of the first MiG jet designs, the MiG 15 (below) and 17 (shown above).



A tandem-seat trainer version of MiG 15 first appeared in early 1950s, is still in widespread use.

The 29, latest of the MiG clan, is an improvement—an evolution—of the MiG 25, code-named "Foxbat" by NATO. It is slightly longer than the 25, has new engines and is probably the fastest fighter in the air today. In addition, the 29 has six pylons, or "hard points," on the wings for carrying air-to-air weaponry (compared with four on the 25), a new "look down" radar system which can distinguish a low-flying aircraft or cruise missile from ground clutter, and a "snap down" fire control system which can direct a missile at a low-flying target. It appears to be the answer both to cruise missiles (along with advanced, mobile SAMs) and low-altitude-penetration attack aircraft like the U.S. F-111.

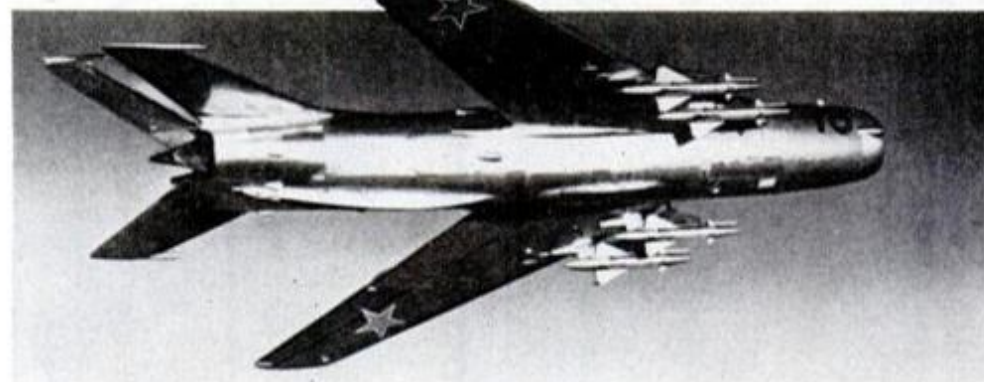
What's more, the MiG 29 should be in operational service in the Soviet Union by 1981, thus posing some tough theoretical problems for NATO air forces—which aren't even sure they're out from under the problem first posed by the Foxbat a decade ago.

In 1967 a Soviet aircraft (later identified as a MiG 25) shattered the existing world speed and climb (time-to-altitude) records. Among the new records claimed were those for an aircraft carrying a 2000-kilogram (4410-lb.) payload—which

meant the new fighter flew faster loaded than any existing Western combat airplane could fly clean. By 1969, the record-breaking Foxbat was in service with regular Soviet units.

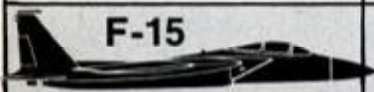
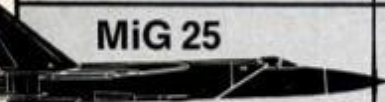
The U.S. couldn't mount a challenge until February 1975, when a specially prepared F-15 fighter, built by McDonnell-Douglas Corp. and known as the "Streak Eagle" in its stripped configura-

tion, broke the Soviet marks. But even before the congratulations had died down, some three months later, in May, the U.S.S.R. sent up a new challenger. It went 114,828 feet in slightly over four minutes, 11 seconds—in a "zoom" climb—and easily recaptured two time-to-height records. It turned out this was again a Foxbat. Although it probably had improved engines, it was an aircraft that had by then been operational for *more than six years*. For an equivalent, try to



By lengthening and enlarging the fuselage of their 17 model to accommodate twin engines, the MiG team evolved the Soviets' first supersonic fighter, the MiG 19.

F-15 vs. MiG 25: The air superiority fighters

AIRCRAFT	TOP SPEED	EST. SERVICE CEILING	OPERATIONAL	WEAPONS CAPACITY	EST. COMBAT RADIUS
 F-15	MACH 2.5	OVER 65,000 FT.	1975	16,000 LBS.	UP TO 1600 MILES
 MiG 25	MACH 2.8*	OVER 75,000 FT.	1969	4,400 LBS.**	UP TO 900 MILES

* Reconnaissance version capable of Mach 3.2

** MiG 25 is configured only for air-to-air combat



Soviet pilots talk over a MiG 21 mission. First used as a daytime fighter with small radar, the supersonic delta-wing 21 (below, left) has been steadily improved and upgraded.



Initial problems with the design of the variable-geometry wing of the MiG 23 gave its creators as many headaches as were produced here by its TFX counterpart.

imagine someone taking a stock automobile to Indy and turning in a new lap record.

With its higher range and weapons capacity (see chart on opp. page), the F-15 is more versatile than the Foxbat and, with its low-level speed capability, a superior attack aircraft. In addition, the F-15 is almost certainly equipped with far more advanced electronic systems. Yet plane-for-plane at all jet combat

altitudes, the match-up is hardly conclusive. The Soviet recapture of climb records was followed shortly by a claimed maximum altitude of 123,500 feet, still unconfirmed, by another Foxbat flight—possibly configured as a MiG 29 prototype.

And to air combat considerations, one intangible must be added—the longstanding tradition of MiG aircraft to be single-mindedly, almost obsessively designed to do one thing extremely well: Kill other airplanes.

This obsession can be dated back to 1937 in a Russia almost completely purged of experienced mili-

tary leadership by Josef Stalin (who would buy time for reorganization by signing a “nonaggression” pact with Hitler that gave Poland away), and facing a growing *Luftwaffe* threat with obsolescent Polikarpov-designed fighter aircraft. The need was for a modern interceptor-type plane. A 22-year-old graduate of the Soviet Air Academy, Artem I. Mikoyan, joined the Polikarpov design organization where he befriended the deputy chief designer, Mikhail Y. Gurevich. Their ideas on an interceptor aircraft were similar;

(Please turn to page 136)



An eight-year-old design when it recaptured time-to-height records from the F-15 in 1975, the “Foxbat” is one of the most successful MiG fighters.

Материал, защищенный авторскими правами

THREE STORYBOOK PLAYHOUSES YOU CAN BUILD

Our "straw" and wood versions are take-apart designs and can be stored flat. The brick house is up to stay.

by Harry Wicks
HOME AND SHOP EDITOR

Build a storybook retreat for kids. No matter how hard or long he huffs and puffs, even the Big Bad Wolf won't be able to blow down these playhouse-size versions of The Three Little Pigs' homes. It won't matter whether your youngster prefers the "straw," "stick" or "stone" house because all three of these charming 4-ft.-square playhouses are easy to build; and, because we used low-cost A-C exterior-grade plywood, conventional building techniques, Z-Brick and 2 x 2 lumber, the playhouses are also economical. Each costs far less than an equal-quality commercial version would cost—if any were available.

The brightly colored straw hut can be built for as little as \$60, plus paint, depending on the materials used for walls and roof. The stick house with its whimsical plastic pipe smokestack will run about \$85. The



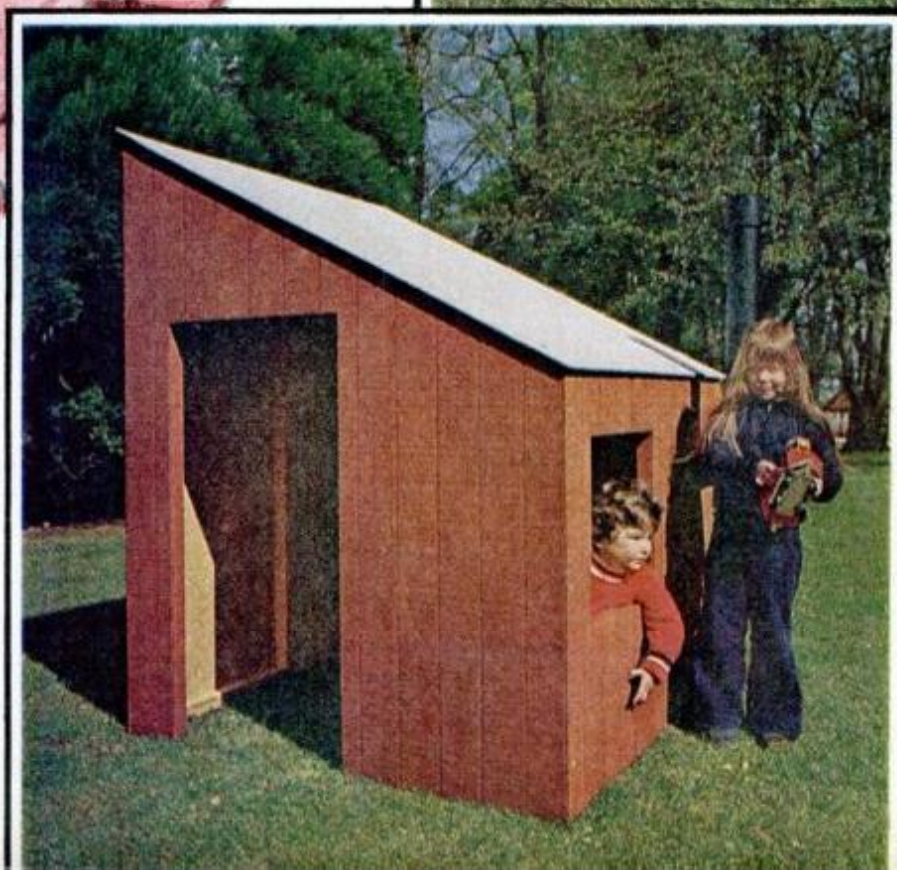
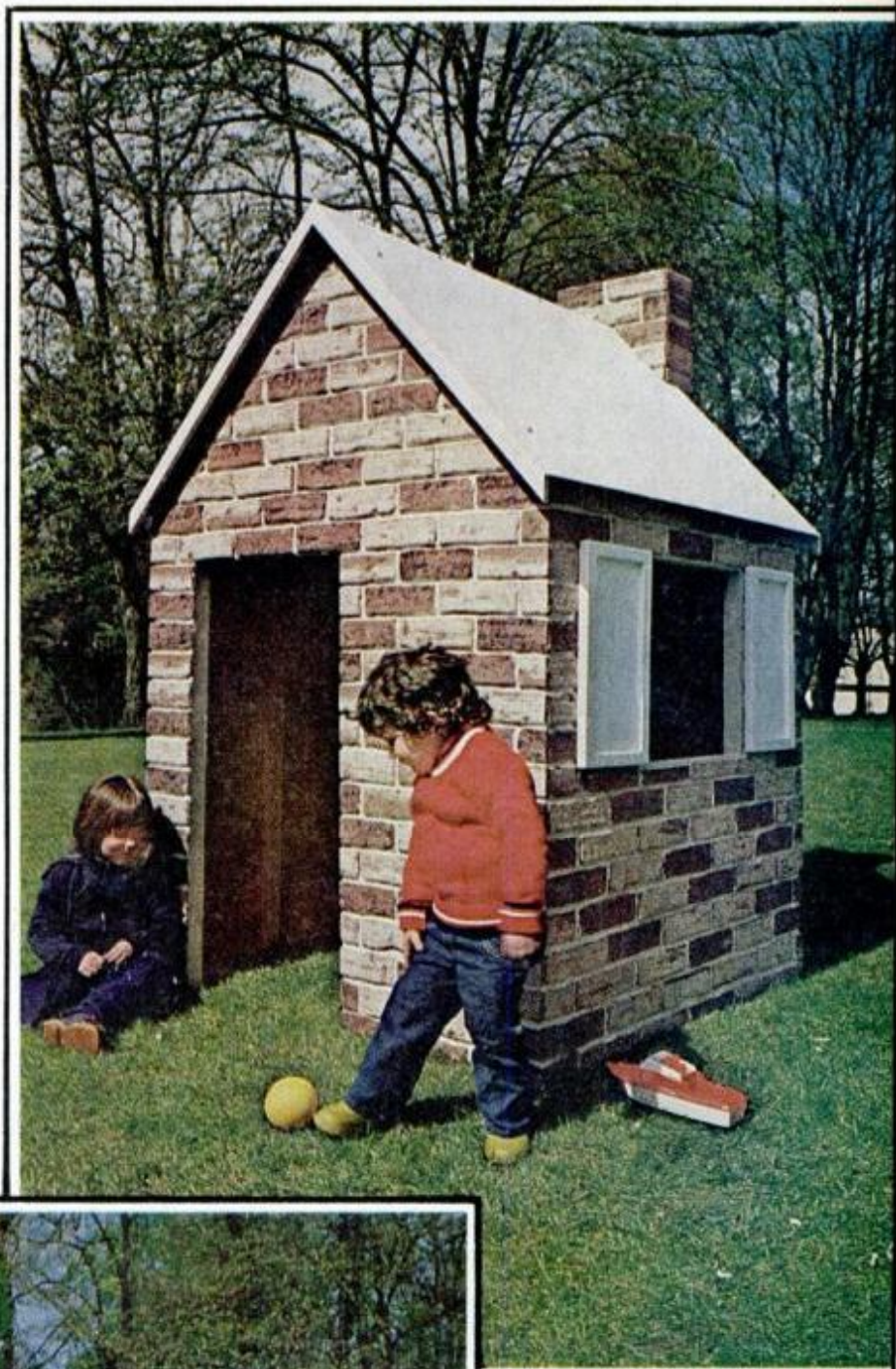
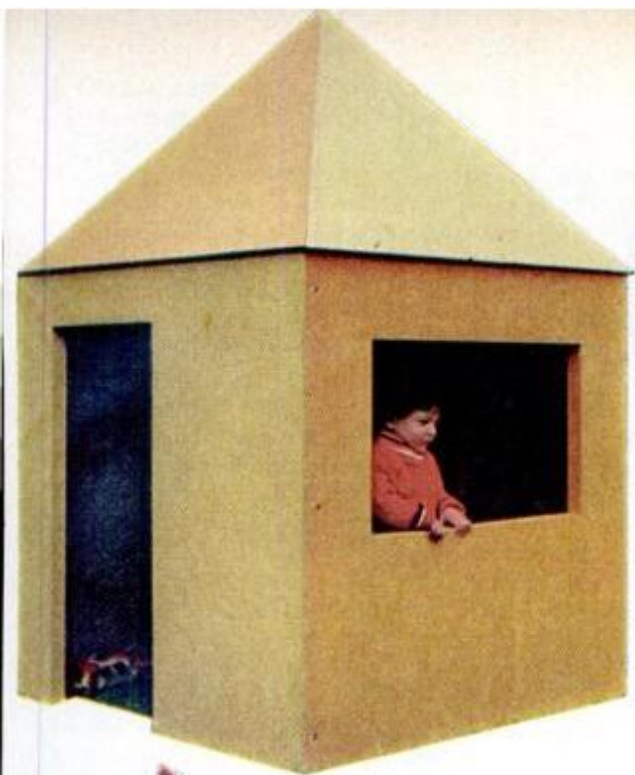
"stone" house is built of 3/8-in. plywood and faced with Z-Brick. It can be built for \$200 or less depending on your choice of brick pattern.

A big design plus is that the straw and stick huts can be assembled with bolts. Thus, when it's cold and the kids would rather play in the basement, or if you should have to move, these two houses can be taken apart with little effort and reassembled indoors or in another place.

General directions for building

Because the houses are intended basically for use outdoors, pick materials that resist exposure to the elements. Plywood should be an exterior grade, hardware should be galva-





PM photos: Bob Strode

Storybook playhouses provide youngsters with an environment in which imaginations can soar. These three are first built using basic construction techniques and modern materials. Our "straw" version is of low-cost fiberboard, while the other two make use of APA grade-trademarked plywood. The first is painted a bright yellow to visually impart the look of straw; the second is stained to blend with yard surroundings; the 'brick' version is skinned with easy-to-use Z-Brick.

nized, paints of exterior type and the Z-Brick protected with two coats of the recommended masonry sealer.

Our houses are designed without doors and windows that close so a neighbor's toddler wandering into one of the houses won't become trapped inside. If you add a door, hinge it so it swings outward and is not self-locking. If you put in windows, play it safe and install sheet acrylics instead of glass; acrylics won't shatter. A window should be hinged so it swings in and can be held open with hook and eye. A window swinging outward that is left open could be run into accidentally by an exuberant youngster.

To make the hut usable on rainy days install either 15-lb. felt or 4-mil polyethylene plastic. The plastic will look better. Apply either material over the roof using staples with a 12-in. overlap at joints. Fasten a strip of lattice, serving as a batten, over each row of staples.

If you build either of the take-apart huts, you can simply position the structure on a relatively level section of your back yard. Since these versions are lightweight, you

can relocate them periodically to renew the lawn beneath.

The brick house stays where it's put. Thus you may prefer to excavate to a depth of 4 in., level the area, and backfill with pea gravel. If you do, lay a single course of bricks (on the flat) around the perimeter of the excavation and set the house in place before pouring the gravel (or you will have a task leveling the house on pea gravel).

Straw house

The prototype shown was built of fiberboard. Though this material will keep down costs, it is not the best choice if you plan to leave the structure exposed to the weather. It can be painted, of course, to beef up its weather resistance but fiberboard eventually deteriorates when exposed to moisture. For a more durable house, use $\frac{3}{8}$ -in. A-C exterior-grade plywood.

Cut the parts as shown below and test-fit the sections before boring pilot holes for the bolts. The units can be held temporarily using lengths of 1x2 tacked diagonally across abutting sections. Check all

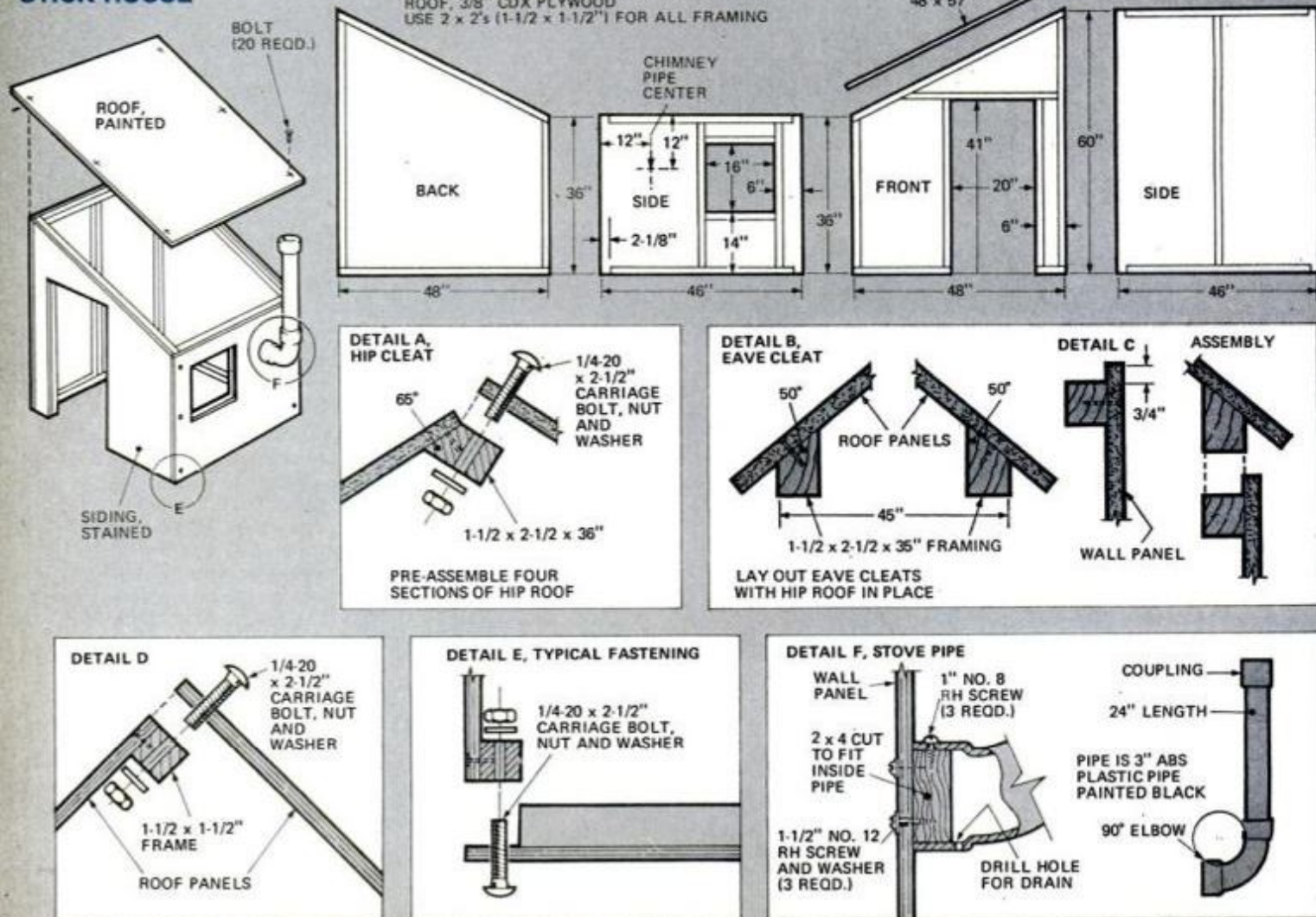
joints carefully and, when satisfied with parts fit, mark for permanent fastening. The 2x2 cleats should be fastened to the plywood using resorcinol (weatherproof) glue and galvanized screws or 4d common nails.

Since plywood comes from the factory with a relatively smooth finish, sanding—except for cut edges—is unnecessary. Do fill any voids in edges with a wood filler and sand these spots, however. Apply a coat of exterior primer to all outside surfaces, following manufacturer's instructions, then apply a coat of yellow paint. To increase the wood's resistance to weather, give the unpainted interior surfaces at least two coats of an outdoor polyurethane varnish.

Stick house

For looks, we skinned the walls of our stick house with $\frac{5}{8}$ -in. textured plywood siding (Texture T-111). Lay the parts out on the plywood, label each and cut them out. Assembly here is the same as for the straw hut. The wood 2x2 cleats are fastened to side and roof panels with resorcinol glue and galvanized

STICK HOUSE



screws. Before fastening permanently, assemble for a test fit. When satisfied with the way the parts go together, remove the cleats and reattach with glue and screws.

The black "stove pipe" is a 3-in. ABS black plastic pipe. You will need about 2 ft. of straight pipe plus the fittings listed in the materials list. Since the pipe comes with printing on it, it should be painted.

To finish the stick house, simply apply exterior stain. If you used good-looking textured siding, apply a transparent stain that retains the natural look and lets the wood show through. We used Olympic 704 semitransparent. If you have economical with a low grade of plywood, choose a heavy-bodied stain that will hide the uglies (like knots and boat patches).

Stone house

Since this hut is also built of 3/8-in. plywood and 2x2 stock, construction methods are exactly the same as for the straw and stick houses. Our brick veneer is the glue-on type that is sold in lumberyards and home centers. On our

model, we used Country Rustic red brick by Z-Brick Co. Woodinville, Wash., 98072.

Assemble the house using galvanized nails, screws and resorcinol glue. Complete major carpentry work before applying brick facing.

Installing the brick we chose is basically a four-step procedure:

1. Apply a thin coat of Z-Ment mortar to area to be covered; don't apply more than you can work before mortar dries.
2. Press Z-Brick in place, wiggling slightly from side to side.
3. Dress mortar joints with clean, narrow paintbrush.
4. Apply two coats of nongloss Z-Sealer following directions on can.

The shutters on this house were edge-trimmed with pine to give them some dimension. They are attached with finishing nails after brick application has dried. Warning: Drive nails through mortar joints *only* or you will crack the bricks.

Notice that roof rakes are trimmed with strips of plywood, and that the roof sections are notched to fit around the chimney.

MATERIALS LISTS—THREE PLAYHOUSES

Stick House

No.	Size and Description (use)
3	sheets 3/8" x 4' x 8' textured T-111 siding (sides, front and back)
1	sheet 3/8" x 4' x 8' CDX plywood (roof)
5	16' lengths, 2 x 2 pine or fir (framing)
1	3" scrap, 2 x 4 (to mount stovepipe)
1	3" dia. x 2' length ABS black pipe, one coupling, elbow (stovepipe)
1	gal. ext. stain, Olympic 704 (exterior finish)
Misc.	Solvent for ABS pipe; resorcinol glue; 20 pcs. 3/16 x 2 1/2" carriage bolts, nuts, washers; 4d galv. common nails; 3 No. 8 x 1" RH screws; 3 pcs. No. 12 x 1 1/2" RH screws and washers.

Stone House

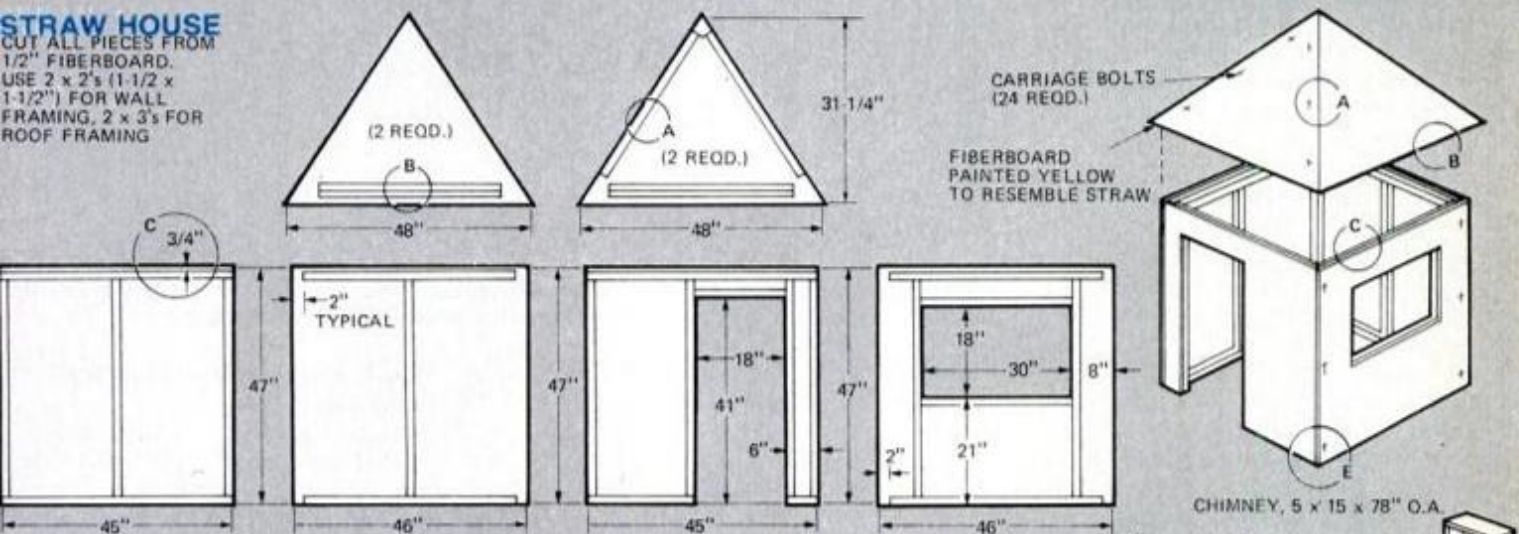
No.	Size and Description (use)
4	sheets 3/8" x 4' x 8' A-C ext. plywood (sides, front, back, roof, shutters, trim)
5	16' lengths, 2 x 2 pine or fir (framing)
12	boxes (30 bricks per box) Z-Brick (exterior facing)
1	5-gal. container, Z-Ment (mortar adhesive)
1	qt. Z-Sealer (brick sealer)
2	qts. ext. varnish (interior finish)
Misc.	resorcinol glue; 14 1/4 x 2 1/2" carriage bolts; galvanized 4d finishing and 6d common nails.

Straw House

No.	Size and Description (use)
4	4 x 8' sheets fiberboard or 3/8" x 4' x 8' A-C ext. grade plywood (sides, front, back, roof)
2	12' lengths, 2 x 3 pine or fir (roof framing)
5	16' lengths, 2 x 2 pine or fir (wall framing)
2	qts. ext. primer paint (exterior undercoat)
2	qts. ext. yellow paint (exterior finish)
1	gal. ext. varnish (interior finish)
Misc.	resorcinol glue; 12 1/4 x 2 1/2" carriage bolts, nuts, washers; 24 3/16 x 2 1/2" carriage bolts, nuts, washers.

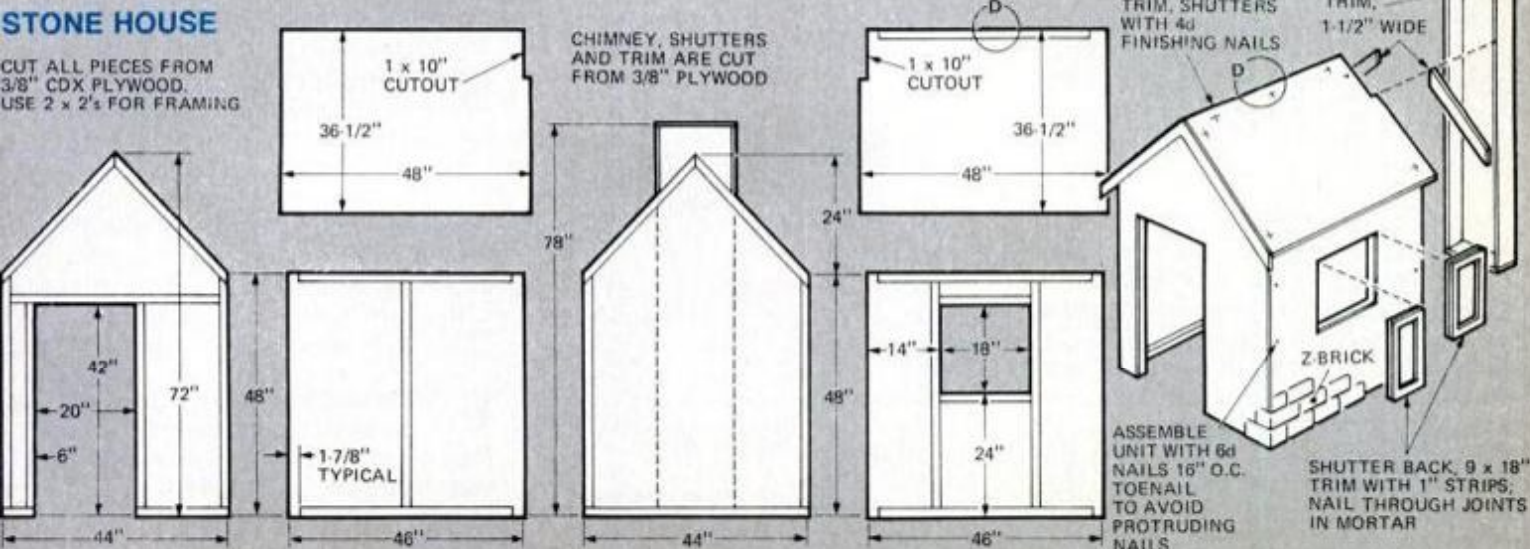
STRAW HOUSE

CUT ALL PIECES FROM 1/2" FIBERBOARD. USE 2 x 2's (1-1/2 x 1-1/2") FOR WALL FRAMING, 2 x 3's FOR ROOF FRAMING



STONE HOUSE

CUT ALL PIECES FROM 3/8" CDX PLYWOOD. USE 2 x 2's FOR FRAMING



Test yourself: How much do you really know about energy?

Here's a quiz that will push your energy quotient to the limit. If you get eight answers right, consider yourself energy wise.

by Victor D. Chase

Energy facts and figures are being tossed at you every day. Here's a chance to test *your* energy-quotient. There's no passing or failing, though, and peeking at the answers is encouraged. In return for taking the test you'll pick up some tips that may help reduce your utility bills.

1 What is energy?

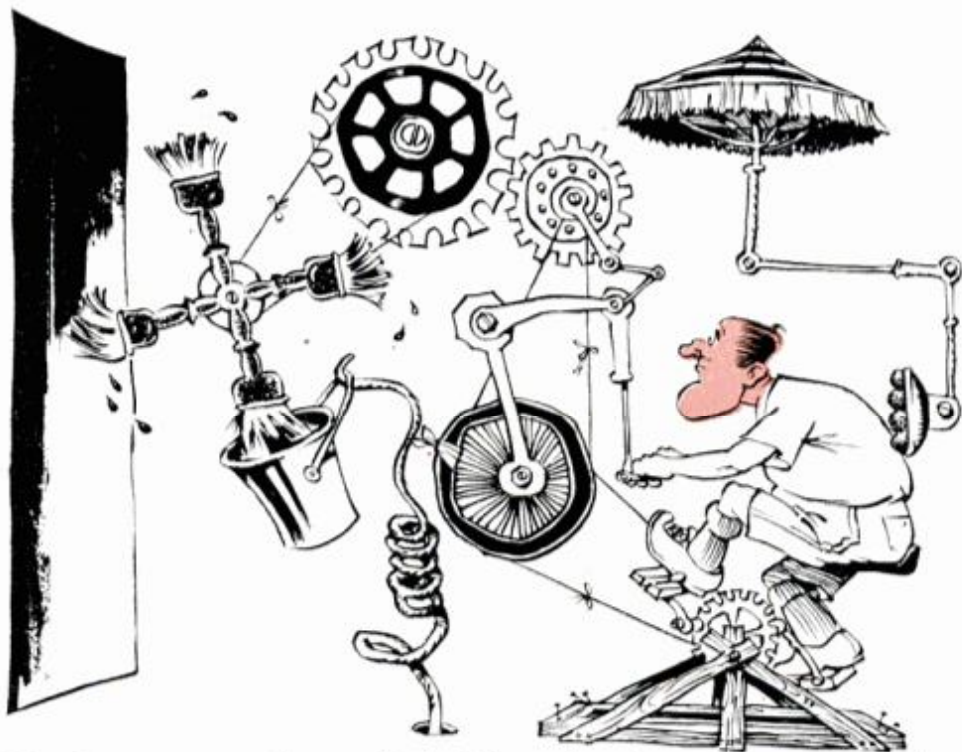
In its broadest sense, energy is the ability to do work. Various kinds of energy include: electrical, chemical, light, sound and heat. In some cases one kind can be transformed into another. Plants, for example, convert solar energy into chemical energy. A lamp converts heat into light. Your home furnace converts the energy originally expended to form oil or gas back into heat.

2 Is there *really* an energy shortage?

Strictly speaking, the answer is no, for energy can neither be created nor destroyed—only changed in form. In other words, burning oil or gas doesn't use up that energy, it merely changes it from one form to another form for our use. On the other hand, most energy is only readily usable in the form of fossil fuels—and that's the nub of the energy problem. It's not that we lack energy, but that we are running out of the forms we can readily use. If coal can be converted to an environmentally acceptable fuel, we will have energy to last us for hundreds of years.

3 How is heat measured?

If you answer "degrees" or "temperature" you are only half right. An equally important measure is the British Thermal Unit (B.T.U.). One B.T.U. is that amount of heat energy needed to raise the temperature of one pound of water by 1° F. Temperature measures the intensity or quality of heat, while the B.T.U. measures the quantity of heat. For example, consider a kettle of boiling



Although energy means the capacity for doing work and overcoming resistance, there are better ways than this contraption for using energy to good advantage.

water and a bathtub full of 60° water. The kettle is at a higher temperature (in degrees) than the bathtub, but the tub contains a greater amount of heat energy (in B.T.U.s).



4 How is the energy you buy for home use measured?

If you use natural gas you're billed on a cubic foot basis (1021 B.T.U.s per cubic foot). Electricity is billed in kilowatt hours (3412 B.T.U.s per kilowatt hour). Fuel oil contains 139,500 B.T.U.s per gallon.

5 What part of your home's total energy consumption is for heating and cooling?

For a typical single family home in the middle belt of the country (climate equivalent to that of Washington, D.C.), heating accounts for about 50 percent of the total energy use. Cooling takes 10 to 20 percent. This varies from region to region.

6 What is a heat pump?

It is both a heating and a cooling device. During the summer it operates like a standard air conditioner—removing heat from the indoors and dumping it outside. In

cold weather the heat pump reverses itself and removes heat from the outdoor air, even from very cold air, bringing the heat inside. It is more economical than electrical resistance heat.

7 Are flue heat recovery devices a good idea?

They can be, if installed safely. Most residential furnaces waste useful heat by sending it up the chimney. Devices are sold that capture this heat. They are fine as long as they don't take too much heat out of the flue gas. The temperature at the tip of the chimney must remain above the boiling point of water (212° F.), plus a 100° safety factor, to keep flue gases flowing up the chimney and prevent combustible products from forming inside the chimney.

8 "R-value" refers to what?

It refers to the thermal resistance of insulation. The higher the R-value rating, the better the insulation will be.



9 How much is enough insulation?

Even the experts differ. Generally, 3½-in.-thick fiberglass in the sidewalls (rated at R-11) and 6 in. of either batts or loose-fill insulation in the ceiling (R-19) are considered good. Unless the studs in your home are 2x6s (and most of them are not) all the insulation you can get between the standard 2x4 wall stud is 3½ in.

To increase the thermal resistance of your outside walls (the R-value) without going to larger studs, sheet insulations such as polystyrene can be placed on the outside of the wall during re-siding or initial construction.

10 What is a vapor barrier and is it important?



A vapor barrier can be a heavy paper or foil facing that comes attached to the insulation, or a polyethylene film. The vapor barrier prevents moisture from penetrating the walls and ceiling of your home damaging the insulation and structural members. Just by breathing, cooking, showering and washing, not to mention having a humidifier, a family of four puts several quarts of water per day into the air.

During the winter, if no vapor barrier is present, the moisture passes through walls and ceiling and freezes inside them. When it thaws the resulting water can damage wood and insulation. Apply the vapor barrier facing the conditioned air, i.e.: toward the *inside* of the house.

11 If you are adding insulation to your attic, should it include a vapor barrier?

If, as in most attics, yours already has loose-fill insulation, don't lay a vapor barrier above it. This would serve to lock the moisture that passes through the ceiling into the old insulation. If there is already a barrier in place, a second one isn't needed. If there is no vapor barrier, rake aside the existing insulation, put down the new with a barrier, then top it with old insulation.

12 Does attic ventilation save energy?

Yes. Ventilation not only saves energy, it also saves roofs and paint jobs. In summer, attic ventilation helps reduce the temperature in the attic and thus reduces the load on the air conditioner. In cold weather ventilation lets moisture escape. Where no vapor barrier is used, good ventilation is essential.

13 How much is enough attic vent area?

The best configuration has the

vent area split between the eaves and ridge of the roof. This allows natural convection currents to bring cooler air in through the lower eave vents and exhaust the hotter air through the high ridge vents. When this design is used, or if a vapor barrier is used, 1 sq. ft. of vent area is the minimum needed for each 300 sq. ft. of ceiling. Where the vent isn't split or no vapor is used, the vent requirement doubles.

14 Is power ventilation in the attic worthwhile?

In most cases if you have good natural ventilation as described in answer 13, you don't need power ventilation. However, if you don't have a split vent configuration, the use of a power ventilator can help cool your home during hot summer days. If you don't have an air conditioner, you will be more comfortable with a power ventilator; if you have an air conditioner, you'll need to use it less often.

Electric attic vent fans that are thermostatically controlled cost \$50 to \$75; if professionally installed, double this.



15 Are electric vehicles practical for family use?

Not yet. Available lead acid batteries are too bulky, heavy, costly and don't last long enough to make these vehicles practical.

16 Is solar energy practical for home heating?

Yes. But just how practical must be judged on an individual basis. You can gain a considerable amount of solar heat passively (without special equipment) through proper positioning and design of a house when it is built. The average weekend do-it-yourselfer can build an active solar system including collectors and other equipment to heat his garage or a single room. A handier person can install a system to provide solar heating for more space in the home. Solar domestic water heating is currently a more practical active solar application in most parts of the country. **PM**

Renault still suffers a bit from "Dauphine hangover" dating from the late 1950s, when the firm imported thousands of four-door Dauphine subcompacts into this country to compete with the VW Beetle.

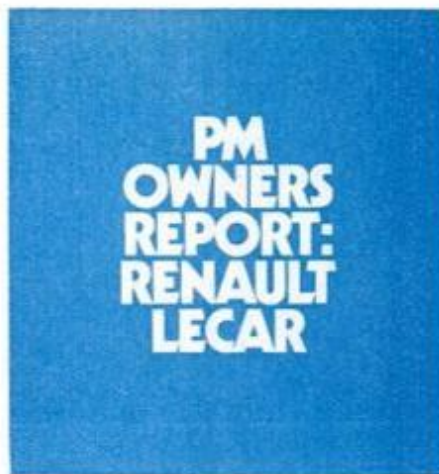
But Renault's dealer network tended to lag behind Volkswagen's. Renault parts were slow in coming, and mechanics were inexperienced. Dauphine overall quality thus came into question.

Present staff members of Renault U.S.A., Inc., are very much aware of the Dauphine's lingering



Just over a quarter of LeCar's owners bought it for its unique styling.

reputation. They've been doing their best to counter it. The question at this point—after 2½ years of Renault LeCar sales—is: Do today's owners feel they've



bought a quality product with a good service network?

To answer this question, we surveyed LeCar owners. On the topic of Renault quality, they had this to say:

An Illinois architect: "Excellent; I feel the car is very well made for the price." A California public relations man: "Well engineered and well put together." And a Vermont artist: "Good workmanship. It's a simple but nice interior that doesn't require a high degree of assembly skill to obtain a very good, finished appearance."

In all, 81.5 percent of our respondents rated LeCar workmanship *good to excellent*.

On the topic of dealer service, 69.3 percent scored it *good to excellent*. That's four points above the 1977 Honda Accord's rating and among the highest we've recorded during the past two years!

Here are some comments owners make about their dealers:

"Fine service department—includes an imported French mechanic."—California teacher.

An Illinois nurse is resigned that his dealership "gives you the runaround just like any other." A California architectural draftsman says: "List of items was taken



Photos by the author

All but 0.8 percent rated Renault's front-seat comfort *good to excellent*.

BY MICHAEL LAMM WEST COAST EDITOR

Economical, cute and roomy, say owners, but exhaust brackets tend to fall off

Washer/wiper for backlight comes on GTL Deluxe versions.





Engine lies longitudinally behind the transaxle. Block encroaches a little . . .

care of and each commented on individually—gave me a feeling of personal care." A Wisconsin factory worker indicates that the "dealer replaced rear window seal but the window still leaks." He'll bear with them, however, because "they are friendly, give good explanations of work and are willing to answer mechanical questions."

A New Mexico physicist (at age 55, one of LeCar's older owners) ordered his car here and picked it up in France for use during his one-year sabbatical. He "had two dealers, one in France and one in

U.S.A.—both good." This owner has more miles on his LeCar (17,316) than any other owner in our survey and has had only two problems: "faulty oil pressure light and rear window washer—both covered by warranty." He considers his present service department "excellent."

When we asked owners why they chose LeCar over the other small car rivals, we got these answers:

"I saw a picture of one in a magazine," wrote an 18-year-old Idaho legal secretary, "and fell in love with it. I wanted a small car



. . . into front compartment, lurks just ahead of the center-dividing console.

with good gas mileage, easy to park, fun to drive, and one I could be proud of. It's so distinctive!"

Economy swayed more than

From R5 to LeCar

LeCar began life in France as the Renault 5, in 1972. Over a million were sold throughout Europe before it was brought to these shores in late 1975. The name became LeCar after mid-1977 ("Le Frog" was also considered briefly).

In its U.S. form, LeCar uses a 1289-cc (78.8 c.i.d.) Four with pushrod ohv. The engine stands behind the front axle, the four-speed transaxle resting ahead of it. Unlike the VW Rabbit and Honda Accord, LeCar's engine lies longitudinally. It delivers 60 bhp in its 49-states version.

LeCar's unitized body stands on a 95/96-inch wheelbase, the right side being an inch longer than the left to accommodate transverse torsion bars. Only the three-door hatchback is imported, although a five-door sedan, known as the Renault 7, is available in Spain.

By tradition, Renault has boasted multipurpose interiors. LeCar converts easily from its four-passenger self to a virtual station wagon at the flip of a seat.

Also by tradition, the suspension has more wheel travel than normal, resulting in a softly sprung car. It gives an excellent ride, yet with good cornering characteristics.

LeCar comes in two trim levels—GTL and GTL Deluxe. Airconditioning, sunroof, and AM/FM are optional.

A NATIONWIDE SURVEY BASED ON 1,811,402 OWNER-DRIVEN MILES

Large windows, slim pillars give good visibility all around.

Americanized front treatment accommodates round headlamps and 5-mph bumpers.

Four-speed transaxle stands ahead of engine.

Unitized body keeps LeCar's curb weight to 1805 pounds.

Generous wheel travel and soft torsion-bar rates smooth ride.

Wheelbase is an inch shorter on this side than the other.

half the buyers, with styling ranking a solid second. And like the secretary, most LeCar owners tended to be young—under age 30. About a third were female.

When queried on their specific likes, nearly 60 percent ranked economy first on their list. "I like the gas mileage I'm getting," observed a California electronics technician. "It's up to 41 mpg on the highway, just like the EPA says. But in addition, I like the comfort of the front seats and the way they recline, the way the back end converts into a station wagon, and the way the spare tire up front is easy to get at."

Agrees a Georgia accounting clerk: "It's cute. And has a very smooth ride, even on very bumpy roads. And I like the sunroof. And the seats are up high, so I don't feel I'm sitting in a hole."

Front-wheel drive received considerable praise, especially for what it did for traction in snow. In fact, LeCar's handling characteristics proved nearly as well liked as its economy. Said an Illinois police officer: "It handles and drives superbly and has a great suspension system. I wish I could get this sort of ride in a small American car."

"The smallness makes for easy maneuverability and parking in tight places," noted a New Hampshire housewife. "The torsion-bar suspension gives great stability and a fine ride."

And a California oral-surgery assistant: "The fun-sun roof is great; LeCar is very roomy; everyone is surprised when they get in. Great handling and steering with front-wheel drive, great comfort in the front seats."

We also asked owners to list the things they don't like about LeCar. Here's a typical cross section of their answers.

"Exhaust-system brackets keep falling off," complained an Illinois apartment manager, and he was



With rear seat folded, LeCar boasts 17.9 cu. ft. of cargo space and a . . .



. . . flat floor. Full hatch means low lift sill, aids hauling long items.

echoed by 24.5 percent of our respondents. Rubber attachments holding the tailpipe to the car tend to break.

"Noisy, buzzy engine at highway speeds, and the gas tank isn't large enough," added a New York physicist. Several owners recom-

mended a fifth speed or overdrive to correct this. An Illinois machinist suggested, "What LeCar needs is a road gear."

Other proposed improvements (we always ask for them): "I'd like to see them change the manual choke to an automatic. In cold weather LeCar is hard to start no matter how I choke it."—Michigan salesman.

"Thicker sheet metal."—California counselor. "Needs more horsepower and a longer dipstick."—California computer operator.

Despite these minor annoyances, though, the majority of LeCar owners feel good about their choice. A Florida ceramics instructor sums it up this way:

"I truly enjoy this car more than any other I've owned, and that includes a variety—Dart, Riviera, Gran Torino wagon, and now LeCar. I just love it! It's such a pleasure, especially on long drives—quick, easy handling, smooth, comfortable; everything anyone would want. I'm amazed at how much stuff and/or people I can get into it. Everything on the car is in such a convenient and sensible place, like the wiper control, horn, lights, etc. I'm looking forward to your report, because I am anxious to see how many other owners are as pleased as I am."

And a Connecticut enthusiast explains why LeCar is a cult car: "I get more G.P.M. (giggles per mile) than anyone I know. It's an idiosyncratic little bugger, with more personality and charisma than you'll find in your look-alike Japanese tin boxes or coldly efficient German machines." **PM**

SUMMARY OF 1978 RENAULT LECAR OWNERS REPORTS*

Total miles driven 1,811,402	Cold starts 7.3	Comfort opinion (rear seats):	Average 16.4
Average miles per gallon	Gas mileage 5.6	Excellent 21.6%	Fair 6.3
In town (EPA 26) 28.7	What changes would you like?	Very good 37.4	Poor 8.0
Long trips (EPA 41) 35.9	Rear window wiper 12.6%	Good 26.4	Number of vehicles owned:
Why did you choose LeCar?	Five-speed transmission 9.5	Fair 10.6	LeCar only 45.3%
Economy 53.7%	No changes 8.1	Poor 4.0	Two cars 42.8
Styling 25.8	Different seat shape 8.1	Had any mechanical trouble?	Three cars 8.2
Price 22.5	Use regular, leaded fuel 5.0	Yes 57.4%	Four or more cars 3.6
Size 17.6	Workmanship opinion:	No 42.6	Makes of other cars owned:
Handling 14.8	Excellent 36.6%	What type of trouble?	Chevrolet 20.3%
Specific likes:	Good 44.9	Exhaust system 26.5%	Renault 10.5
Economy 59.0%	Average 15.2	Electrical system 10.8	Volkswagen 9.8
Handling 54.0	Fair 1.2	Carburetor 8.6	Ford 9.8
Comfort 36.4	Poor 2.1	Cold starting 8.6	Datsun 7.5
Ride 28.9	Comfort opinion (front seats):	Dealer repairs satisfactory?	Age distribution of owners:
Styling 18.4	Excellent 60.1%	Yes 64.8%	15-29 years 50.6%
Specific dislikes:	Very good 29.6	No 35.2	30-49 years 38.0
No complaints 15.5%	Good 9.5	Dealer service opinion:	50-plus 11.3
Rattles 13.3	Fair 0.8	Excellent 34.0%	Would you buy another LeCar?
Poor dealer service 11.6	Poor 0.0	Good 35.3	Yes 73.6%
			No 26.4

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

Polaroid's sonar- focus camera

The next SX-70 focuses automatically—even in the dark.

by Stephen Walton

Polaroid has announced a camera that combines the point-and-shoot convenience of a fixed-focus lens with the sharpness of an adjustable-focus lens.

It's an automatic-focusing camera which uses a refinement of the ultrasonic ranging technique first shown seven years ago (*Coming: A Camera that Can Focus Itself*, page 82, March '71 PM). The technique is like the submarine sonar you see in World War II movies, and Polaroid calls it sonar. To get the distance, it bounces a .001-second "chirp" off the subject and measures the time it takes the echo to return.—A servomotor sets the lens accordingly.

Since the lens's "park" position is at (actually just past) infinity, the closer the subject is, the farther the lens moves. A 128-position electronic accumulator receives inaudible "ticks" given off by a tiny built-in clock that starts when the chirp is emitted. When the chirp echo returns, the clock stops. The difference between 128 and the number of ticks received determines distance of lens travel.

The system is a logical addition to the SX-70 single-lens-reflex camera. Press the shutter release halfway, and you see your subject zip into focus. If the sonar has been fooled (shooting through glass, for example), you know right away and can focus manually. Shoot flash in dim light—or no light—and you're still in focus. There's no word yet on price or availability. I'd guess about \$250, and in time for Christmas. **PM**



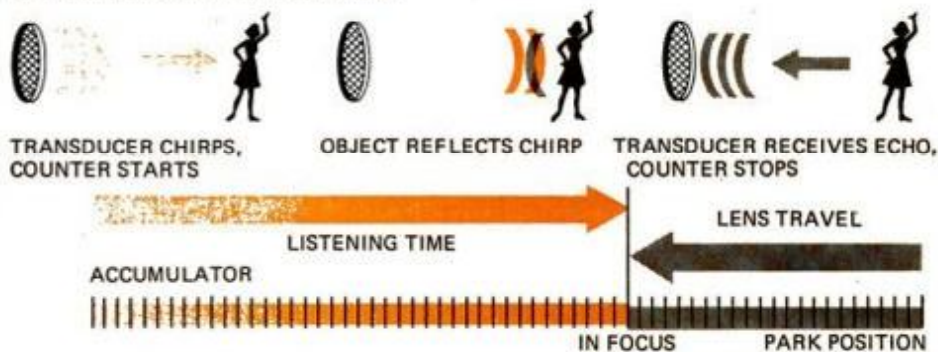
Additional weight of sonar unit is negligible in use; camera handles like a normal SX-70.



Sonar unit adds about 1½ inches to length of folded camera, is powered by flat battery in SX-70 film pack.

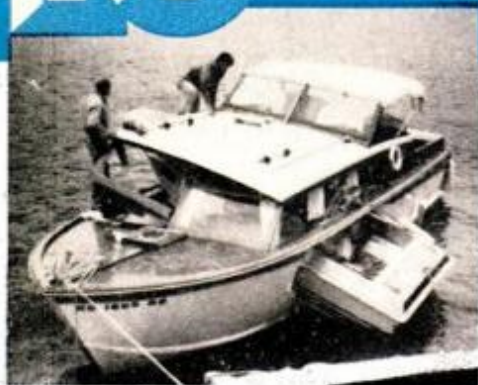


AUTOFOCUSING OPERATION



10

worst boating blunders



Runabout taking a shortcut through this cruiser learned rules of the road too late.

Midsummer's boat-accident epidemic can be reduced by these simple safety tips.

by Anne Staffin

1

Fueling up. Even before you leave the dock, you can get in great trouble. Putting gasoline in your tank incorrectly may turn your boat into a bomb.

The Coast Guard estimates one cup of gasoline has the explosive power of 15 sticks of dynamite, and they find the pleasant relaxing days of summer are a time when a skipper may not bother with the gas-up rules that can prevent a fire or explosion afloat.

Before gassing up, always first shut off all engines and electrical devices. Close all hatches so that gas fumes, displaced from the tank as the gasoline goes in, don't settle to your bilges. Don't smoke. Wipe up all spills. Let your boat air out. Use a blower or electronic fume detector if you have one. Then sniff for any gas smells before starting the engine.

2

Right-of-way. A boat is heading for you on a collision course. What do you do? Many boatmen are unfamiliar with the rules of the road and accidents result.

Yet only three basic situations—overtaking, passing and crossing—are involved.

In simple terms, stay on your own side of the channel when passing another boat, and give the other boat the right of way if you are overtaking it or it is approaching you from ahead and to your right. You must also make clear which

direction you are going so you do not confuse the other boat. Take into account its maneuverability. A ship may require a great distance to turn and throw a steep wash. Small boats should stay well out of the way. Night visibility, sailboats and craft under tow can complicate matters.

Then there is the "general prudential rule": In cases of immediate danger, do whatever necessary.

3

Speeding. A boat doesn't handle just like a car, as many boatmen find out too late. Boats have no brakes, but they can toss you overboard if you swerve while going

too fast or crossing a steep wake



or wave, and they can skid out of a turn. Even at slow speeds, the stern swings out wide during a turn and can hit a dock, swimmer or floating log or debris that you are trying to dodge.

While there are usually no speed limits out in open water, you can be arrested if you are going so fast that your speed constitutes reckless operation or endangers other boatmen.

4

Standing. Most boat fatalities are due to drowning, and one of the easiest ways that you can fall overboard is to stand up in a small

boat. Too often someone reaching out to net a fish or retrieve an oar, or standing at the gunwale to relieve himself, loses his balance and tumbles in. The shock to his sys-



tem of the cold water, plus the frantic struggle to get back into the boat can bring on a heart attack.

Nonswimmers, children, the handicapped and elderly—anyone, in fact, who is out boating alone or when the water is rough—should wear a Coast Guard-approved personal flotation device or PFD, the official name for life preservers.

If someone falls overboard, throw him something immediately to keep him afloat, the Coast Guard advises, and circle slowly to approach him from downwind in order to pick him up.

5

Stern anchor. Boats are designed to be anchored with a line running from the bow, but some small craft owners find it more convenient to secure the

line to the transom instead. It's easy to do—much easier to sit back by your outboard motor, tie the anchor line to a stern cleat and drop the anchor right there—but you may drown as a result. With a stern anchor your stern is pointed into the wind. A large wave may come along, slop over the outboard cutout and suddenly swamp your boat. If yours is a pre-mid-1978 model without upright flotation, your flooded hull is likely to turn over. The New Jersey Bureau of Marine Law Enforcement reports this happens several times a year in its waters; sometimes lives are lost.

But isn't it safer to lower the anchor back next to your tackle box and motor while you are seated

and how to avoid them

in the cockpit rather than crawling forward on a slippery little bow deck? No; instead, rig a grab rail on the foredeck or install a remote-control anchor winch.

6 **Bow riding.** "You wouldn't think of letting your kids ride on the hood of your car at 25 mph, but this is what people are doing when they allow bow riding," a water safety officer explains. "If the child



falls off, he lands right in the path of the spinning propellers."

Bow riding, along with sitting up on top of a seatback, or on a gunwale or transom, while the boat is underway, are classified as unsafe practices. Thus, these practices could be considered negligent boat operation by the Coast Guard and subject you to a penalty. They could also injure or even kill you or a loved one.

The foredeck pedestal seat of the popular bass boat has also been the cause of many accidents when the rider falls overboard from it at speed. It's illegal in some states to ride on a pedestal seat.

7 **Lookout.** While towing a water skier you think you see a submerged log ahead. You swing to one side, look back to check your skier, recheck the water ahead. When you look back again your skier has disappeared. Took a spill? Hit the log? An observer is always useful when boating through water with debris or heavy traffic, and essential with wa-

ter skiers being towed by the boat.

A boat used frequently for ski towing should have a seat mounted facing aft for a full-time observer. The driver needs to keep a continuous watch ahead for swimmers, shoals and flotsam, and should not take time out for watching astern as well. Some states require, by law, an observer or rear-view mirror. Ideally, ski tow boats will have both, with a large wide-angle mirror mounted amidships at the top of the windshield. In low visibility and at night, an extra pair of eyes can also prevent many near-misses.

8 **Overloading.** Your little skiff can seat six so it has the capacity for six passengers, right? Wrong! You may drown yourself, your family and friends if you go along with this widely held theory. Actually a crew of three might be unsafe if they are all large, heavy people, or the motor, battery and gear aboard add weight enough to exceed the safety limits specified for the boat.

Since 1972, American boat manufacturers have been required to include a U.S. Coast Guard Capacity Information Plate on most monohull boats under 20 feet in length. These indicate maximum passenger, motor and gear weight, as well as recommended horsepower.

Again, there is no law that says, "Don't overload or overpower your boat." But if an accident results, you might be charged with reckless and negligent operation—if you're still alive!



9 **Weather and water.** Even experienced boatmen don't realize, sometimes, how quickly a stretch of water can turn ugly when wind or current begin making waves, or one starts fighting the other. Failure to check weather forecasts, monitor radio reports, read tide tables, obtain lo-



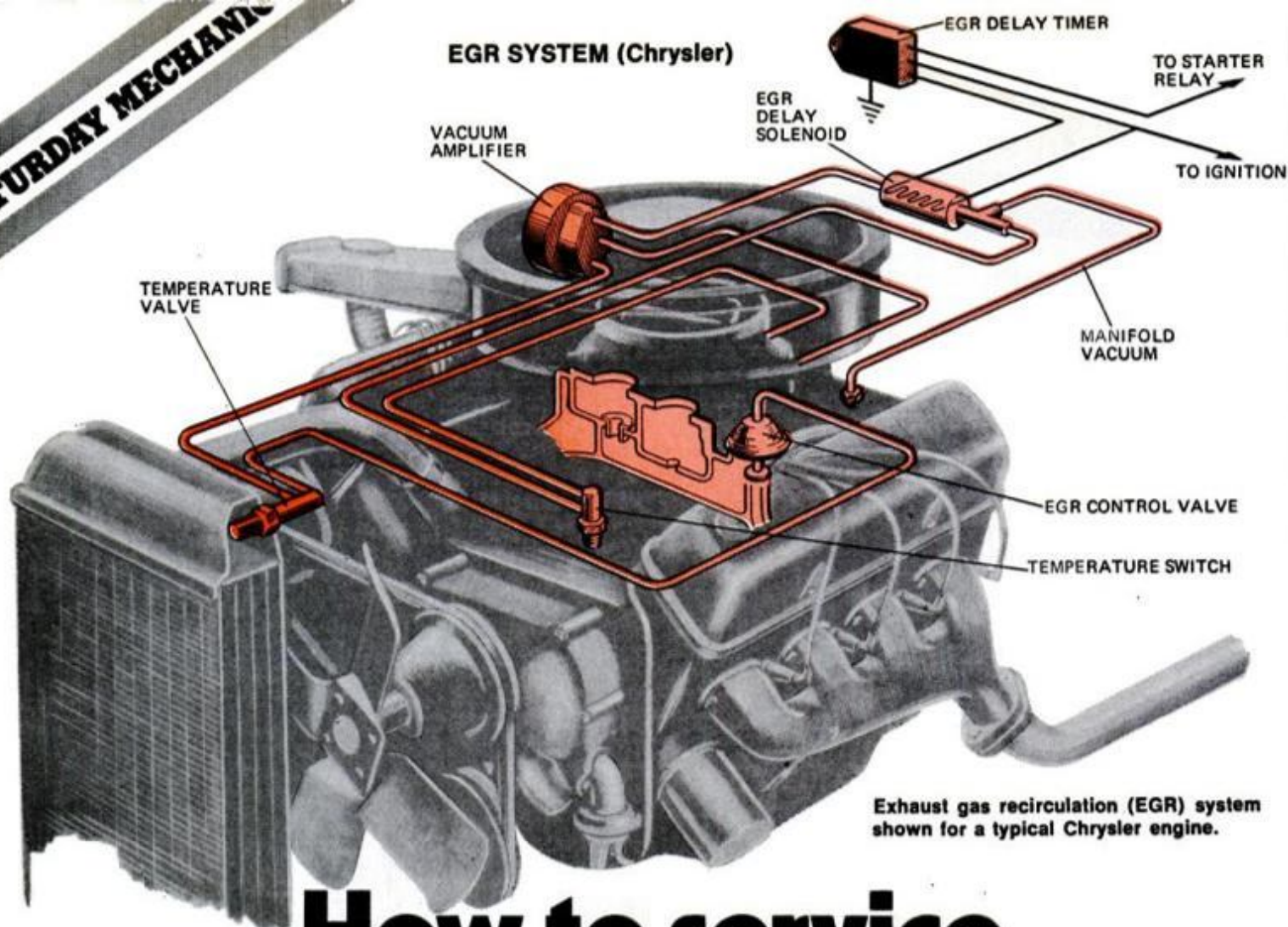
cal information about strange waters—or not heading for port when conditions threaten—cause trouble every year. A sudden gust of wind ahead of a squall can capsize a small sailboat or motorboat in a moment; it's the most frequent small boat accident.

Adverse wind and water can also slow you down and use more gas, so carry an extra supply to be safe.

10 **Sunshine and beer.** A blazing sun, with glare reflecting from the water, can give you a quick sunburn and

a large thirst. Too many boatmen feel they are away from troubles and traffic on the water and don't need to be alert and sober to operate a boat. Accident statistics show they are wrong. Any gear aboard not maintained in good condition might fail if the water gets rough and the skipper isn't alert. Each year some groggy owner tries to fill his gas tank through a fishing-rod holder or stern-flag socket, hits the starter and gets blown into the water. For safety, stay sober, stick with your boat if you end up overboard, and always tell friends when to expect you back home. **FM**

EGR SYSTEM (Chrysler)



Exhaust gas recirculation (EGR) system shown for a typical Chrysler engine.

How to service your catalytic converter and EGR system

By Mort Schultz

Get a gas mask. The first batch of catalytic converters put on cars in 1975 is about to expire.

A catalytic converter, which is the muffler-shaped container hung under a car with the exhaust system to cut down on hydrocarbon and carbon monoxide emissions, has a life expectancy of 50,000 miles.

Those screwed-up EGR systems are going to make matters even worse. The EGR—shorthand for exhaust gas recirculation—is a means of lowering combustion temperature so oxides of nitrogen, pollutants that develop in a high-temperature environment, are kept in check. This is done by recirculating metered amounts of exhaust back into the combustion chamber, which slows the combustion process and

lowers the combustion temperature.

The EGR has become a forgotten soldier in the fight to contain air pollution. According to a report issued by the Environmental Protection Agency last November, malfunctioning EGR systems ranked third, behind carburetor and ignition, in "malperformance" of emission control-related equipment in new cars.

If this is true for new cars, it is safe to assume that EGR systems in older cars are in worse shape. The system went into nationwide use in 1973 and is supposed to be serviced at between 12,000 and 24,000 miles, depending upon the car.

The catalytic converter and EGR system are easy enough to keep in shape. And if you live in a state

with mandatory emissions inspection, you don't have a choice.

Types of catalytic converters

There are two types of catalytic converters on U.S.-built cars. One is filled with thousands of alumina pellets. Alumina is an aluminum oxide. Pellets are coated with a combination of platinum-palladium, or platinum-palladium-rhodium catalyzing agent. The other, called a monolithic converter, contains a one-piece extruded honeycomb material that is coated with a platinum or platinum-palladium catalyzing agent.

American Motors and General Motors vehicles have the pellet-filled units as main converters, but in some situations (noted below)

CATALYTIC CONVERTER

PM art: Fred Wolff

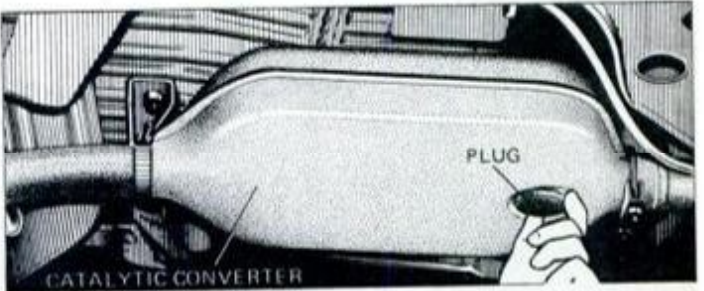
EXHAUST OUT

EXHAUST IN

Three-way design catalytic converter is the latest state of the art. Platinum and palladium oxidize HC and CO in exhaust to H₂O and CO₂. Rhodium reduces the NO_x levels.

CERAMIC-PELLET SUBSTRATE (PLATINUM, PALLADIUM, RHODIUM)

Pellet-type catalytic converter has plug on the bottom side. When the converter needs to be rejuvenated, only the pellets need to be replaced. Vacuum pump sucks out the spent pellets, then a vibrator tool jiggles in the fresh pellets.



they also use monolithic converters. Chrysler and Ford employ monolithic converters.

Monolithic and pellet converters function the same way. The catalyst oxidizes exhaust from the engine into carbon monoxide (CO) and hydrocarbons (HC) into harmless water (H₂O) and carbon dioxide (CO₂).

In the process, the temperature inside the converter rises to a level somewhat higher than that of the exhaust gases. However, insulation inside the converter keeps the outside skin at about the same temperature as the muffler.

So much for the early scare that converters would burn up the nation's woodlands. Also proven unfounded was the fear that catalytic converters were filling the air with sulfate and sulfuric acid. According to a GM report, "The amount of sulfate and sulfuric acid coming from the exhaust of catalytic converter-equipped cars is so small that it can be measured only by very sophisticated and sensitive instruments."

The main difference between pellet and monolithic converters, other than construction, is that the pellet converter can be serviced. Pellets can be replaced when they become ineffective. When the catalyst-coated honeycomb in a monolithic converter gives out the entire converter is replaced.



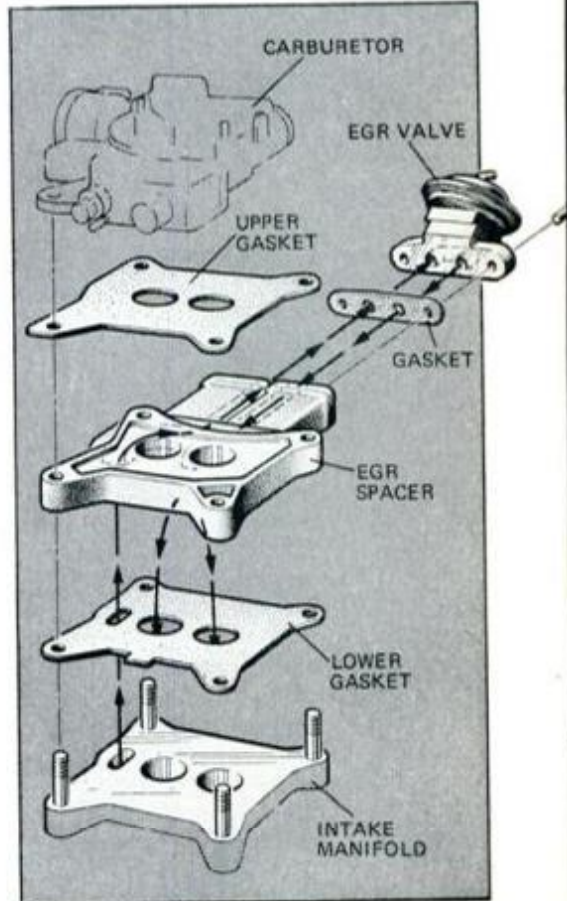
EGR valve diaphragm pulsations can be felt and are check of proper operation.

of a do-it-yourself job than replacing pellets, because no special equipment is needed. The unit is replaced the same way a muffler is replaced. Ironically, however, replacing a monolithic converter yourself (or pellet converter, if necessary) is more expensive than having someone replace pellets.

Depending on the engine, a new monolithic converter costs \$125 to over \$200. It is doubly expensive if the car has dual exhaust, which requires a converter for each exhaust system.

Having pellets replaced by a shop runs about \$100. If you have to replace an entire pellet converter, the cost is \$200, but this is neces-

(Please turn to page 104)



EGR assembly and carburetor are shown for Ford engines. Replacement of the EGR assembly is an easy job.

Replacement procedures

Perhaps surprisingly so, replacing a monolithic converter is more

Ear conditioners: Shape your own sound environment

New gadgets and recordings can help you concentrate better or sleep more soundly.

by Dave Sagarin



Photo: Stephen Fay

As I write, I'm surrounded by the sounds of a cornfield on a hot summer's day—the buzz of an occasional fly, the drone of stationary insects, the rustling of the cornstalks. A bird is sitting in a tree a hundred feet away, and a few minutes ago I was aware of a car on the dirt road.

I'm not really sitting in that cornfield, and I'm not really paying close attention to the sounds. They're coming from a record. But I find that the background of rustic noises makes me feel good, and that I can concentrate or read with greater absorption.

A number of "environmental" sound sources are now on the market, with more coming. Some are natural recordings. Some are synthetic, with sounds produced and modified electronically. And some are mechanical "white noise" sources.

The claimed benefits of these sound sources are stated in numer-



Sources of environmental and offbeat sounds: 1. Edmund Professional Sound Conditioner synthesizes and controls sounds of wind, surf, rain and waterfall. 2. Sleep Mate generates gentle, constant "white noise." 3. Environments records offer a wide range of natural and artificial sounds for background use. 4. Auditory

ous ways: to provide a "carpet of sound" which tends to screen out jarring, intrusive noises; to help you generate tranquilizing brain waves; to help you sleep; to help you concentrate; to improve your love life.

Well, it *does* sound like snake oil

illusions records show phenomena in the psychology of perception. 5. Graymark Computer Sound Effects Generator provides a spacy burble of bleeps. 6. Wind-generator circuit from PAIA in case. 7. PAIA's Chord EGG. 8. PAIA's electronic wind chimes. 9. PAIA's surf board. 10. Jupiter Tranquil—white noise from space.

they're selling. And there are people who consider the whole idea of controlled environmental sound a needless complication. I know a five-year-old who enjoys listening to white noise but can't work or sleep with it on. I know two good chess players. One plays classical

music all the time, the other natural sounds. There's a "home-court advantage": each usually wins with his sound.

When I think of summer sounds—children playing, airplanes, a power mower down the block—coming through open windows, they're vastly different from winter, when windows are shut and outdoor sounds are muffled by snow. Sounds can evoke the deepest levels of personality, and this is a part of the magic of environmental sounds.

The cornfield, along with assorted recordings from swamps, woods, storms and seashores, is from a small New York company, Syntonic Research. Irv Teibel, guiding light of the firm, was not initially driven by any desperate need to give the world peace of mind. He had bought a top-quality tape recorder because he admired it. Looking for things to do with it, he started recording sounds from the environment.

Playing those tapes back while working, he found he was concentrating well—something which had always been a problem for him before. He eventually realized that if he had found a solution for himself, perhaps others could use it too.

Teibel uses discs because each one gives over 1000 plays without noticeable deterioration. He has yet to find a cassette or eight-track tape good for more than about 600 plays. Durability is important because environmental recordings are intended for continuous use, while even a favorite music recording is rarely played more than a score of times a year.

This is where synthesizers and electro-mechanical devices have an advantage. They "play" as long as you wish. Natural-environment recordings may be more interesting to some people, but synthetic sound works fine for many others.

Eliminating brain static

Dr. Lou Gerstman, professor of psychology at City College in New York, has a theory that may explain why environmental-sound sources help us concentrate. In most people, half the brain (usually the left) deals with structured thought—reading, computation and direct interaction with the outside world (see-reach-touch). The other side of the brain amuses itself on a different level, dealing with abstract thoughts, fleeting images and feelings.

Dr. Gerstman suggests that the right brain produces a level of "noise" that interferes with the left brain's ability to function. The en-



vironmental sounds may interest the right brain and keep it involved, so that it quiets down and stops sending static to the left brain, which can then get down to business.

What exactly is *noise*? "Noise" is the word we use to describe sounds we don't like. In science, noise is information we don't happen to want: static in electromagnetic signals, flare in a lens, a subway train disturbing a seismograph. In a very quiet room what may disturb us is not exactly the quiet, but the way any intermittent, distant noise—the telephone ringing in the middle of the night—is jarring, while the same sound in context—a phone ringing in an adjoining office—goes unheard.

"White noise" is the term for sound that's made up of a random mixture of frequencies and intensities—the static hiss between stations on an old radio is a perfect example.

White noise can be generated by a transistor selected for its noisiness, by that old radio, by a fan or by wind or waves.

'White noise' kits

The noise generated by the transistor can be led through circuitry to make it simulate natural sounds. PAiA Electronics offers several modified-white-noise devices, sold as kits to be wired up and hooked to your present audio system. There's wind, surf, wind chimes and the "Chord EGG" (Encephalo-Gratification Generator).

The kits require battery power supplies and come without cases for \$14.95 to \$24.95 each. A case that takes surf, wind or wind chimes is \$4.50. (Available from PAiA, Box 14359, Oklahoma City, Okla. 73113.) The kits are of a low-intermediate level of difficulty—you really shouldn't tackle one as a first effort, but they're not very hard to make.

The wind chimes, after careful tuning, give a continual, slow-pulsed series of clickings and random tones; you first listen for sequences, but eventually accept the randomness. The Chord EGG produces a constantly changing series of slow, pulsed chords. You'll probably either love it or hate it.

A new PAiA offering (which I haven't tried) is the Chatter Jammer, a little \$7.95 kit with two earplugs that generates a constant hiss, and is intended solely to block out offensive environmental noise.

Kits from Graymark International are primarily for the educational market; they're sold with components, printed-circuit boards and cases separate, and the boards come undrilled. The company's Computer Sound Effects Generator, about \$22 complete, makes adjustable sounds that remind you of R2D2's comments in *Star Wars*. Graymark's address is 1751 McGaw Ave., Irvine, Calif. 92714.

Jupiter Tranquil, a cassette recording from Shields Products, Inc., 1104 Prospect Ave., Cleveland, Ohio 44115, is the result of interaction between the magnetic field of the giant planet Jupiter and its moon, Io. Cascading radiation is produced. Though recorded through a radio-telescope, it sounds like varying white noise generated locally.

Marpac Corp. manufactures a range of sound generators, both electromechanical (using a fan to make the noise) and fully electronic. The fan-type Sleep Mate 500 has a compact, unobtrusive body and variable ports to control the quality of the sound; it costs less than \$30. The model 900, identical outside, has a two-speed motor and tone control.

Rain, waterfall, wind, surf

The electronic model 1200 (about \$130) makes rain, wind, waterfall and surf sounds. Imagine a constant roaring hiss. Turn it down to low volume and it's rain. Louder, with some of the highs filtered out, it's a

(Please turn to page 132)



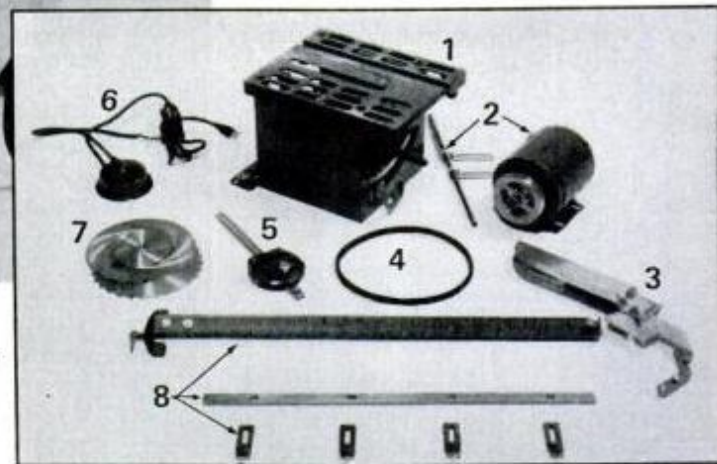
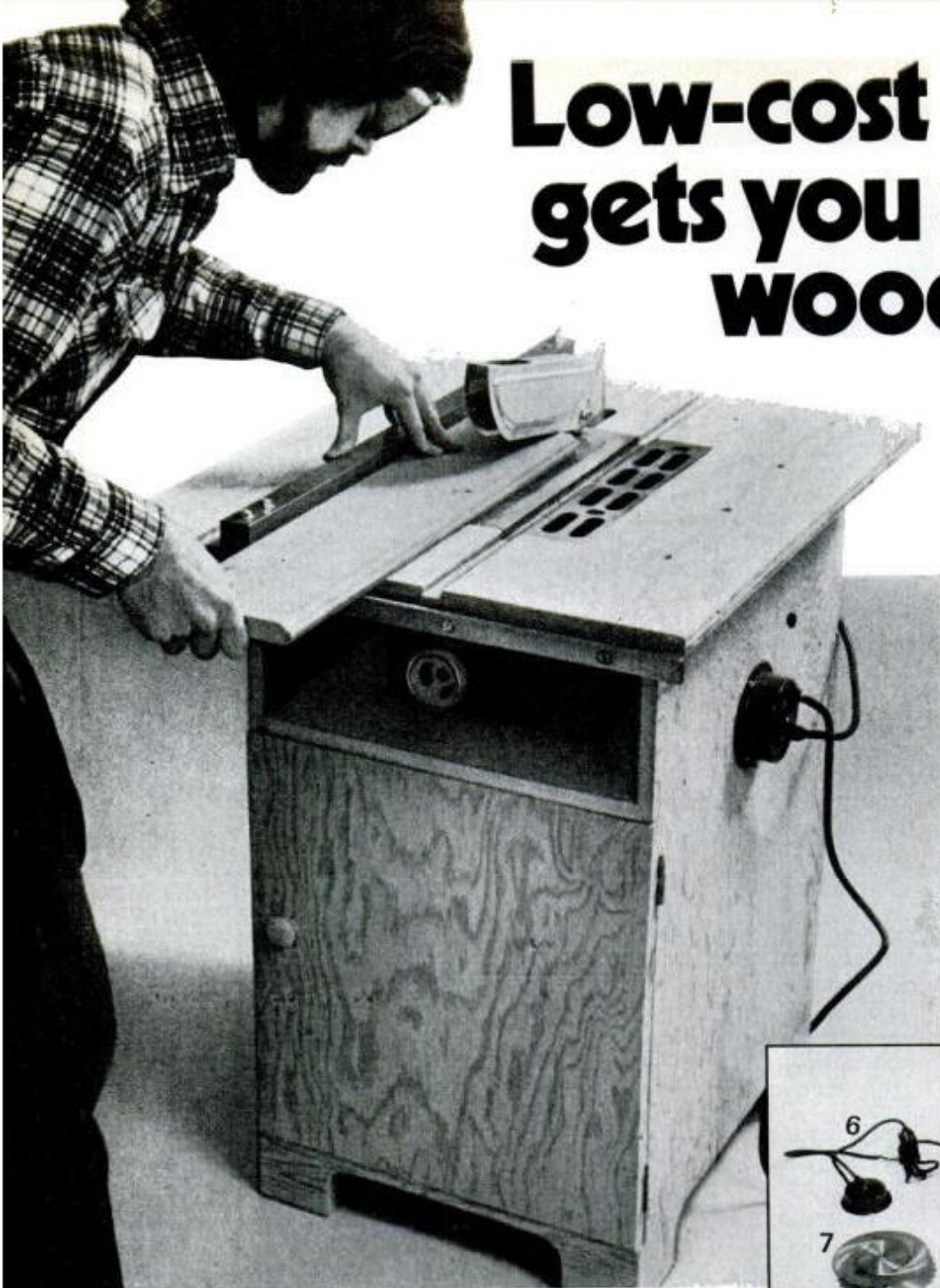
Low-cost table saw gets you started in woodworking

PM reports on AMT's arbor saw; shows how to mount it in a homemade cabinet base.

by Joseph R. Provey
ASSISTANT HOME AND SHOP EDITOR

PM readers regularly write us and ask if those inexpensive mail-order power tools are for real. Most want to know how well a table saw that costs less than \$40 performs. To get the answer, I recently ordered one, put it together and then put it through its paces.

The one I selected is model No. 2165 from the American Machine and Tool Co., Fourth and Spring St., Royersford, Pa. 19468. The first thing I realized was that although the saw sells for just \$39.60, my total cost to complete the setup would be more than \$100.



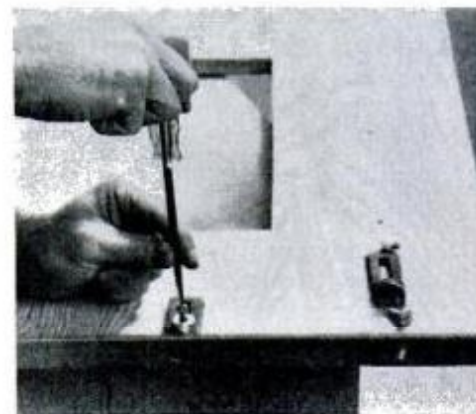
What you get: (1) 8-in. tilting-arbor saw with $\frac{5}{8}$ -in. arbor; (2) GE electric motor (1725 rpm) with 4-in.-dia. pulley and motor mounting assembly; (3) guard and splitter; (4) $\frac{1}{2}$ x 29-in. standard V-belt; (5) miter gauge; (6) on/off switch, power supply cable; (7) combination blade (plywood blade is extra); (8) rip fence assembly for cabinet base. (Motor and fence assembly are extra.)



To begin cabinet/base construction, cut plywood using a clamped-on straightedge and portable saw—or use a handsaw.



To make table-saw cutout, bore 1-in.-dia. holes at corners—then use a keyhole saw or set-tooth blade in sabre saw.



Fence guide bar is supported by four brackets fixed under front edge of table with 1-in. No. 8 rh screws, 3/16-in. washers.

Here's the actual breakdown:

8-in. tilt arbor saw, \$39.60

Electric motor, \$29.90

Rip fence assembly for cabinet base (A354C), \$6.50

One 4x8 sheet, 3/4-in. A-C plywood, \$24.50

Misc. hardware (hinges, screws, door pull), \$3

Total, \$103.50

Note: Optional ball-bearing 1/2-in. arbor assembly (No. A359), which converts saw into heavier duty ball-bearing model, is \$9.50 extra.

If you have a spare washing machine motor, you can save the price of the motor offered with the saw. Be sure your motor is at least 1/2 hp. If it's rated at 3450 rpm instead of 1750 rpm you'll need a 2-in.-dia. pulley and a 26-in. standard V-belt in place of those supplied.

Although you can't expect the high performance of a \$400 model, this light-duty table saw will accomplish most home workshop tasks with ease, speed and accuracy. It makes especially good sense if you're setting up a shop for the first time and don't want to invest in an expensive saw for the present. After awhile you might trade up.

Lever locks blade elevation

Niceties, like a self-aligning fence, are missing, but there are some features that make good sense. The saw blade elevation adjustment, for example, is not the typically bothersome crank—it's an easy-to-use lever that locks in position with a second, cam lock lever. The hardware used to put the tool together is standard, thus easy to replace without having to order specially machined replacement parts. The saw also accepts standard attachments like dado and molding cutters, wire brushes, grinding wheels and sanding discs.

Plans for constructing the cabinet base from one 4x8 sheet of 3/4-in. A-C plywood come with your saw. The enlarged plywood table (23 7/8 x 27 in.) makes it easier to control large workpieces. Overall table height is 32 1/2 in., but this can be changed to suit your preference.

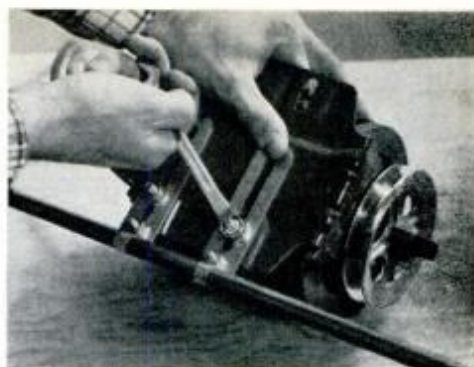
Careful attention to several critical steps during construction and installation of the cabinet base and saw will assure safe, accurate cutting. The first such step is to make certain the grooves are cut in the cabinet sides at precisely the right heights to prevent a lopsided saw shelf. Grooves—and later the miter gauge slots—are easy to cut with a dado bit chucked in a router. Or you can make repeated passes with a portable circular saw guided by a fence. Smooth out any rough spots in groove bottoms with a chisel.

The manufacturer's plans suggest a method whereby repeated passes of the workpiece over the table saw

[\(Please turn to page 134\)](#)



Attach black and white wires to leads (either wire to either terminal). Secure green (ground) wire to cover plate screw.



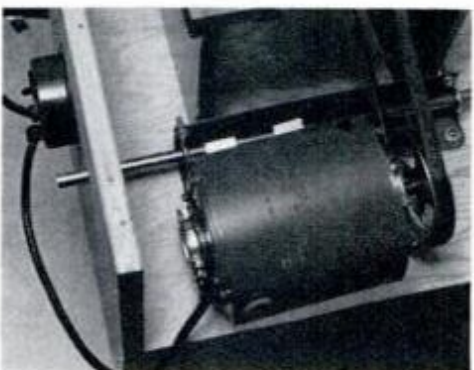
Motor mount assembly consists of a pair of rails, clamps and a rod. Bolt to motor base with carriage bolts as shown.



Motor is suspended by drive belt—and allowed to slide or pivot on rod supported by two eyebolts fastened to saw bottom.



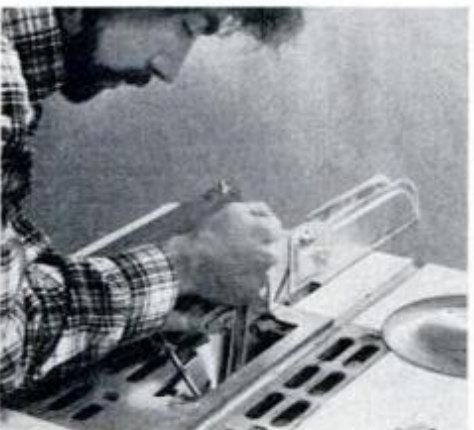
Locate switch within easy reach—but not where it can be bumped and accidentally turned on while making adjustments.



When saw is set for bevel cut, motor must be free to slide. Bore 3/4-in. hole to allow rod to pass through side of cabinet.



Use 1 1/2-in. No. 8 fh wood screws to fasten table to base. Countersink heads to prevent workpieces from being snagged.



No-frill saw design makes for a few inconveniences. Blade-changing (above) requires removal of finicky, five-piece plate assembly to get to blade. The opening is also too small for easy blade exchange. However, saw will cut bevels in 2-in. stock (right)—frills or no frills.



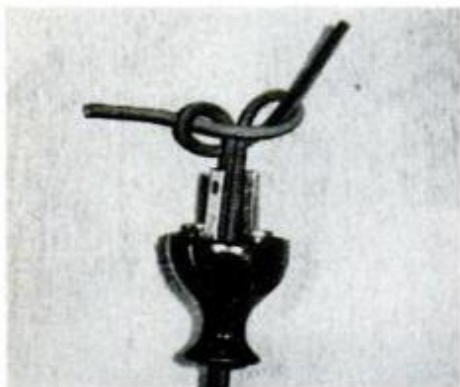
WORKSHOP MINICOURSE

ELECTRICAL PLUG REPAIR

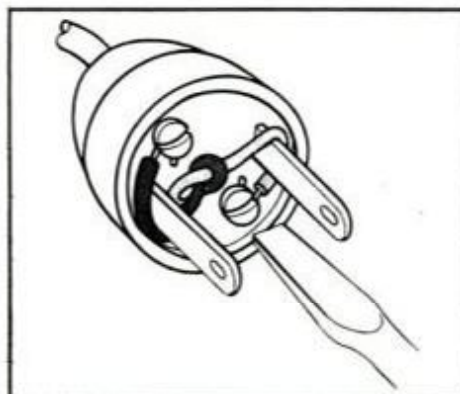
If you have an appliance or lamp that is working intermittently there's a strong possibility that the problem is either a damaged plug or line cord, or both. Since a professional charges about \$7.50 to replace a plug—and the job is really easy—we've spelled out the basics here so you can pocket those dollars. When replacing a plug, check line cord for damage, and cut off damaged wires; if necessary, replace entire cord. Make certain that all plug connections are absolutely tight.



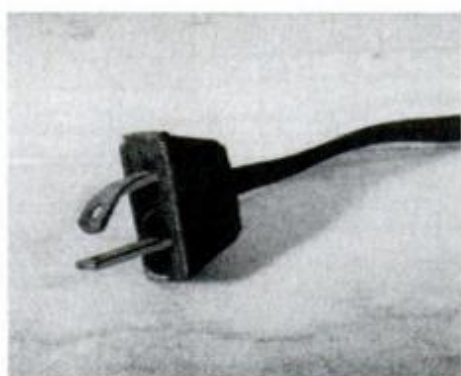
1. Cut off the old plug. If wire is damaged, cut off the damaged section.



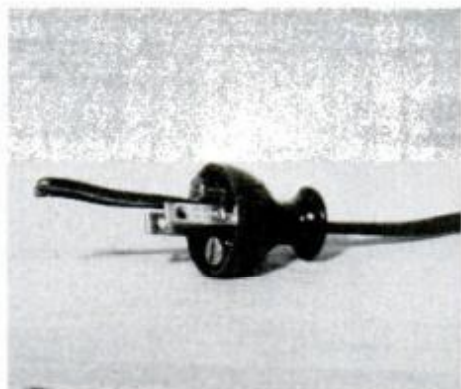
4. Next, tie an Underwriter's knot as shown, pull knot tight to fit plug.



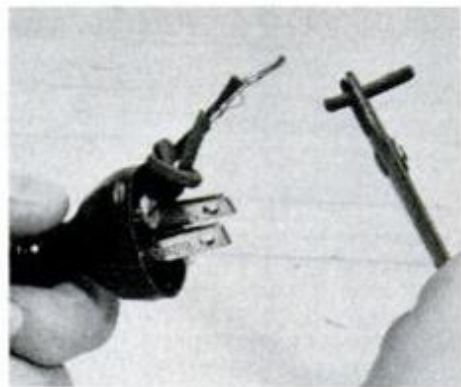
7. Wrap a wire clockwise around each terminal screw, then tighten screws.



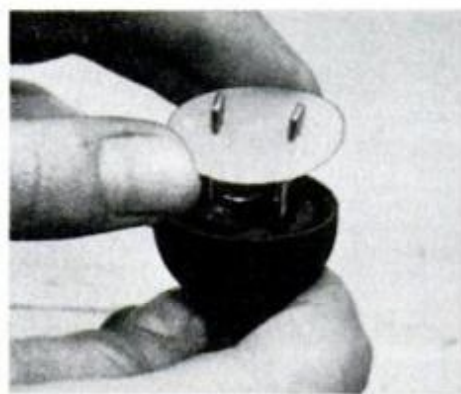
When a plug looks like this, don't fiddle with it to make it work—replace it.



2. Remove plastic cover that comes with new plug, and slip plug onto cord.



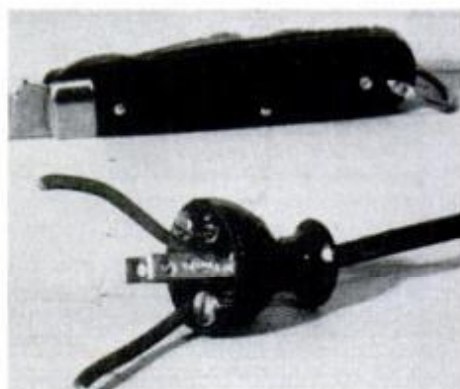
5. Strip about 1/2 in. of insulation from ends of both wires; don't break wires.



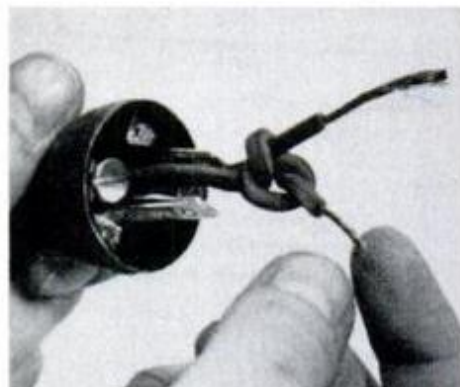
8. Replace the small plastic insulator-cover on the prongs of the plug.



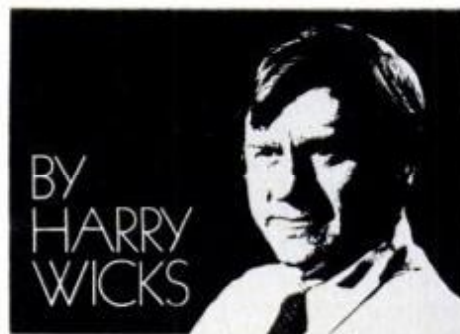
To do that get a UL-approved plug, screwdriver, wire stripper and knife.



3. Use pocket knife to separate the two wires. Do not nick the insulation.



6. Twist wire strands together tightly using a clockwise direction-of-twist.





Hooked up to the tuner output of a small AM/FM portable radio and driving two Poly-Planar foam speakers (here encased in grille cloth and a simple wood frame), the booster amp gives clear sound at surprisingly high volume levels. The amplifier itself is on the small circuit board inside the box below—batteries take up most of the available space.

Build a booster amp for big sound from small radios



This simple circuit and a loudspeaker will turn your transistor portable into a take-along hi-fi system.

by Jeffrey Sandler

There's beautiful sound trapped inside your AM/FM transistor radio, but you might never know it. What starts out as a good signal is degraded as it passes through inexpensive amplifier stages, then loses still more quality fighting its way out through a 2-in. loudspeaker.

But with our booster amplifier, you can get hold of that clean, original signal, crank it up and drive speakers with all the volume you'll need, even outdoors. With highly efficient speakers like Poly-Planar P-40s, the sound quality is superb. In PM tests, the booster amp performed just like a.c.-powered receiver-speaker combinations in the \$100

to \$125 price range. The sound is so good it has to be heard to be believed.

But this booster amp is compact and battery-powered. It turns your transistor radio into a completely portable hi-fi receiver. It's not stereo, of course, and it's *not* intended for a.c. operation—using the amp with a non-battery power supply or with a line-powered radio could present a shock hazard.

The circuit is designed around National Semiconductor's LM386 chip, a low-voltage audio power amplifier that steps up a signal 20 to 200 times. Here the gain is set at 200 by means of the 10-mfd. capacitor between pins 1 and 8. The

amplified signal appears at pin 5 and drives the loudspeakers.

The other circuit components set up proper IC operating conditions. One 220-mfd. capacitor filters the battery power supply; the other keeps d.c. voltage out of the speakers. The 10-mfd. capacitor between pin 7 and ground provides additional supply filtering. The 5.6-ohm resistor and .1 mfd. capacitor off pin 5 and the .1-mfd. at the minus input (pin 2) prevent instabilities. The .1-mfd. capacitor between the volume-control pot and pin 3 blocks d.c. from the input.

Build the circuit by following the

(Please turn to page 117)

How to use your wood lathe like an expert



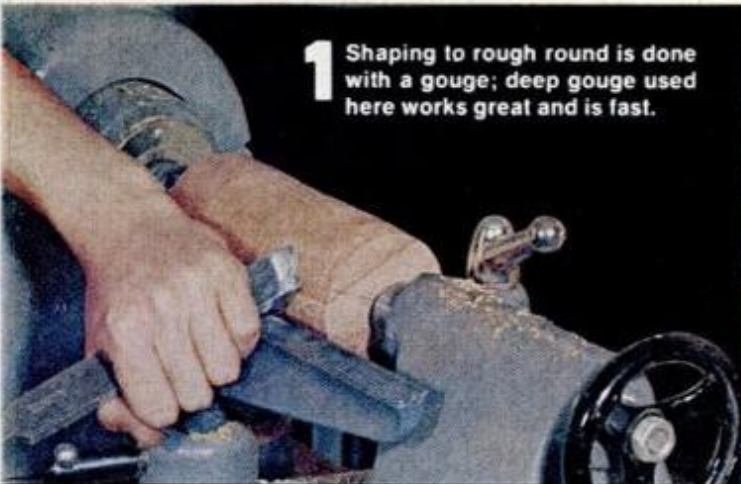
Handsome objects for daily use are easier to turn than looks imply.



Tools that will get you started: chisels, oil-stones, quality book.



1 Shaping to rough round is done with a gouge; deep gouge used here works great and is fast.



2 Next, use the parting tool to cut to desired depths; check cut often with a caliper.



3 Use fine, then very-fine sandpaper shoeshine fashion to smooth the turning spindle.



4 Before removing piece from lathe, check its shape against pattern for the turning.



5 Final smoothing is with 000 steel wool; note that the turning is now faceplate mounted.



6 Finish is applied before stand is removed from lathe; next, it is glued into its turned base.



Using scraping methods you can turn wood successfully on your first try. But you must first master the basics.

by Harry Wicks
HOME AND SHOP EDITOR

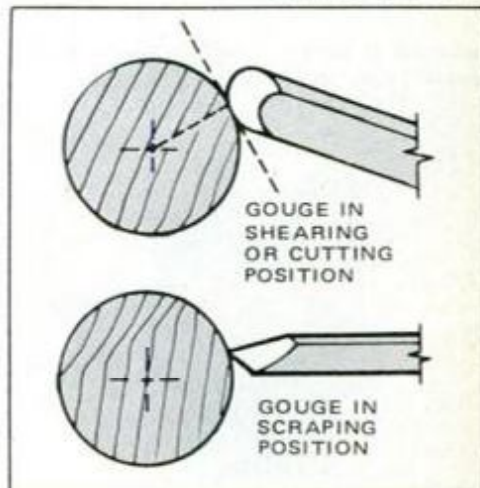
Though a wood lathe is the one shop tool that almost guarantees shop satisfaction, many workshopers shy away from the tool because they believe it takes some kind of "special" skill to master a lathe. If you have such reservations, you are depriving yourself of a great deal of shop fun and creative satisfaction.

For openers, the lathe is the *only* shop tool that will let you turn out a completed product all by itself. You can shape, glue, assemble and finish without ever leaving this remarkable tool. The items in the photo at the bottom of the facing page were all turned out using only the Delta/Rockwell lathe shown.

It is not an exaggeration to say that you can, in fact, turn out a handsome project on your very first try by using scraping methods. I have students in my woodworking class who have proven that fact semester after semester. But you do owe it to yourself to learn the basics before switching on the lathe.

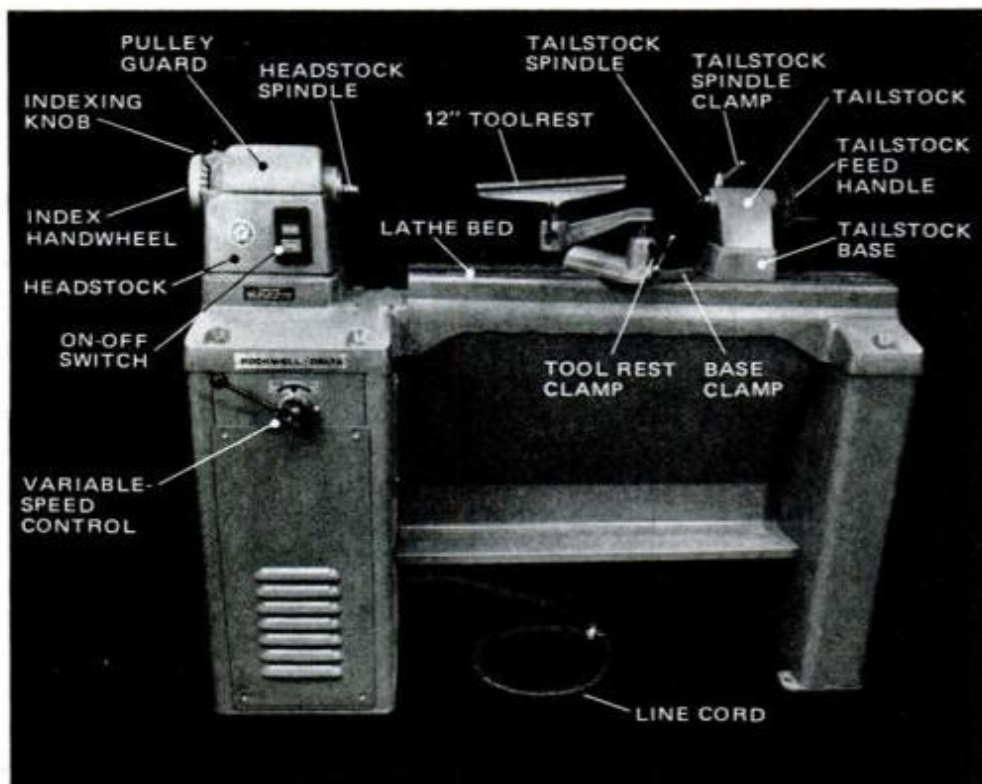
Since there are so many tech-

PM photos by the author



Shearing position gives clean smooth cut, but scraping is better for beginners.

Tools of the woodturner's trade



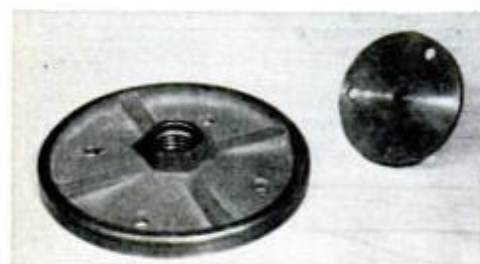
Familiarize yourself with the purposes of important lathe components identified here.



Toolrests come in various sizes, shapes. Shown are 6- and 12-in., and right-angle.



Assortment of inside and outside calipers is needed to check diameter of work.



Faceplate is used for turning bowls; it is threaded onto the headstock spindle.



Screw (left), drive and spur centers; the first is for small faceplate work.



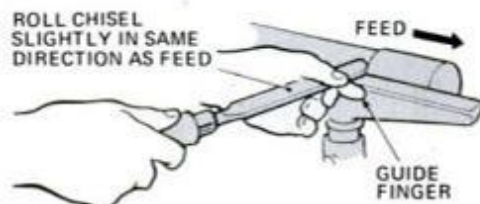
Drive center fits into headstock spindle, turns the work driven between centers.



Cup, or dead, center is used at tailstock to support the outboard end of spindle.

niques and skills that you can use and develop on the lathe, it would be presumptuous to think that we could tell you all that you need to know in a few pages of this magazine. So, instead, during the next 12 months we will present several lathe articles in a logical progression of the skills and tools needed. The first installment zeroes in on the basics—the tool and the accessories that are used with it.

The quickest and easiest way to get yourself into safe and satisfy-



Right way to rough a blank round; gouge is rolled slightly in direction of travel.

ing woodturning is with the help of a good book of instructions. One of the best that I have come across is shown on the opening page—*Creative Woodturning* by Dale Nish, Brigham Young University Press. I like Nish's technique of showing attractive and sensible projects, and then giving instructions for duplicating them. The book is available for \$8.30 postpaid from Woodcraft Supply Corp., Dept. PM 778, 313 Montvale Ave., Woburn, Mass. 01801.

About wood lathes

The label *wood lathe* is generally used when referring to a woodturning lathe to avoid any mixup or confusion with its cousin, the screw-cutting metalturning lathe.

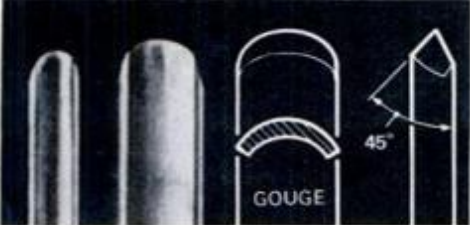
A wood lathe is designated according to the maximum diameter of work which can be swung over its bed. Thus, a lathe that can handle a 12-in. diameter piece of wood is called a 12-in. lathe.

The important parts of a lathe can be seen in the photos at the left. Basically, a lathe consists of a headstock, a tailstock and a toolrest. The latter is comprised of the rest itself mounted in a base that slides along the bed. There is a variety of rests available and these can be interchanged to suit the task at hand. At the least you should have both 6- and 12-in. rests, as well as the right-angle rest for faceplate turning.

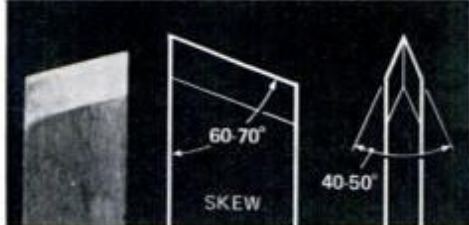
Though there are two types of headstock spindles, solid and hollow, most—like the lathe shown at top of this page—are hollow. The hollow spindle is internally tapered at both

(Please turn to page 128)

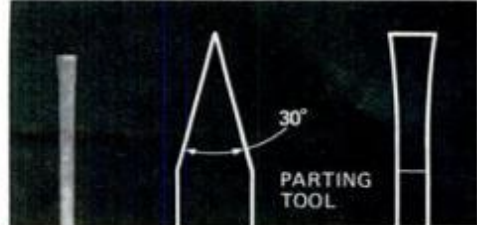
Guide to the lathe chisels you'll need



Gouge is the cutting tool that you will use most often; its cutting edge is beveled on convex side (about 45°). Use a gouge for roughing out stock and to reduce stock to cylindrical shape. Gouges are available in widths from 1/4 to 1 in.



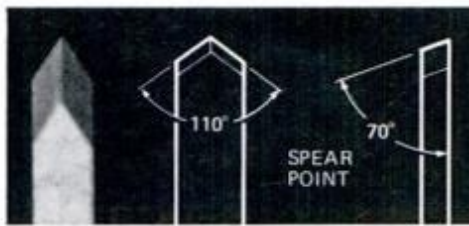
Skew chisels feature a cutting edge that is at an angle to the side of the tool (around 70°). Generally, both sides of the cutting edge are beveled as shown. Use a skew to make V cuts, beads and tapers; available in sizes from 1/4 to 1 1/2 in.



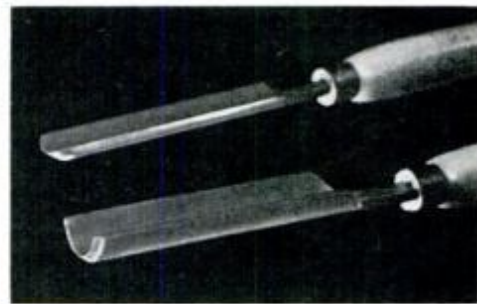
Parting tool has flat sides and a square bottom, is used to make narrow grooves to desired depths. Note that the tool is thicker at the center of the blade than at the edges, center thickness determines cut width. In sizes from 1/2 to 1 in.



Round-nose chisel can be used for coves and the like in spindle turning, for concave cutting in faceplate turning (bowl interiors). The tool is used with a scraping action; a sharp one produces a very smooth cut. Sizes from 1/4 to 1 in.



Diamond point chisel is also a scraping tool. It is used whenever its shape is needed to fit the turning being worked. The most common size used is 1/2 in, but you can grind other chisels to a diamond point to custom-suit the job at hand.



Standard gouge (top) and extra-deep gouge from Woodcraft Supply. The latter lets you rough-round stock incredibly fast.

How to sharpen your turning tools



To restore cutting edge to correct angle, grind tool on grinding wheel with true face.



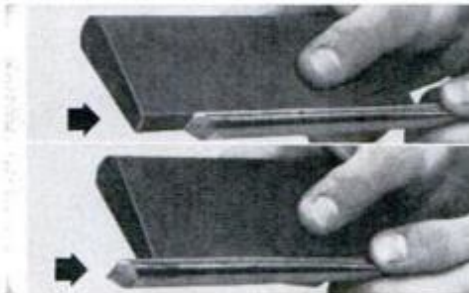
Gouge bevel can be ground as above or as in photo at left. Watch bevel carefully.



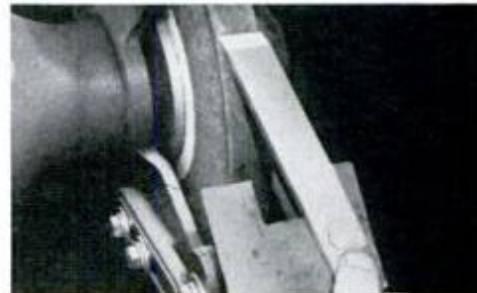
To whet the gouge, pour oil on oilstone, stroke the gouge using a circular motion.



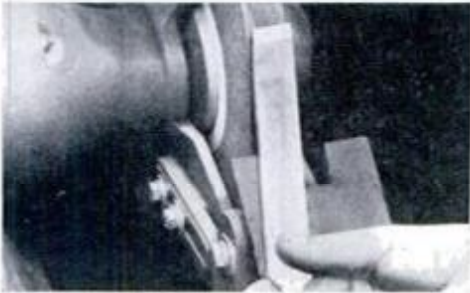
As gouge is moved in circular motion, rotate the beveled edge from left to right.



Next, slipstone is placed on concave side as at top, then pulled downward (bottom).



To grind a skew, let bevel contact wheel face then move it back and forth slowly.



Next, flop chisel and grind second side. Note: Correct angle must be maintained.



To whet skew, pour oil on stone, keep bevel in full contact, use figure-8 motion.



When "wire" forms on the edge, turn the skew over and whet its second bevel.

A well-designed family room provides the setting for a variety of activities. It should be functional enough for day-to-day living, cozy enough to let you curl up with a good book—and adaptable for a party. The room shown below features a breakfast/snack counter that readily converts to a refreshment bar when friends come to visit. A contemporary, wrap-around sofa with cushions and pillows offers plenty of seating. The center of attraction is the fireplace wall, complete with fire-simulating electric logs and a log-bin. It keeps the setting intimate and has a raised hearth that doubles as additional seating. These ideas were developed by designer Shirley Regendahl for PPG Industries.

The key to any multipurpose room is to keep the plan simple—and furniture durable and easy to clean. Avoid unnecessary overcrowding with furniture. It can reduce the utility of any living space. Route traffic around (not through) the area used for relaxing, to prevent it from seeming unsettled and hectic.

Coherent visual impact, also helps make the user feel good about the room. For example, it would be disorienting to have the snack counter

5 great projects for a family living center

How to create a room that serves as the hub for your family's indoor activities.

Photo: Hans Van Ness

visually intrude upon the lounging area. In this instance, the designer used graphics painted on the floor to distinguish the two areas from each other. A solid wall would have done the same thing, but then you couldn't use the two areas jointly.

An area with several zones of activity also needs to be visually unified. To achieve this, the unpretentious look of rough-textured wood was specified. Not only are the walls, hearth and bench front paneled, but the ceiling as well. To obtain this textured-wood effect without the expense of rough-sawn wall and ceiling panels, 8-in.-wide strips were ripped from 1/4-in.-thick sheets of C-D plywood. The stains used are from Pittsburgh Paints' new Rez Wood Stain System. Semitransparent Graywood Frost is used on walls and ceiling, while the fireplace wall is a complementary Portsmouth Blue. For details on adapting any of these projects to a living center of your own, read items one through five and see drawings.

1. Snack counter

This multiuse counter is sized for eating from one side only, but can

You'll find that this 16x16-ft. area can be recycled over and over, beginning the day as a place for breakfast, and ending the day as the perfect spot for the family to get together with a favorite table game.



be extended on the kitchen side to accommodate a four-place setting. For durable service, the surface can be covered and edged with plastic laminate. (See *How to Build Your Own Kitchen Cabinets*, page 141, April '78, for instruction on applying plastic laminate to a countertop.)

The bar surface may also be painted as shown in photo. Low-gloss, ebony enamel was used because it stands up to heavy-duty use and is easy to wipe clean.

Begin construction by cutting notches in legs. Use a dado head on

a table saw set for widest cut. A router can also be used with work-piece securely clamped in place. Test-fit all joints and then assemble frame with $1\frac{1}{4}$ -in. brads and glue. Clamp overnight. Use $\frac{3}{4}$ -in. plywood for shelves and countertop. Stain paneling to match the walls.

2. Painted floor

To paint runner design on floor, use a latex-based, urethane enamel to resist wear from heavy traffic. It cleans easily with a wet sponge and mild detergent. Our design has a



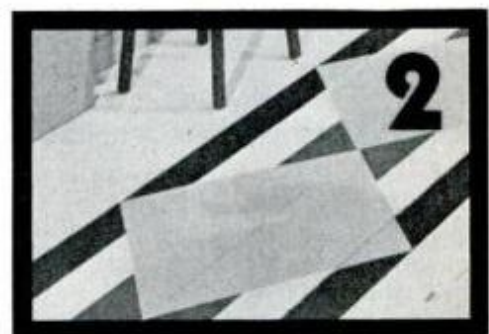
white background with Black Pearl stripes, Gray Wisp diamonds and Fleet Gray triangles. Use paper pattern when marking triangular and diamond-shaped areas. Masking tape applied to borders before painting will assure straight, clean outlines.

3. Wrap-around seating

This sofa will stand up to continuous use. Pillow coverings should be removable and made from washable fabric for easy cleaning. To build, cut out as many frames from $\frac{1}{2}$ -in. C-D plywood as required and notch for plates and cleats as shown. Seats and seatbacks should be made from $\frac{3}{4}$ -in. A-C plywood. The sofa back should be solid $\frac{1}{4}$ -in. A-C plywood. Panel the front to match the wall or use solid $\frac{1}{4}$ -in. A-C plywood.

When joining benches at a right angle, butt bench frames, then cut sheathing to fit. The seat and seatback will have to extend beyond the end of one section. Use $1\frac{1}{2}$ -in. No. 6 fh wood screws to secure the butt joint where seatbacks meet.

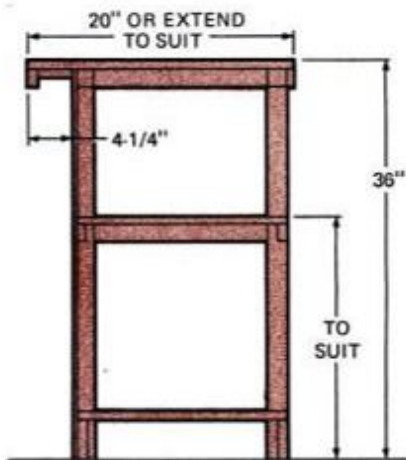
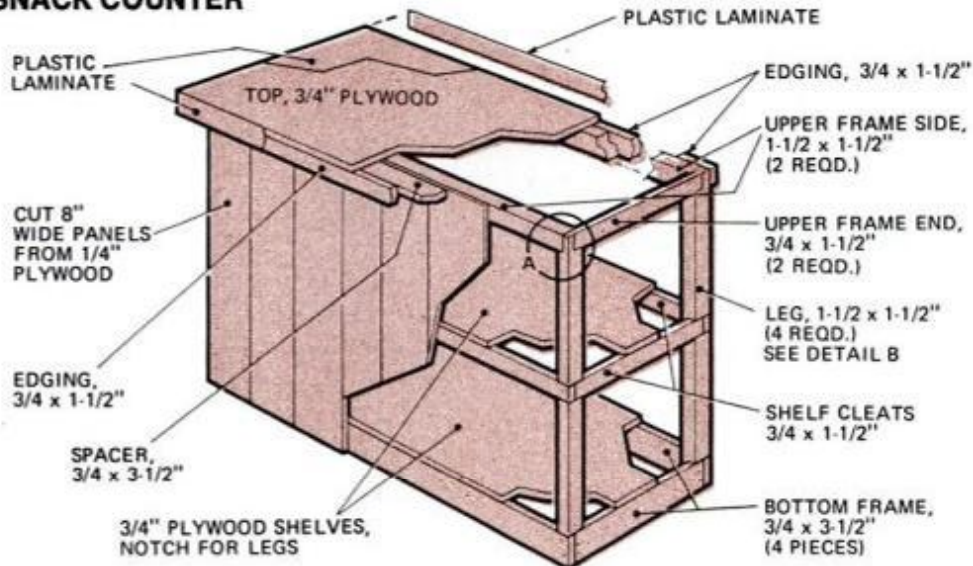
4. Fireplace wall



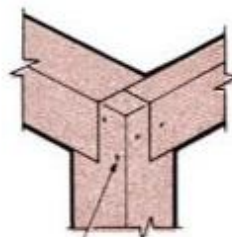
This wall may be thought of as an assemblage of three-dimensional and one-dimensional shapes. If the log bin and artificial fireplace with electric logs don't suit you, you might build book compartments and display shelves in their places.

Plan the openings you desire and build frames (as shown in log bin plans) to support a five-sided box, sized to suit. The only difference between constructing the $33 \times 46\frac{1}{2}$ -in. fireplace box and the log bin is that a larger header is required at

SNACK COUNTER

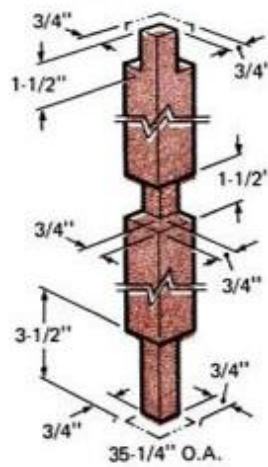


CROSS-SECTION VIEW



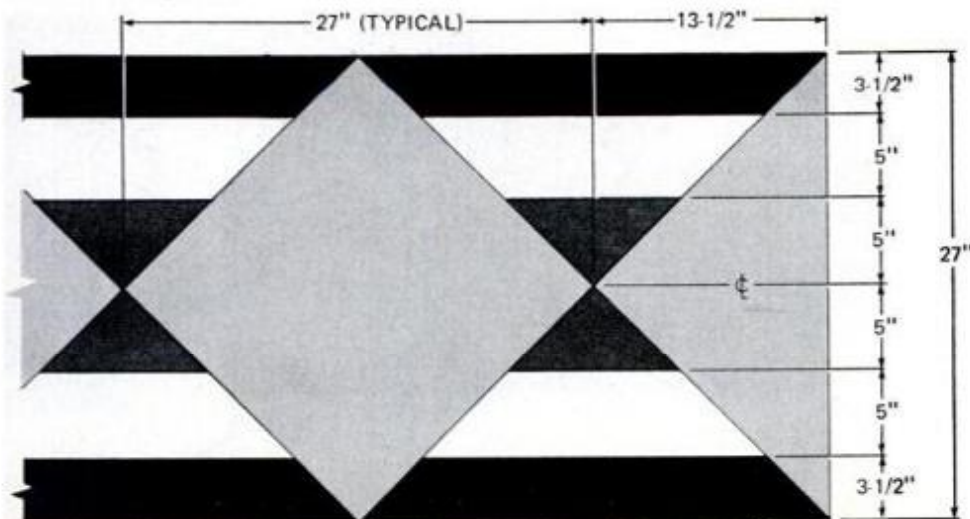
PRE-DRILL $\frac{3}{32}$ " PILOT HOLES TO PREVENT SPLITTING. FASTEN WITH 6d FINISHING NAILS, STAGGERED. (TYPICAL)

DETAIL A



DETAIL B

PAINTED FLOOR





the front of the firebox opening to support the weight of the stud, nailers and paneling above. Use doubled 2x4s nailed with wide face flush to the new wall surface. Trim all openings with $\frac{1}{4} \times 1\frac{1}{8}$ -in. lattice.

Construct wall of 2x4s, 24-in. O.C. The paneling is cut from $\frac{1}{4}$ -in. C-D plywood into 8-in.-wide strips. Apply stain before cutting plywood. Cut edges may have to be retouched later. Nail strips to wall at sole and top plates. Bridging halfway up the wall, also serves as a nailer.

5. Raised hearth

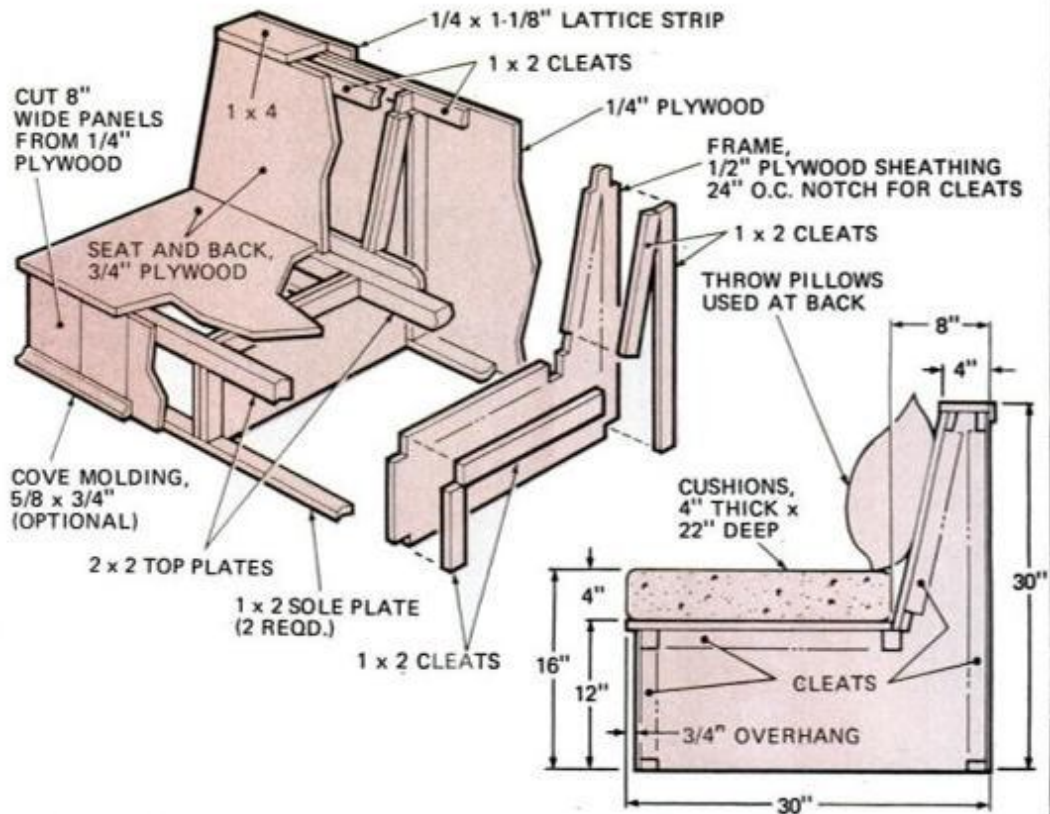


The hearth/bench is easy to construct. A 2x4 ledger strip nailed to the studs in the fireplace wall supports the back of the hearth. The front and ends are really a small wall, paneled and stained to match the fireplace wall. Use a 1x12 for the top, and stain to match seating and trim.

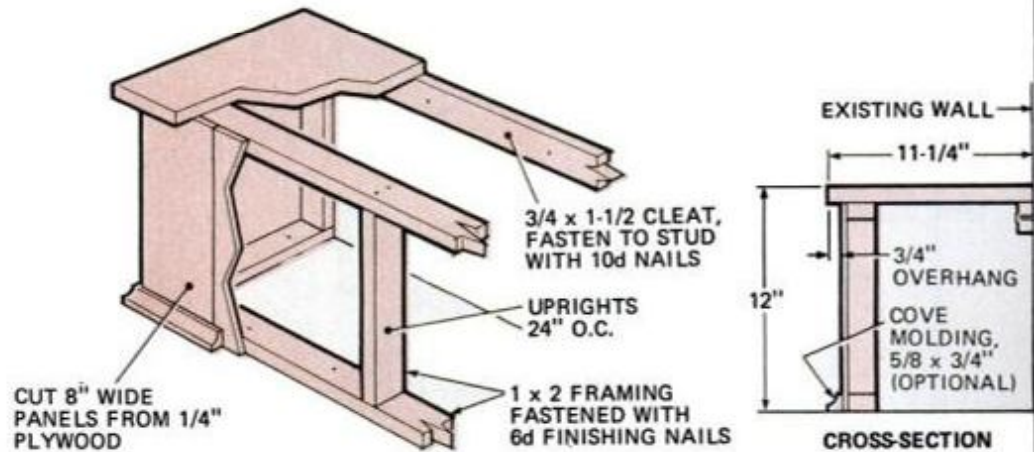
Manufacturer's information

Although you won't be able to match the effect our photographer achieved in simulating a roaring blaze in the fireplace, information on electric logs can be obtained by writing to: Firelogs, Inc., Box 3127, Commerce St., Poughkeepsie, N.Y. 12603; or Arkla Industries, Inc., Appliance Div., 400 East Capitol, Little Rock, Ark. 72203. **PM**

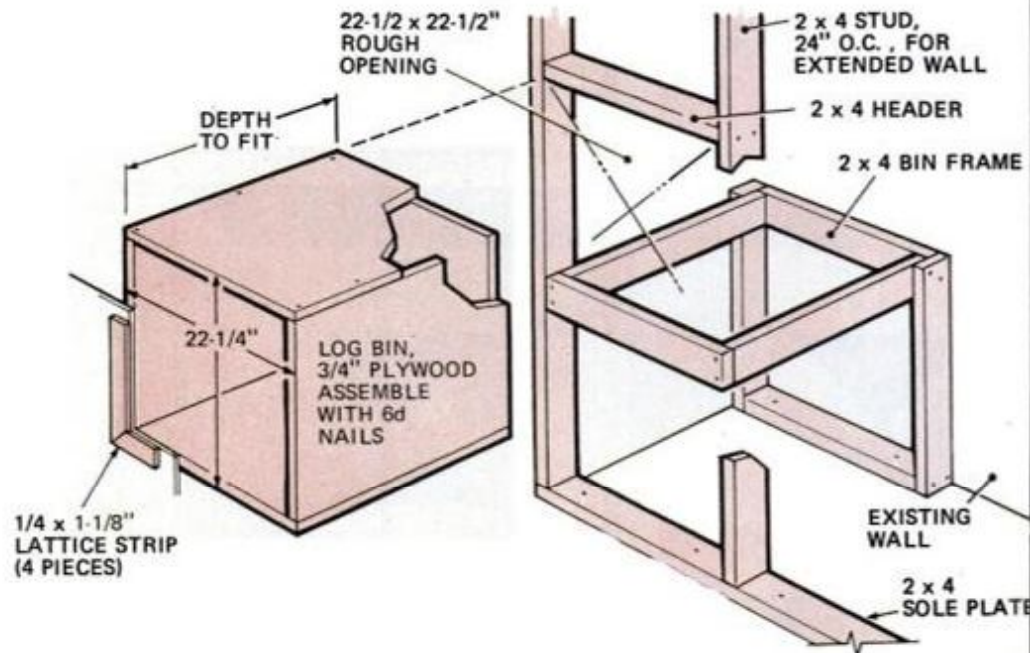
WRAP-AROUND SEATING



RAISED HEARTH



LOG BIN





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CATALYTIC CONVERTER AND EGR

(Continued from page 89)

sary only when the outside body is distorted.

Distortion (bugle) occurs because excessive heat builds up in the converter—not the converter's fault.

Excessive heat is caused by a carburetor, ignition or air pump problem that permits unburned fuel to enter the converter where it ignites. If a damaged converter is replaced without correcting the problem, the new converter is going to fail prematurely.

If a pellet converter's bottom cover is ripped or dented, you shouldn't have to replace the whole converter, only the bottom cover (see Section 5, *Car Care Guide*, PM May, 1978).

Replacing pellets is done with a vacuum pump and vibrator—two tools that have the same part number (J-25077). They can be ordered from Kent-Moore Tool Div., 1501 South Jackson St., Jackson, Mich. 49203 and cost about \$350.

To replace pellets, a threaded or pressed-in plug is removed from the base of the converter. The vacuum pump is attached to suck pellets out and the vibrator, possessing a can of fresh pellets, is attached to pump the new pellets in.

Who's got what

Although there are only two main types of catalytic converters, there are some interesting variations. These variations have occurred in California and signal trends that will probably become nationwide.

American Motors and General Motors cars built for California in 1977-78 use pellet converters as the main instrument, but they also possess monolithic warm-up converters. Chryslers and Fords have monolithic warm-up converters in combination with the main monolithic converters.

A warmup converter's small size and closeness to the engine cause it to react more rapidly than a main converter to incoming gases. It converts exhaust gases into nonpolluting agents when the engine starts.

Generally, a six-cylinder engine has one warm-up converter between the exhaust manifold and main converter. An eight-cylinder engine has two warm-up converters, one serving each bank of cylinders.

Replacing a used-up warm-up converter is as simple as replacing the main converter. Remove the front exhaust pipe at the exhaust manifold and at the pellet converter joint. The warm-up converter is integral with the front exhaust pipe.

The second generation

In 1978 GM and Ford introduced a so-called "Phase Two" catalyst emission control system on some models for use in California. They are the Chevrolet Monza, Oldsmobile Starfire, Pontiac Sunbird, Ford Pinto and Mercury Bobcat with standard engines. Mercedes, Saab and Volvo use a similar system.

This system looks promising as the nationwide catalytic unit for the 1980s. It controls oxides of nitrogen, as well as hydrocarbons and carbon monoxide (hence it is most often referred to as a *three-way* catalytic converter).

It reduces dependence on EGR systems and ignition-spark retarding to meet oxides-of-nitrogen standards.

One of the catalyst coatings in a three-way system is rhodium, which controls oxides of nitrogen by separating this polluting agent into harmless nitrogen and oxygen. Unfortunately, rhodium is scarcer and more expensive than platinum and palladium.

The heart of the phase-two system is an electronic-fuel control unit, which receives voltage signals from an oxygen sensor in the exhaust system. The sensor tells the control unit if the fuel mixture is too rich or lean. The unit makes the necessary correction at the carburetor. Accurate air/fuel ratio is critical to operation of the system (see the first application of the three-way system in *Driving the Lambda Sond Volvo*, page 57, July 1977).

The oxygen sensor should be replaced every 15,000 miles. Otherwise, servicing procedures for the phase-two converter are the same as for other pellet converters.

Beating an old horse

By now everyone should know they shouldn't use leaded gasoline in a car that has a catalytic converter except in an emergency. Using a few gallons of leaded gasoline is acceptable to get a car to a gas station that has unleaded fuel.

Constant use of leaded gas will leave combustion deposits, mainly lead, in the converter, producing the same results as a blocked exhaust system—lack of power and limited top speed even at wide open throttle. According to Ford, rust that gets inside a converter from a rusting exhaust manifold will do the same thing.

EGR: The way it works

EGR systems from car to car work pretty much the same. Technically, the system is called PEGR (propor-

(Please turn to page 106)

GET 6-PASSENGER ROOM IN TRADITIONAL FULL-SIZE OR SPORTY MID-SIZE FORD LTDs.

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Ford LTD Country Squire

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FORD DIVISION





Now you can kill wasps and hornets in their nests from...

CATALYTIC CONVERTER AND EGR

(Continued from page 104)

tional exhaust gas recirculation), because the design provides exhaust gas recirculation at a rate proportional to engine load.

No exhaust gas recirculation is provided at idle, because none is needed since combustion temperatures are low enough to restrict oxides of nitrogen formation. As acceleration is applied and the car reaches cruising speed, more EGR is provided as needed.

The job of metering exhaust gases to the air-fuel charge falls to the EGR control valve. The EGR valve, in turn, is controlled by vacuum.

In a typical engine, the vacuum signal is proportional to engine air flow (or load) and is provided by a port in the carburetor venturi. The vacuum signal is applied to a vacuum amplifier, which modulates vacuum in such a manner that output from the amplifier is normally 10 times the magnitude of the input vacuum signal. The amplified signal actuates the EGR valve.

There are other key parts to an EGR system besides the EGR valve—the coolant temperature switch and valve. These eliminate EGR when the engine is cold to provide stable engine operation during warm-up.

Cars for sale in states other than California may also have an EGR delay solenoid and timer that keep the EGR system nonfunctional for about 30 seconds after engine starting, regardless of temperature, to improve start-up performance.

Testing the EGR

If a part of the EGR system malfunctions, engine hesitation and/or poor idling result. The main compo-

nents of a typical system—EGR valve, coolant temperature switch, connecting hose—may be tested as follows:

Caution: The engine has to be at normal operating temperature and the EGR valve may be hot. Be careful not to burn your fingers. You may wish to wear gloves.

1. With the engine idling, hold your fingers against the bottom (diaphragm) of the valve. You may feel slight vibration—normal in six- and eight-cylinder engines.

2. Accelerate the engine. The diaphragm should open (move upward).

3. Return the engine to idle. The diaphragm should close (move downward).

Note: If the installation prohibits your being able to place your fingers on the diaphragm, watch the EGR valve stem instead. It should move as the engine is accelerated rapidly and is allowed to return to idle.

4. If the diaphragm (valve stem) doesn't move, pull the vacuum hose off the valve. Hold your finger over the end. Accelerate the engine to a speed equivalent to 2000 rpm. You should feel a strong pull. If not, remove the hose and check it for a restriction or cracks.

5. If vacuum is present, remove the EGR valve for cleaning (see *Car Care Guide, Section 2, PM May, 78*). Or replace the valve.

Note: EGR valves are different from engine to engine of the same make. Be sure to get the right one.

6. If you are experiencing a driving problem when the engine is cold, and the EGR valve and hose test satisfactorily, test the coolant-temperature switch. With the engine cold, see if vacuum is present at the EGR valve by feeling for suction (Step 4.) If it is present (it shouldn't be), replace the switch usually found at thermostat housing or coolant passage.

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Specific service problems

■ One reason for poor idling and hesitation for Ford engines can be a burned-out EGR spacer between the carburetor and intake manifold. This would allow a constant flow of exhaust gases into the intake manifold. Replace the spacer, and the upper and lower gaskets.

■ Some AMC four-cylinder engines use a stainless steel restrictor plate between the EGR valve and intake manifold. The plate and the two gaskets that sandwich it are calibrated for a particular engine-exhaust system combination and should not be altered or replaced with any other type of restrictor plate. There is an identification number or letter on every plate. Be sure the new part has the same number or letter as the old part.

■ Two field fixes have been initiated by Chrysler to resolve acceleration sag, low and intermediate speed surging, and stalling during warm-up of 1975-77 225-cu.-in. engines with one-barrel carburetors. The primary repair calls for revamping the coolant temperature switch system. Refer your dealer to service bulletins 25-05-77 (2/21/77) and 25-06-77 (4/4/77).

A troubling report

The Environmental Protection Agency report referred to above emphasizes that emission controls are only as effective as we allow them to be. Analyzing the first substantial amount of emissions data from in-use vehicles showed that about 60 percent of 1975 models had emissions above 1975 Federal Standards at low mileage. The 1976 vehicles also showed a high failure rate. Reasons given are:

■ Misadjustment of basic engine settings, particularly idle speed, ignition timing and choke.

■ "Willful or inadvertent" disablement of a component or system. Examples include plugged, disconnected or rerouted vacuum lines; "carefully damaged" EGR valves; broken or missing idle mixture limiter caps.

■ Defective components, including leaking vacuum diaphragms, faulty coolant temperature-sensing vacuum switches and timers, broken EGR back-pressure transducers.

■ Inadequate maintenance (dirty air cleaners, worn-out plugs).

■ Using nonspecified parts. Replacement components should match the particular engine and emission control system combination. As an example, replace resistor-type spark-plugs with the same type, instead of using nonresistor plugs. **PM**

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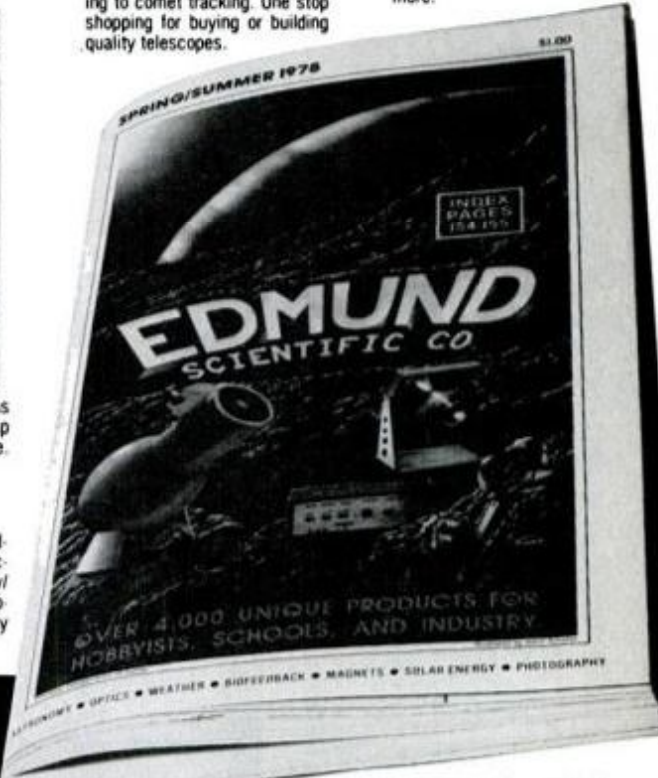


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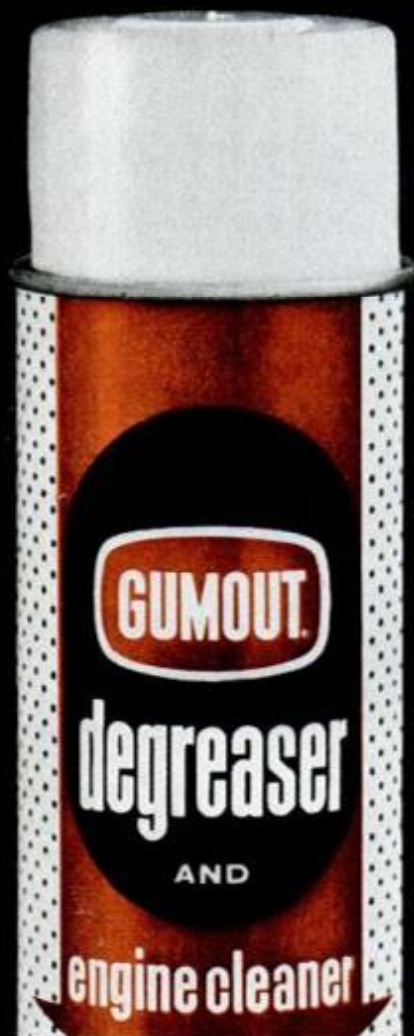
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CULT CARS

(Continued from page 51)



PONTIAC

A 1966 GTO was a rocket to the moon; '64 to '71 models, especially convertibles, are now hunted down by muscle-car buffs.

T-Bird has taken since. Most people who own a two-seater know it's worth \$4000 to \$12,000, depending on the model and its condition, but there's still a chance to get one that needs work at a reasonable price. California is full of gorgeous 'Birds; East Coast cars tend toward the rusted hulk category. The four-seat "Square Birds" of '58-'60 are a good second choice and can still be found for under \$3000.

The '55 Chevy, don't ask me why, has become a very "in" piece of iron. Maybe it's just the same kind of '50s nostalgia that makes Fonzie and Sha-Na-Na so popular. Convertibles, two-door coupes, and the futuristic Nomad wagons are the best investments. A '57 model is a good second choice, but '56s seem to be definitely out-to-lunch. You could get V8s in Chevy's long before they became available in the Corvette, and in '57 GM went power mad with dual four-barrels, fuel injection, and 10.5:1 compression ratios optional on everything from the 'Vette to the Nomad wagon!

The **Corvair**, Ralph Nader's favorite target, has a huge following, with large clubs full of true believers willing to help like-minded owners find parts and service. The hot tickets here are any convertible, the turbocharged Monza Spyder models, and the rare, modified Fitch Sprint coupes. But any Corvair can be as much fun to drive as it is to be seen in . . . at least until you turn on the defrosters and start spraying the inside of the windshield with motor oil! Look, nobody's perfect.

Studebaker Avantis have a lot going for them, including rarity, arresting styling by famed designer Raymond Loewy, no-rust fiberglass bodies, and seats for four adults. Parts are relatively easy to come by through various clubs and from the firm that still builds the Avanti II in part of the old Studebaker plant in South Bend, Ind. Less than 6000 Avantis were built in '62 and '63. The supercharged R2 and R3 engines are most coveted, but service for their Paxton blowers may be hard to

obtain. Studebaker's Hawk GT is a good second choice at about half an Avanti's cost of \$3500 to \$7500.

Pontiac GTOs are a reminder of the days when "muscle cars" still had some muscle. GTOs were the first of Detroit's big-engine-in-a-small-car school of design. If you still like to use greasy kid stuff in your hair and to burn rubber, get a '64 to '71 GTO, preferably a convertible with the 360-hp Tri-Power (three carburetor) engine.

Early Corvettes are sliding into the high-priced collector category. The six-cylinder '53-'55 roadsters are already out of sight. I always liked the rounded-off styling of the '56 and '57 models. The '63 Stingray coupe, with its split rear window, is a nice car to own. If you can't get one of those, find one of the real stormers of the mid-'60s that put out over 400 hp from 396 or 427 cu. in. Today's 'Vettes are only pale imitations of what Chevy fans used to call "America's only true sports car."

Shelby Cobra owners will dispute that last remark. Just over 1000 of these lightweight aluminum roadsters were built in England from 1962 to '67, then shipped to California where ex-racer Carroll Shelby shoe-horned the latest Ford V8s into them. The 289-cu.-in. model weighed only 2050 pounds, had a 271-hp engine, and went fast enough to beat Ferrari for the 1965 World Manufacturer's Championship. The 427-cu.-in. version used a 490-hp NASCAR engine and went even faster. Today, Cobras are collectors' items in the \$15,000-\$30,000 bracket.

Early Chrysler 300s are stormers from another school—a big engine in a big car. The 1955 A through '61 G models used 340 to 380-hp versions of the Chrysler hemi engine with dual four-barrel carburetors. About 1300 a year were built, and they made a big splash in AAA and early NASCAR racing (when Daytona was literally "on the beach").

The **Volvo 1800ES** was a handsome "sports-wagon" version of Volvo's pinheaded P1800 sports coupe. The teensy roof of the coupe was extended straight back to form a striking mini station wagon with the world's first all-glass hatch. It was a true multipurpose car that could

speed a romantic couple along undulating country roads at 100 mph, carry the wife and kids to a picnic, or haul around camping gear and lumber. Introduced in 1972, it was discontinued in '73 when 5-mph bumpers could not be grafted onto its lovely exterior. Only 8000 were built, and clean cars now demand \$5000 to \$7500.

Cult cars in the making

Honda Accord is in such demand right now that buyers are waiting months for delivery, and some dealers are charging up to \$1000 over list price. Why? The Accord offers a combination of styling, convenience, handling, comfort, and reliability in a package that's fun to drive all day long. Owners rave about them—including NASCAR stars David Pearson, Darel Dieringer and the Wood brothers—and it's hard to find an unhappy Accord owner. They display all the waving, tooting, and light-blinking symptoms of a car cult. Whether this will continue once the Accord is available in good supply remains to be seen.

Datsun Z cars, when first introduced in 1970 as the 240Z, went through much the same syndrome as today's Accord—long waiting lists and selling prices above list price. Today's cars have slightly bigger engines, slightly less performance, but a still loyal following. Resale prices on used 240, 260 and 280Z cars remain high, despite a new model that is supposed to be introduced early next year. So pick a price from \$1500 to \$9400 and buy a new or used Z car.

A Porsche, any Porsche, is a cult car for several reasons. The first is performance, and most Porsches have that in spades. The second is style, which is not quite the same thing as styling. Some Porsche models look just dreadful, but all of them have a certain flair, class, panache. The third reason is that Porsches have inspired a very real cult—a following of fanatical owners and fans—and this in turn assures that most Porsches will always have a good resale value. Nice models to own are the Speedster roadsters of the '50s (which look like upside down teacups but are now worth over \$7000) or the similar but less costly 356 convertibles. Three current models of historical significance are the \$34,000 Turbo (fastest road-going Porsche ever built), the \$18,000 911 SC (probably the last of the air-cooled Porsches), and the \$26,000 928 (first of a new generation of water-cooled V8s).

Buick Regal Sport Coupe with its

(Please turn to page 110)

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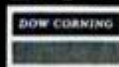
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CULT CARS

(Continued from page 109)

optional turbocharged V6 engine marks Buick's transformation from a maker of plush but dull doctors' cars to GM's performance division of the '70s, just as the 88 did for Oldsmobile in the '50s and the GTO did for Pontiac in the '60s. The turbomotor will be the only way for performance cars of the future to meet ever tougher pollution and fuel economy laws. Others will follow, but Buick has the first mass-produced turbo this year. It combines the power of a modern-day V8 (165 hp) with the fuel economy of a Six. But this is only the tip of the iceberg; Buick is developing an extensive line of hot-rod pieces for the V6 that can boost power to over 300 hp!

Firebird Trans-Am and Camaro Z/28 are the only survivors of the '60s muscle-car era. Today, Pontiac's 400-cube Trans-Am goes and handles better than Chevy's 350-cube Z/28. Next year we'll see a special 10th Anniversary Trans-Am that will be the only '79 Pontiac with the 400-inch engine. Nice older models to shop for are the '68-'74 Trans-Ams and the '68-'71 Z/28s, which were real powerhouses.

BMW, any BMW, mixes the mystique of a Porsche with the practicality and quality of a Mercedes. Cheaper than the former and faster than the latter, they are great fun to drive. Our Auto Editor once accompanied a young lady to inspect a used BMW. Her reason for wanting one? "I'm going out to California, and you just have to drive a BMW there!" If that's not a working definition of a cult car, I'll hock my Honda! **FM**

DID WE MISS YOUR CAR?

Some of the better-known cult cars are detailed in the accompanying article. Here is a list of some more cult cars—marques whose owners will be hopping mad if we overlooked them:

- Alfa Romeo (any Alfa)
- Austin-Healey (100 and 3000)
- Buick Riviera ('49, '63-'64)
- Ford Skyliner ('57-'59 retractable hardtop)
- Hudson Hornet ('51-'54)
- Jaguar XK-120 ('48-'53)
- Lancia (any Lancia)
- Lincoln Continental ('56-'57, '61-'64 4-door convertible)
- Lotus (any Lotus)
- Mazda RX-7
- Mercedes Benz 300 SL
- Morgan (any Morgan)
- Renault R5 ("LeCar")
- Shelby Mustang ('65-'70)
- Subaru 4WD (wagon and BRAT)
- Vega (Cosworth engine only)

Let's see, does that do it? Well, we'll certainly hear from fans of TVRs, Isos, any cars with gull-wing doors, and . . . —W.H.

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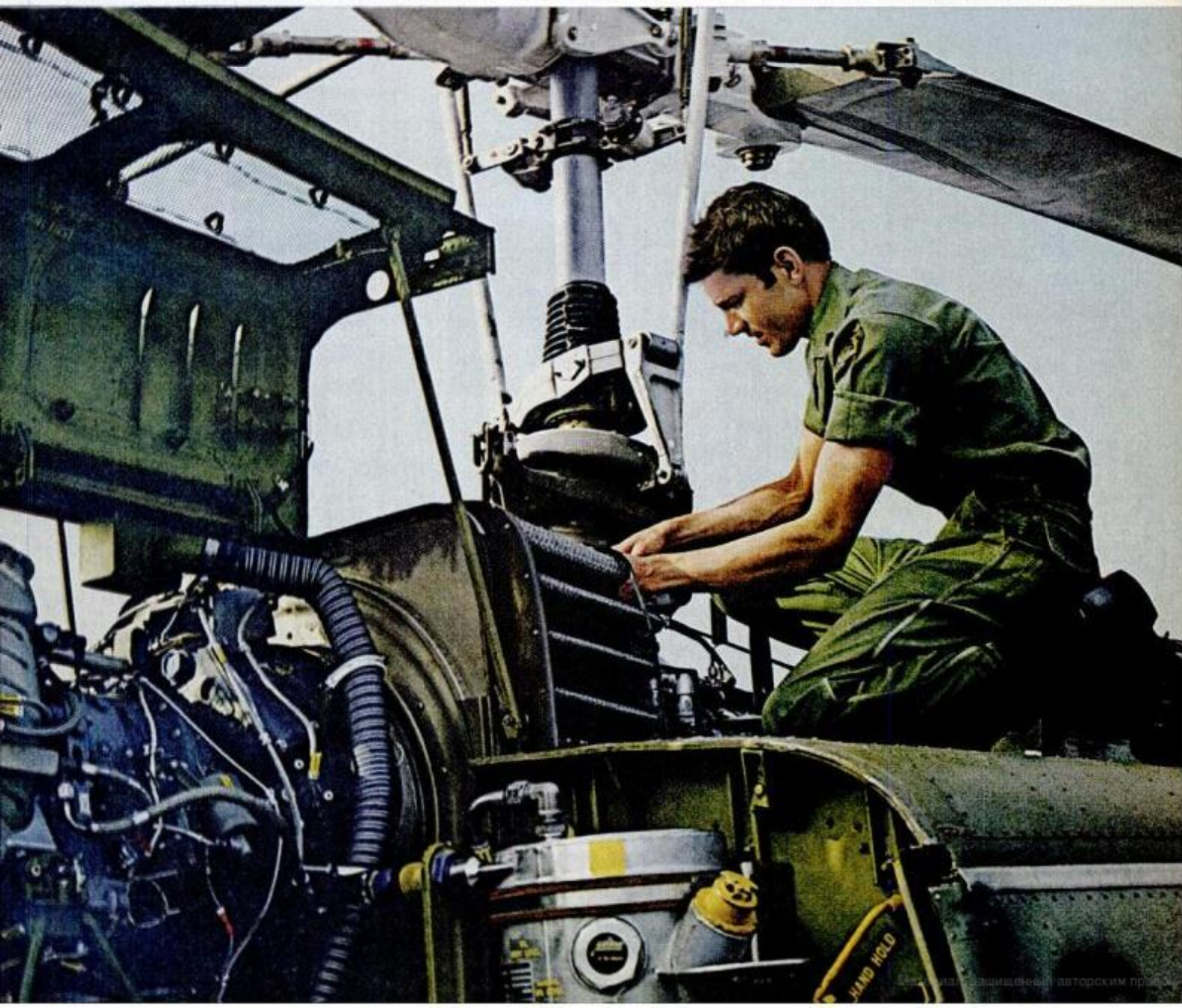
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Even when you don't get a letter, this mailbox and planter combination can make you smile. It's built from Kopper's Wolmanized lumber which resists damage from insects and rot. Called, "Outdoor Wood," it

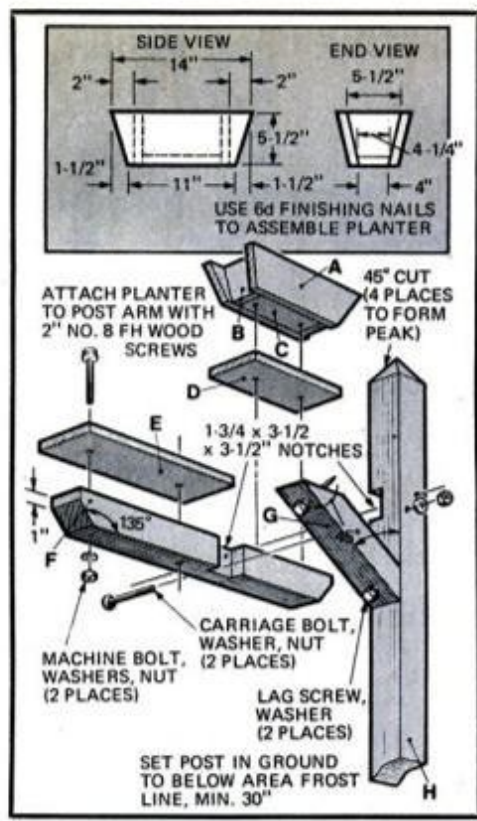
is pressure-treated with non-leaching, preserving salts and will not affect plantings. 4x4s are readily available at many lumber supply yards, but 1-in. stock is more difficult to obtain—you may have to treat your own shelves and planter by soaking pieces in wood preservative.

Use 8d finishing nails and resorcinol glue to assemble. Galvanized hardware will prevent rust stains.

Don't forget to provide a layer of gravel inside the planter—and a few drainage holes along its bottom edge to prevent your flowers or greenery from being drowned in a heavy rain. Periods of sunny, dry weather will



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Part	Quantity	Size and description (use)
A.	2 pcs.	3/4 x 6 x 14" (planter side)
B.	2 pcs.	3/4 x 5 1/2 x 5 1/2" (planter end)
C.	1 pc.	3/4 x 4 1/4 x 8 1/2" (planter bottom)
D.	1 pc.	3/4 x 5 1/2 x 15" (planter shelf)
E.	1 pc.	3/4 x 5 1/2 x 18 1/2" or to suit mailbox, (mailbox shelf)
F.	1 pc.	3 1/2 x 3 1/2 x 37" (arm)
G.	1 pc.	3 1/2 x 3 1/2 x 19" (brace)
H.	1 pc.	3 1/2" x 3 1/2" x 7' or to suit (post)
	2	1/4-20 x 5" machine bolts
	2	1/4-20 x 5" machine bolts
	2	1/4 x 5" lag screws
	8	1/4" washers
	4	1/4-20 nuts

require you to give your plants a watering once a day. Before building the planter mailbox, check with your postmaster to make certain it's acceptable locally. **PM**



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PM PLAN OF THE MONTH

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Innovative hull shape on PM's Family Cat eliminates leeboards without sacrificing handling ease.

We call our new 14½-ft. catamaran the "Family Cat" because it is designed to give the family sailor low-cost catamaran fun.

The Family Cat has enough payload so a family of four can go sailing without loading the boat down to the gunwales. A low-center-of-effort sail rig provides good catamaran performance with less tendency to tip up on one hull. The ready-to-sail cost of under \$350 will fit most family budgets.

In 1974, Stevenson Projects produced its first low-cost catamaran and the reaction was enthusiastic. More than 30,000 sets of plans were sold, which made it just

about the most popular home-built catamaran we know of. By request of the editors of *Popular Mechanics*, the designer analyzed and put to use several years of builder feedback. The result is a combination of the best features of the old Cat with the improvements that have been developed through actual sailing experience in all sorts of conditions from coast to coast.

For the new version, we've increased the payload to over 1000 pounds; made a roomier, solid bridge deck with lockable storage space; and raised the crossbars for dry sailing in rough seas or under rugged surfing conditions.

By loosening eight nuts, the Cat can be disassembled for easy transportation without a special boat trailer. Kick-up rudders can be instantly locked up or down from the cockpit for easy beach launching. Simple disassembly

means the Cat can be stored compactly during the off-season.

For the new Cat, we've increased boom travel, simplified the rig, and made the easy-to-assemble sail even more rugged. The new four-sided, asymmetrical hulls provide dynamic lift to reduce wetted surface when underway and to help prevent pitch-poling. The vertical inboard sides provide leeway resistance without hard-to-handle leeboards. No special tools, jigs, marine hardware or special-order lumber are needed to build the Family Cat. Simple hand tools do the job. To order plans, see below.

HOW TO ORDER PLANS

To order a complete set of plans for building the PM Family Cat, send check or money order for \$5 to PM Family Cat, Stevenson Projects, Box 584, Del Mar, Calif., 92014. Allow two to three weeks for third class mail; add 75 cents for faster first class.

schematic at the right, or get the complete kit, including printed-circuit board. Power can be anything from 4 to 12 volts. With one 9-v. battery, the amp will drive a large (and relatively inefficient) acoustic-suspension speaker system with good volume. But a 12-v.—eight dry cells—supply will give higher undistorted volume.

The only tricky part is getting into your radio. You can simply plug into the radio's earphone output, but that won't give you the best sound and it will tie you to the radio's volume control. It will be much better for you to take your input from across the radio's volume control potentiometer.

In many radios, there's room enough in the case for an extra jack—use the open-circuit type (Radio Shack 274-297 or 274-251) and wire its terminals to the opposite sides (outer terminals) of the radio's volume-control pot. Otherwise you'll have to replace the earphone jack with an open-circuit jack and make sure you reconnect the radio's speaker so that it's not cut out by the jack.

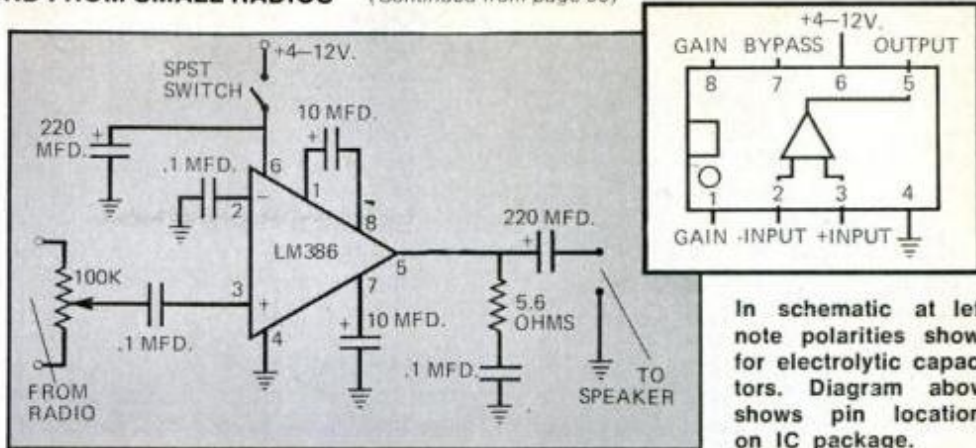
Two types of AM/FM portables I've used successfully with the booster amp are Radio Shack models 12-666 and 12-662. The pocket-size 12-662 is shown in the picture on page 95.

Shielded cable between radio and amplifier is a good idea, though not always necessary. The speakers driven can be up to 16 ohms impedance; I've been quite satisfied with the quality and volume obtained driving two 8-ohm Poly-Planars connected in series.

The efficiency of the booster amp is at a maximum when it is driving a 16-ohm load, and you can overheat the IC by using too great a supply voltage with a low-impedance speaker—limit supply to 9 volts with an 8-ohm speaker, 8 volts with a 4-ohm speaker. Take care not to short the output leads together with power on; this can ruin the chip in seconds.

The amplifier is available as a complete kit including a drilled, etched and labeled printed-circuit board, all components, box, battery case, shielded cable—everything but batteries—for \$12.95 postpaid from Circuit Craft, Inc., 10 Idell Rd., Valley Stream, N.Y. 11580. Poly-Planar P-40 loudspeakers are available from the same source for \$14.95 each postpaid (these are bare foam speakers without the grille cloth or frame shown on page 95).

PM



In schematic at left, note polarities shown for electrolytic capacitors. Diagram above shows pin locations on IC package.

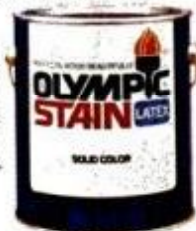
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OUR CRUMBLING INTERSTATES

(Continued from page 69)

concrete. "Congress raised the allowable limit to 80,000 pounds and roads just can't stand it," says one. "We pound, pound, pound all day long. It's all this heavy 'hobby-horsing' that smashes roads."

This constant, savage pounding is wrecking bridges as well as roads—and bridges are expensive to fix. At present, states now want a colossal \$23 billion in federal funds just to repair bridges—in some cases, ironically, to rebuild them to withstand even heavier, more destructive loads.

Truckers also candidly admit that speeding—when Smokey isn't looking—compounds the problem. Some claim they have to exceed the limit regularly to maintain profitable delivery schedules. But most don't really want to speed, and many actually favor strict adherence to the 55-mph limit. The AAA—American Automobile Assn.—is working hard to have this limit increased to 60 mph on roads judged to be in good condition, a move that would benefit truckers and probably please most motorists.

Another problem, truckers agree, is the lack of proper weight control. Many states have given up weight-checking completely or radically reduced it. Once-costly weigh-stations lie abandoned by the roadside. New Jersey—perhaps the most heavily trucked state in the country—is reported to have spot-checked a mere 2057 commercial vehicles in the entire year of 1976. A few other states did somewhat better: Virginia weighed some 600,000 trucks in the same year, but Maryland—also a heavily traveled state—is credited with making only 150,656 weight checks.

Admittedly, stopping each and every truck that crosses a state line is costly and time-consuming, and many states have more pressing financial needs. Still, diminishing weight-control practices—despite the liberal 80,000-pound weight allowance permitted by Congress—is resulting in many big rigs running overloaded. And truckers do not like to haul overweight loads. For their own safety and comfort, they would much rather have load limitation rigidly enforced. An added thorn is that states have been issuing an average of more than 3,000,000 special permits a year for overweight or oversize loads. Understandably, some of these are genuinely necessary—a bridge truss or highway girder that must be trucked to a site can be made only

so small. However, a high percentage of these permits may be subject to question.

Fortunately, the FHWA (Federal Highway Administration) has already ordered a number of states to start policing truck weights. Failure to comply with such orders could "trigger the withholding of federal highway funds," as one Washington road-building administrator warns.

Deferred maintenance

One of the biggest culprits, insists Rep. Shuster, is the euphemism, "deferred maintenance." It simply means roads are allowed to become ruined through neglect. "We see where deferred maintenance got the railroads," he says. "Now we're facing the same thing on highways."

The trouble is, such neglect is not necessarily an intentional evil, although officials do hint that in some cases road deterioration has been deliberately permitted in order to produce fat new construction contracts. In most cases, however, the problem is simply that states have not put aside the money to provide adequate maintenance and rebuilding programs.

Road construction costs have been spiraling upward at an alarming rate, running to as much as \$8 million per mile. A single Interstate sign can cost as much as \$50,000. New York City's proposed Westway, an express route skirting city congestion, will cost a staggering \$120 million per mile if built as planned.

At such costs, states concentrating on the building of new roads have not had funds available for the proper upkeep of existing roads. State officials argue, with some justification, that after federal highway planning and federal funding have encouraged the building of superhighways *through states*, that the states then get stuck with having to maintain them.

Whatever the answer, Rep. Shuster thinks it's time to bite the bullet. "Congress must decide how good a highway system we want and are willing to step up and pay for," he says. The money, he believes, must come from state and federal sources.

Shuster is a leading sponsor of the 1978 Transportation Bill which continues to hand states \$7.5 billion for new road construction, but adds \$2 billion for rebuilding bridges. One proposal for improving road maintenance is to levy extra user taxes on shippers to pay for the damage that heavy trucks allegedly do to highway pavement. Shuster favors this, although he recognizes that increased shipping costs will

eventually be passed on to the public in the form of higher prices.

An added irony is that we may well lose money in one area through our very success in improving efficiency in another. Today's smaller-engined compact cars burn less gas, which conserves fuel—but gas-tax revenues are a primary source of road-maintenance income. Shrinking gas-tax revenues could seriously curtail highway building and repair programs. Despite this possibility, Rep. Shuster sees no need to raise the present 4-cent gas tax before at least 1981—a hopeful sign.

Bold new highway plans

The problems of our declining highway system will not be solved overnight, but already there are some intriguing, imaginative proposals that appear encouraging. One plan under study is to build special heavy-duty highway lanes reserved exclusively for truck use. Automobiles—especially today's smaller, lighter compacts—don't need such high-strength pavement, and building one road for both trucks and cars represents wasteful, and unnecessarily costly construction. At the same time, there would be light-duty, inexpensive "economy lanes" for compacts. Reduced gas-tax revenues would be made up for by the lower cost of building and maintaining such light-use lanes.

Truck weights might be rolled back to less destructive limits, with loads spread over a greater number of smaller, lighter vehicles. A bonus benefit would be the creation of more jobs for truck builders and drivers, and the added cost of such new jobs could be balanced out by the vast savings in road damage. Trucks might also be tuned for optimum fuel-efficiency at 55 to 60 mph to discourage speeding and make it profitable for shippers to maintain slower, less destructive schedules.

Whatever is done must be done soon. According to the FHWA, nearly one mile in every four of our present 37,500-mile Interstate network has already deteriorated to "fair" condition or worse. Because deterioration accelerates as it progresses, it is only a short quick step from "fair" to "poor" and—finally—"impassable."

We know, because we drove on many roads that even now are close to impassable. Money for road improvement is available. After all, highways are a \$32 billion annual business—that's the astronomical amount of money realized from gas and user taxes every year.

As Rep. Shuster says: The time has come to bite the bullet. **PM**

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Dealers' Inquiries Invited.

NEW PHOTO OPTICS

(Continued from page 70)

length lens. To be sure, the Vivitar is a hefty chunk of glass (29 oz.), and I peeled on the right side of my neck exactly where the camera strap pulled my T-shirt aside under the equatorial sun. But in embarking from the cruise ship *Buccaneer* into lifeboat-size launches every day and making numerous wade-in landings in some fairly impressive Pacific surf, I was quite happy to have only one lens and one camera body to keep dry (in a plastic bag).

"And, most important, my home slide show won't suffer from that constant 'normal-lens ennui' of middle-distance figures that puts even good friends to sleep. From now on, I'll look at even close-to-home vacation picture opportunities with a new perspective."

Traveling demands telephoto capability because people are often your most interesting subjects, and lenses in the 90-to-135-mm range give the most pleasing facial perspective in head-and-shoulders portraits. Greater length will give you details from a distance, candid shots that otherwise might be impossible.

New gear I've tried gives extra versatility at portrait-and-beyond focal lengths. When you add a wide-angle lens you have a compact travel rig.

One piece is Samigon's Vari-Zoom attachment. Screwed to the front of my 100-mm lens by means of a Series VII adapter ring, it gave me a 75-to-125-mm zoom lens. "Zoom" may be an overstatement, because I found it necessary to refocus after focal-length changes, but it did let me adjust framing without changing camera position. The Vari-Zoom occasionally gave vignetting (dark edges), softened edges slightly and was vulnerable to flare at maximum length. But it has produced some quite acceptable portraits, doesn't reduce lens speed and lists at only \$75.

Vivitar's 70-to-150-mm close-focusing zoom also gives you that flexibility at people lengths, with optical performance rivaling that of a fixed lens. At \$250 list price, it's a true zoom that requires little or no refocusing.

What's really new about this lens is an accessory offered by Vivitar, a "2X Matched Multiplier." That's a two-power teletender specifically designed for this lens. It performs better than a conventional 2X teletender, giving much more sharpness at the edges of the picture. Its list price is \$60.

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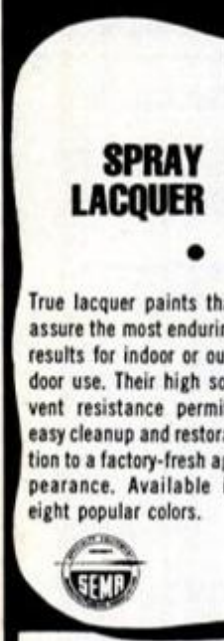


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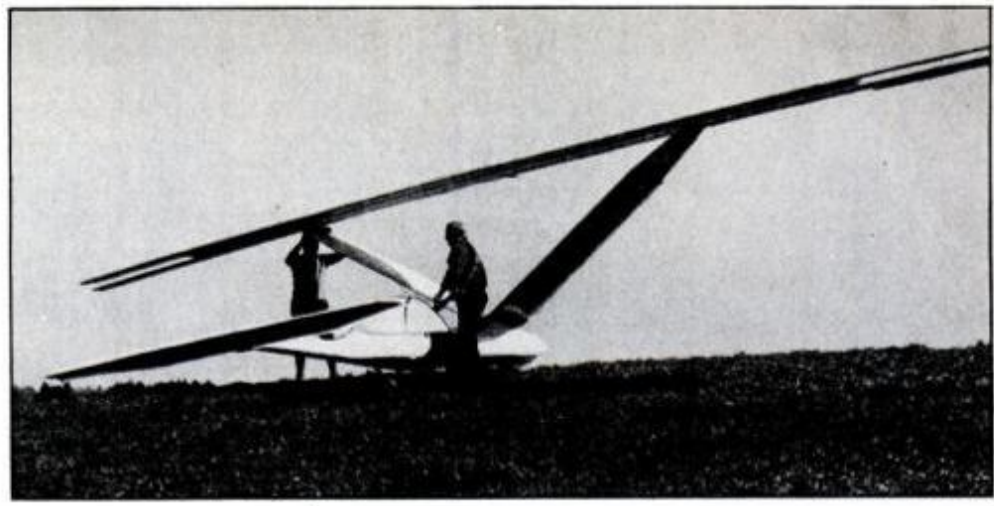
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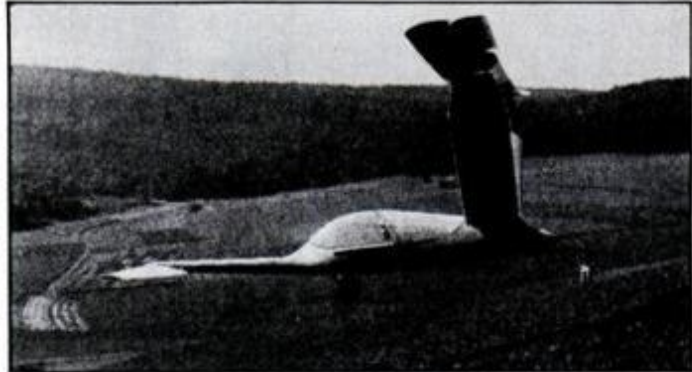
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on tracks, permitting weight-shift for pitch/speed control. When airborne, doors below close for streamlining.

Turns are controlled by ailerons on the main wing and also by twisting the entire canard surface plus or minus 5° (on glider's longitudinal axis). Two skids—one in the nose retractable—are for landings. (Launch wheel is an option.)

The canard design has such strong pitch-up characteristics that Farner claims the 2FL cannot exceed 62 mph, resisting not only inadvertent dives but even deliberate pilot action.

The Canard-2FL will have to

meet stringent Swiss requirements. Chuckles Farner, "The authorities are a little reluctant to call it a hang-glider so we will probably" also certify it in the sailplane category." It should be recognized as a hang-glider in the United States (air towing won't be permitted).

For transportation, the aircraft separates into sections, the largest 15.8 feet long. Production may be under way by the time you read this, and a retrofit power pack (about 12 hp, in an outside mount) will be tried later this summer. After that, Farner expects to produce yet another version with a hidden engine and folding propeller. **PM**

FARNER'S CANARD VS. THE STANDARDS

This is a quick look comparing manufacturer's specifications for the Canard-2FL with those for two of the best-performing hang-glider types (rigid and flexible) and two roughly comparable sailplanes. There hasn't been sufficient flying to verify 2FL performance, but an independent designer informs PM that the claims appear substantially correct. "Takeoff speed" is the air (not ground) speed at which a foot-launched glider starts flying before the pilot loads on, running into a light wind. "L/D" is the ratio of distance forward vs. descent. "F.p.m." is feet per minute. European sailplane and 2FL prices are subject to the fluctuating U.S. dollar, and do not include shipping, reportedly about \$800 to the East Coast for the 2FL and \$1200 for the sailplane (including trailer).

Glider Types	Takeoff Speed	Stall	Maximum L/D	Minimum Sink	Weight	Price
Flexible hang glider	10 mph	18 mph	9:1 @ 23 mph	210 f.p.m @ 18 mph	53 lbs.	\$ 1300
Rigid hang glider	12 mph	21 mph	12:1 @ 27 mph	170 f.p.m. @ 21 mph	70 lbs.	3500
Canard-2FL	13 mph	23 mph	31:1 @ 35 mph	95 f.p.m. @ 30 mph	95 lbs.	7020
U.S. sailplane	—	28 mph	23:1 @ 53 mph	175 f.p.m. @ 40 mph	445 lbs.	12,000
Euro. sailplane	—	26 mph	36:1 @ 57 mph	135 f.p.m. @ 49 mph	467 lbs.	13,200

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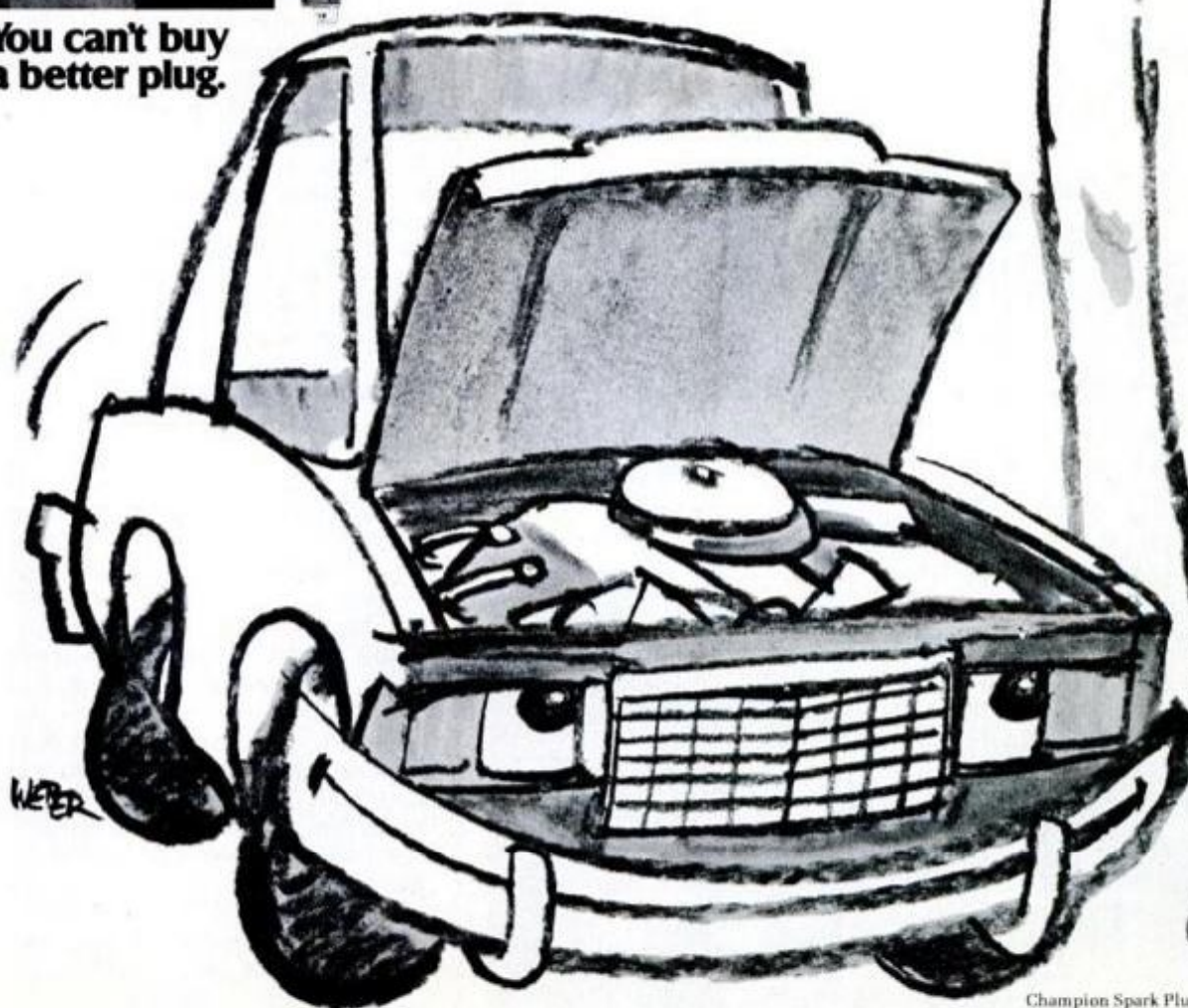
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NASA'S EYE IN THE SKY

(Continued from page 60)

minutes. But even after that phase was over, the KAO continued tracking Uranus for another hour and a half. Elliot and his colleagues were most interested in the fact that the main occultation had been followed by five brief secondary occultations similar to the first set recorded.

Upon returning to Perth, Elliot was met at the airport by Bob Millis, who'd hurried there directly from the Perth observatory. Elliot was glad to learn that Millis and his team had also recorded the unexpected occultations. The two men came to a preliminary conclusion: The occultations could have been caused by a number of satellites in a "swarm" around Uranus.

The Cornell University scientists flew back to the United States, arriving on the night of March 13. The following night, in the living room of their home in Ithaca, N.Y., Jim Elliot and his wife unrolled the observational record chart, all 40 feet of it. Now Elliot saw clearly that the two sets of secondary occultations—before and after the planetary eclipse—matched exactly in terms of time intervals. The explanation jumped out at him: Uranus was encircled by rings!

Since then, Elliot's findings have been corroborated by studies of observations made on March 10 at four different observatories.

The rings of Uranus aren't in the same league with those of its neighbor, Saturn. Saturn's are each almost 20,000 kilometers wide while four of those of Uranus are estimated at 10 kilometers (about 6 miles) in width, and the fifth ranges from 40 to 100 kilometers (25 to 62 miles).

Rings of ice or 'dust'

Their composition is still in doubt. At first, astronomers thought of ice particles, but now they say the rings may be "dust."

The discovery of the rings tended to overshadow other of the flight's results—among them a determination that Uranus has a radius of 26,200 kilometers, which figures out to be a diameter of about 32,540 miles.

Though it's operated by NASA, the KAO is used mostly by university scientists, foreign as well as American. It is sent on a variety of missions and is solidly booked for a year ahead.

Prior to the Uranus mission, it figured in another dramatic discovery by NASA and University of

(Please turn to page 126)

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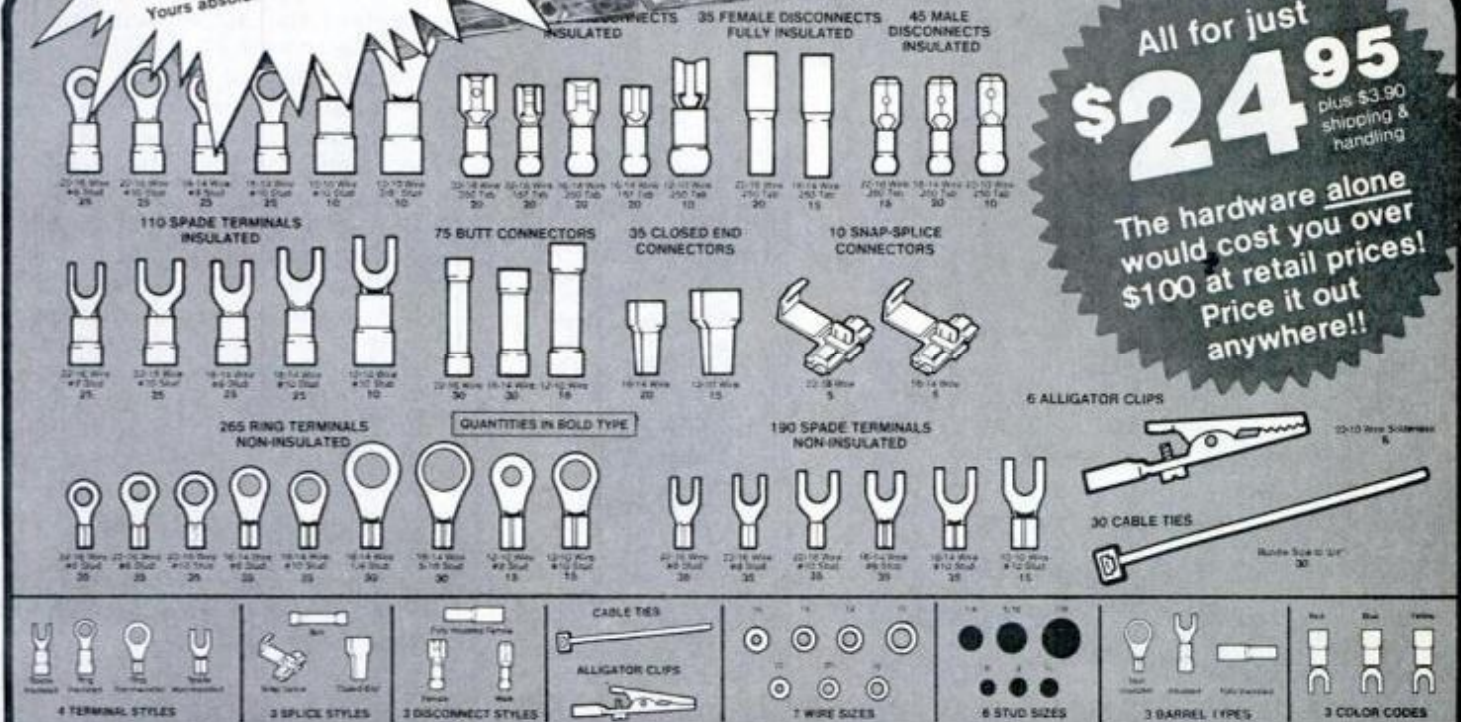
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NASA'S EYE IN THE SKY

(Continued from page 124)

Arizona astrophysicists, The discovery was that of a huge disc of glowing gas surrounding a star in the constellation Cygnus. This find offers the intriguing possibility that this stellar system may be in the process of spawning planets.

Future research flights, according to Ames's Robert Camcron, include infrared spectroscopy studies of the giant planets as well as distant galaxies and nebulae.

Checking a belly temperature

An unusual assignment is scheduled for October, 1979, when the Space Shuttle goes up for its second orbital flight test. When the Shuttle reenters the atmosphere, the KAO will be peering at its belly from below. The object is to obtain infrared temperature readings of the Shuttle's heat shield, which may be much thicker than required. With a thinner and lighter heat shield, the Shuttle will be able to carry a heavier payload.

While the KAO continues to provide vital service, scientists at Ames are planning the next airborne observatory—a Boeing 747-SP equipped with a powerful 3-meter telescope. That's a diameter of about 118 inches, larger than many land-based instruments.

Astronomers, it seems, tend to think big. **PM**

NEW GENERATION TELESCOPES

(Continued from page 61)

observes TV screens and readouts to make sure the telescope is acquiring the proper targets and to keep a check on incoming data. The telescope itself remains unattended. Research planned includes infrared and optical observations of very faint astronomical objects.

Tomorrow's big 'eye'

The principle of the multiple-mirror 'scope is also the basis for the Next Generation Telescope project underway at Kitt Peak National Observatory in Arizona. Scientists and engineers there are thinking in terms of a really big "eye"—a telescope with hundreds of small mirrors combining to create the equivalent of a single 1000-inch mirror. This instrument would have 5 times the resolving power and 25 times the light-gathering capability of the 200-inch Hale reflector.

"It would open up an entire new era in astronomy and provide information critical to a broad range of fundamental questions," says Leo Goldberg, director of Kitt Peak.

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WOOD LATHE BASICS (Continued from page 98)

ends for a No. 2 Morse shank (see [drive center photo, page 98](#)). Small lathes usually have a No. 1 Morse taper. Most manufacturers make the tailstock spindle to match the headstock so that the various attachments can be used at either end of the lathe if desired.

Adjustable tailstock

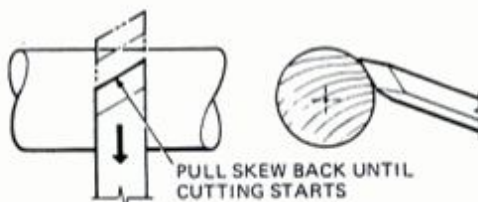
The tailstock is adjustable, of course, to suit the length of the work to be turned between centers; the headstock is fixed. The former can be moved along the bed and across the bed (slightly), and its spindle can be projected or retracted by turning the feed handle. Any and all tailstock spindle positions can be fixed by clamping.

Cutting tools

Basically, there are five shapes of chisels that you will have to learn about and master. All are shown on page 99. The most important—and probably the first one that you will use—is the gouge. This is used for roughing cuts, making coves and other operations. The skew chisel is also important because it does the

best job of smoothing cylinders and cutting beads, shoulders, V grooves and the like. It is also the most difficult chisel to master, which means that you should first practice with it using inexpensive scrap wood.

The spear (or diamond point) is used when its conformation matches the shape of the work. The round-nose chisel is also used to suit work



For smoothest finish, you must master the skew. Be advised that it takes practice.

configuration. Both chisels are used with a scraping action.

The parting tool is a double-ground tool used for making sizing cuts and cutoffs.

You will also need a number of accessories—the basic ones are shown on page 98. As your skills

and knowledge develop, you will want to add other important accessories to your lathe setup.

Wood lathe safety

The lathe is a safe tool to use when you practice good shop safety habits. The usual power-tool rules apply—make certain tool is solidly affixed to a rigid base or cabinet, assure its being properly grounded to avoid chance of shock, and do wear clothes that are suitable for workshop activities: no dangling neckties, loose sleeves or long hairdos that could be caught in the spinning workpiece.

Several safety rules that apply especially to the lathe:

- Develop the technique of always spinning the work by hand before turning on power, to check clearance.
- Keep chisels sharp for easy cutting operations.
- Run all work at a safe, high (top) speed. More often than not, this means at speeds below 1000 rpm.

In the next installment on wood lathes we will discuss the techniques of spindle and faceplate turning. **PM**

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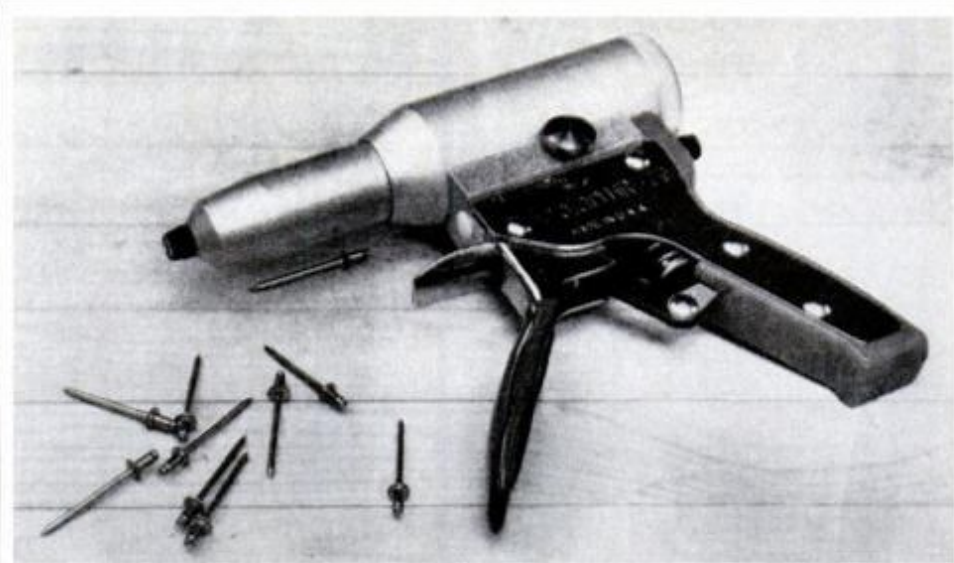
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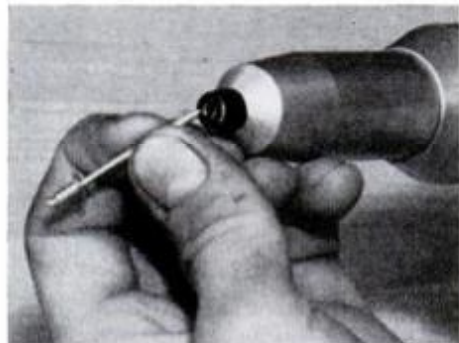
PM LOOKS AT HYDRAULIC RIVET GUN



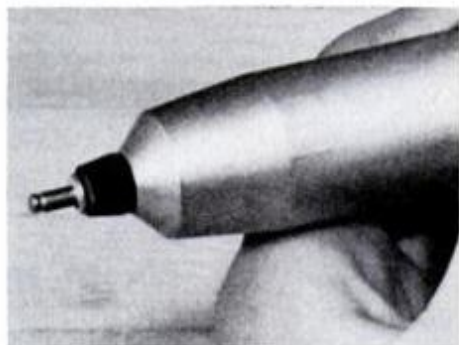
One of the nicest things about my job is that I get the chance to try out new tools almost as soon as they appear on the market. And often I give products a shakedown before they are offered to the consumer. That was the case with the hydraulic rivet gun shown on this page. I spotted it at the last annual Hardware Show and immediately obtained a couple of prototypes for testing. Though there are a number of cold rivet tools on the market, the use of hydraulic action to minimize the effort required for handle squeezing was appealing.

My sons and I used the guns in every application we could think of. Two of the early models failed when it came to ejecting the mandrels, but several suggestions that we offered were followed by the manufacturer and the new version works like a charm. Operation is super easy whether using aluminum or steel rivets.

The maker offers 11 different-size rivets plus backup plates to give the DIYer considerable riveting versatility. To use the tool, you simply insert the rivet mandrel in the right-size nose bushing (two come with the tool) and pump the handle. The mandrel is ejected by pressing a thumb lever.—H.W.



Select the correct rivet size and then insert its mandrel in the tool nose.



Squeeze the gun's trigger as many times as are necessary for forming the rivet.



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Manufacturer's Specifications Hydraulic Rivet Gun

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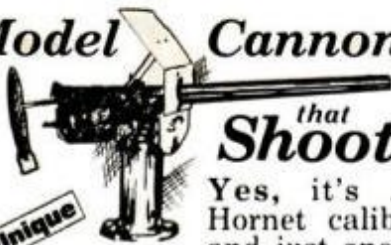
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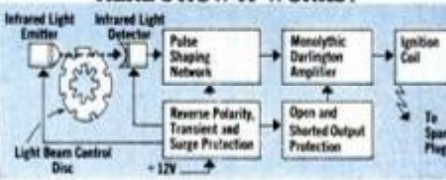
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(Continued from page 91)

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One of the subtlest things Irv Teibel has discovered is the importance of sequences—one sound following another. For example, at the edge of a pond one frog will always croak first, followed at an interval by the response of another. This is one reason why recordings must be continuous, over a long span of time. You can't stop the tape, wait a bit, and restart, no matter how well you can mix down the two resulting tracks—the result just doesn't sound natural.

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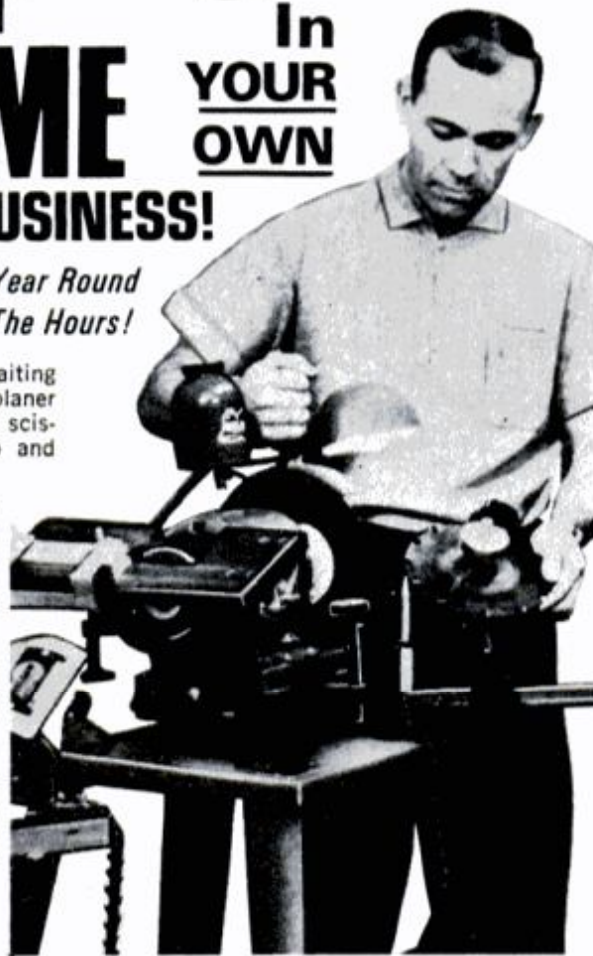
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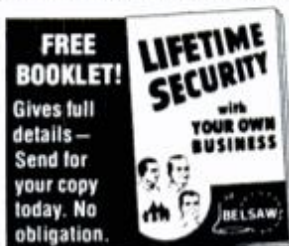
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LOW-COST TABLE SAW

(Continued from page 93)

itself can be used to cut the grooves. To do it, a temporary table is secured to the saw—allowing the blade to protrude—and a series of cuts are guided by a clamped-on fence. For safety reasons, we recommend that only experienced table-saw operators try this.

Fitting saw in the table

To avoid a problem fitting the saw table into the plywood table opening, make a cutout pattern by tracing the cast-iron table. Due to minor variations in casting and grinding, the metal table's size can vary slightly. Check for irregularities around edges and enlarge the opening if necessary.

To be certain that the miter gauge slots in the plywood and metal table align perfectly, lay out the slots with the plywood table temporarily fitted over the cast-iron saw table. Wedge some scrap lumber into the slot to maintain alignment while drilling holes for attaching table to base.

It is also important that the metal and wood surfaces be in the same plane. On my installation, the metal table was 1/8 in. too high along the back edge—and the plywood table was 1/16 in. too high in the front. A careful inspection revealed that the steel base at the rear bottom was slightly raised. The problem was remedied by unbolting the cast iron table from its steel base and removing two "spacer" washers from each rear corner to lower the back end. The plywood table was high at front because two cast brackets (used for securing the guide bar when the saw is used without the wood table) were too high. I solved this by chiseling shallow mortises for the brackets on the underside of the plywood. With the aid of a little paraffin rubbed into the slots, my miter gauge glides as smoothly as if the surface were one piece.

Don't use glue or nails to attach the tabletop to the sides. Screw it in place so it can be removed if it's ever necessary to realign the saw blade or make other adjustments. A couple of other pluses about AMT tools—the company offers a 10-year guarantee on parts. It will repair parts or send replacements if you provide the postage. The GE motor carries a one-year guarantee. If it fails during that time period, AMT will have it replaced at no charge. Also, a dissatisfied buyer may return his purchase within 10 days and get his money back. AMT pays the return shipping charge. **PM**

CHALLENGER AND SAPPORO

(Continued from page 64)

Sapporo's quality of design and workmanship."—Colorado ad salesman.

The handling and comfort of both cars also came in for extensive praise from owners of both nameplates.

"This Sapporo handles very well," writes a California equipment operator. "It drives much better than our previous car and is very comfortable on the freeway or side roads."

"It's quiet and has a good feel on the road," avers an Arizona patrolman. "The Challenger is comfortable but could use a little more head- and legroom. I'm 6-1, and it's close."

"The Sapporo handles like a dream, especially on curves. We'd wanted a small car, but with normalized wheels and tires—not the donuts most economy imports come with. Front-seat comfort is good, but the rear area needs more headroom." Georgia educator.

And a Michigan brass inspector: "The Challenger is very solid, responsive, and easy to handle."

"Comfortable ride," comments a Georgia computer programmer, "and that lumbar support adjustment in the seatback is really great on trips. My

passenger appreciates the reclining feature, too."

The Silent-Shaft engine came in for a few grumbles on smoothness. Several owners expected it to be less rocky at idle than it was. Some of the problem here might result from carburetor adjustment, however.

But a more significant number of Challenger and Sapporo owners noted lack of horsepower as a major disadvantage. This again harks back to the fact that most chose the 1600-cc engine. "I live in hilly country," observed a Colorado owner of a 1600-cc Sapporo with automatic, "and find some grades positively painful." This sort of comment came up again and again.

When we asked owners to list suggestions for improving their cars, we received the following, among others:

"Challenger's rear side-window louvers should be removable so the glass can be cleaned. I'd also like a conventional radio antenna instead of the one in the decklid."—Georgia clerk.

"I'd like intermittent wipers as shown in the owner's manual. These were supposed to be standard equipment. What happened?"—Florida chiropractor.

"Make it a hatchback with foldable rear seat."—California telephone man.

"Oil filter is hard to reach with a standard filter wrench. They ought to make it more accessible."—Georgia army officer.

"More trunk space and more headroom for rear passengers."—Minnesota pressman.

On the other hand, 15.1 and 23.1 percent of Challenger and Sapporo owners, respectively, wanted no changes at all.

When we asked owners whether they'd buy another Challenger or Sapporo next time, nearly 75 percent said yes.

"I plan to buy another small car next time, yes," concludes an Arizona printer, "but I feel this Challenger will last a long time."

An Illinois fastener manufacturer smiles, "We *did* just buy another Sapporo and now own two. We pick it up in three days."

A Texas student: "It's a very sensible car and well worth the money, so yes, I would buy a Challenger again next time around."

And finally an Air Force sergeant stationed in Greece: "You betcha I'd buy another Challenger—if they don't ever change it too much!" **PM**

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MIG: ULTIMATE AIRPLANE KILLER

(Continued from page 75)

in 1939 they formed their own design bureau with its primary objective to fit the smallest possible airframe to the only suitable engine available, a massive 12-cylinder, in-line, liquid-cooled Mikulin developing about 1350 hp on takeoff.

MiG 1 shocked German pilots

The result was a diminutive fighter that was hard to handle but could exceed 400 mph in level flight and offered excellent performance at high (20,000 feet and over) altitudes. This was the MiG 1, modified and improved by early 1941, after some 100 had been produced, into the MiG 3. Its appearance was a shock to German pilots who had been told they would enjoy total fighter superiority, although the Soviets could never produce the MiG 3 in sufficient numbers to significantly oppose the *Luftwaffe*.

Mikoyan and Gurevich had thus stamped their initials on aviation history. The MiG designation and its motto, "Speed and Altitude," would remain with the design bureau, at Mikoyan's insistence, even after ill health forced the semi-retirement of Gurevich shortly before his death in 1954 as it does today, eight years after Mikoyan's death.

The MiG team entered the jet age in 1946, but not as world-beaters. Their straight-wing MiG 9, with twin BMW-built German engines taken as war prizes, didn't quite top 560 mph. Meanwhile, Lockheed's F-80 was churning along at 590 with its single turbojet engine. Captured German documents had given the Soviet designers their first clues to the benefits to be gained from swept wings on high-speed aircraft, but it remained for the British government to sell the U.S.S.R. a number of Rolls-Royce Nene and Derwent engines in 1947 before they had the powerplants to complement such a design innovation.

MiG 15 vs. F-86 Sabrejet

Again the Soviets' strategic need was for an airplane-killer—an interceptor that could climb to high altitudes and knock down long-range bombers. Thus was born the MiG 15, whose 42° swept wing and high T-tail would become known as a trademark. Soviet air units had it in 1948, but its existence remained unsuspected in the West until November 1950 . . . in the skies over North Korea.

American F-86 Sabrejets were rushed overseas to meet the sur-

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prise threat. By December, the two finest jets in the world had met in combat. Immediately and until hostilities ceased in 1953, our 86s were reported as being far superior, with a final 10:1 kill ratio (792 to 78) as substantiation.

But gradually, retrospective accounts took a different tone; the quality of the American pilots versus that of their less trained Chinese and North Korean adversaries loomed paramount. One American ace said "I'd rather fly MiGs against MiGs than Sabres against MiGs." It turned out that the MiG 15 could fly faster above 20,000 feet than most F-86 models and could outclimb and outturn them all. Communist pilots, with a service ceiling advantage of more than 4000 feet, could sit at 49,000 feet and choose when to fight and when not to. Those few with skill and experience ("honchos" was the term used by American flyers) could use the MiG's advantages to a point where they became obvious enemies to avoid (some were undoubtedly Russian "instructors," as a Korean defector later confirmed).

Not that the 15 was perfect: Lateral instability ("snaking") at high speed often made it a poor weapons platform. And its relatively thick-winged airframe was limited to Mach 0.92, giving the transonic Sabrejet an always available escape—*dive* (if you had the altitude to begin with).

Mikoyan and Gurevich were aware of the shortcomings of the MiG 15 and would attempt to correct them, as the two superpowers moved toward the supersonic fighter generation, with the MiG 17. (If you've noticed that Soviet fighters always seem to have odd numerical designations, you're right. Only aircraft slated for export, such as the Sukhoi-designed Su 20, get even numbers.)

MiG 19 vs. F-100

The MiG 17 appeared in 1952, and differed from the 15 mainly in refinements: The fuselage was less stumpy; its wings were more sharply swept, with rounded tips. Carrying on alone after Gurevich's declining health broke up the team, Mikoyan continued the basic refinements, giving the MiG 17 a still longer fuselage and replacing its single bulky engine with two slim powerplants. The result was the first Soviet supersonic fighter, the MiG 19 (NATO code-name, "Farm-er"), in September, 1953.

This was just a few months after the initial flight of the first American supersonic fighter, the F-100.

(Please turn to page 138)

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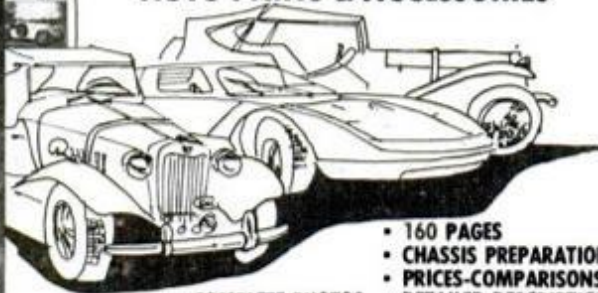
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MIG: ULTIMATE AIRPLANE KILLER

(Continued from page 137)

But the Farmer had a top speed of 920 mph compared to the F-100's 864, and the MiG 19 could initially climb at 22,640 f.p.m. while the American entry could climb only about 16,000. The U.S. fighter had far greater range and could carry a bigger payload—but, again, the MiG had an edge in maneuverability.

In 1955, it became known that Mikoyan had turned out two experimental fighters—nearly identical except for wing design. The E-66 had a delta wing while its sister, the E-66A, had a highly swept conventional wing; both were flown in 1956 at the Soviets' annual airshow at Moscow's Tushino airport. Western observers code-named the swept-wing version "Faceplate," while the delta was called "Fishbed." Today it is the Fishbed that is in service throughout the world in several variants as the MiG 21, replacing the MiG 17 as the standard Third World fighter.

MiG 21 vs. F-4 Phantom

The MiG 21 is a small aircraft, about 48 feet long with a wingspan of 23.5 feet. It will weigh anywhere from 18,000 to 21,000 lbs.—at a time when a typical Western fighter tips the scales at from 40,000 to more than 50,000 lbs. In military aircraft, size is roughly equivalent to cost, and the MiG 21 has been sold to nations such as India, Finland and Iraq for about \$1 million each. (The MiG 17 is still the most prevalent single type in the world. The Peoples Republic of China alone has 4000 of them on combat-ready status, and they are still found in six Warsaw Pact countries, Albania, Algeria, Egypt, Iraq, Morocco, Sudan, Syria, both Yemens, Angola, the Congo, Nigeria, Tanzania and Uganda.)

By contrast, U.S. F-4 Phantoms cost about \$4.5 million apiece. The F-4 has two engines, each alone more powerful than the MiG 21's single turbojet and gulping more fuel so more must be carried aboard. A large wing to lift this weight and a larger fuselage in which to stow the fuel are therefore required, all of which must be supported by very strong—which means heavy—landing gear. Now generally speaking, our fighters weigh more because they are general-purpose aircraft, designed to do a number of jobs more than adequately, at the compromise of excellence at any one.

The MiG 21 Fishbed was intended to do just one job exceedingly well,

to carry on the MiG tradition of knocking other aircraft out of the sky. In its earliest form it was a simple day fighter with a small radar, minimal fuel and a short-life Tumansky engine of only 11,240 lbs. thrust. A short-life engine is lighter, cheaper and very much in line with Soviet military thinking: Since the Fishbed was an air superiority fighter, it would by all odds have only a limited combat life expectancy—so why invest in an engine rated at more hours than the aircraft in which it is mounted? (A secondary consideration may be to keep client states dependent: When Egypt broke with the U.S.S.R., its MiG-based air force was soon nearly grounded for lack of parts. American aircraft would have remained in service months longer without a parts problem. Vietnam is still flying captured U.S. jets.)

In the motto of the Mikoyan-Gurevich design bureau, then, the word "economics" might be added to Speed and Altitude, since it is now another basis on which aeronautical design genius can be assessed.

The hard facts are these: By the tail end of the Vietnam War, the rough tally was one Phantom lost for every MiG 21 we downed. On that basis, for every pilot and \$1-million airplane the enemy lost, we were losing an aircraft costing more than four times as much plus two crewmen. One Fishbed based in North Vietnam (identifiable by squadron markings) succeeded in destroying 14 U.S. aircraft.

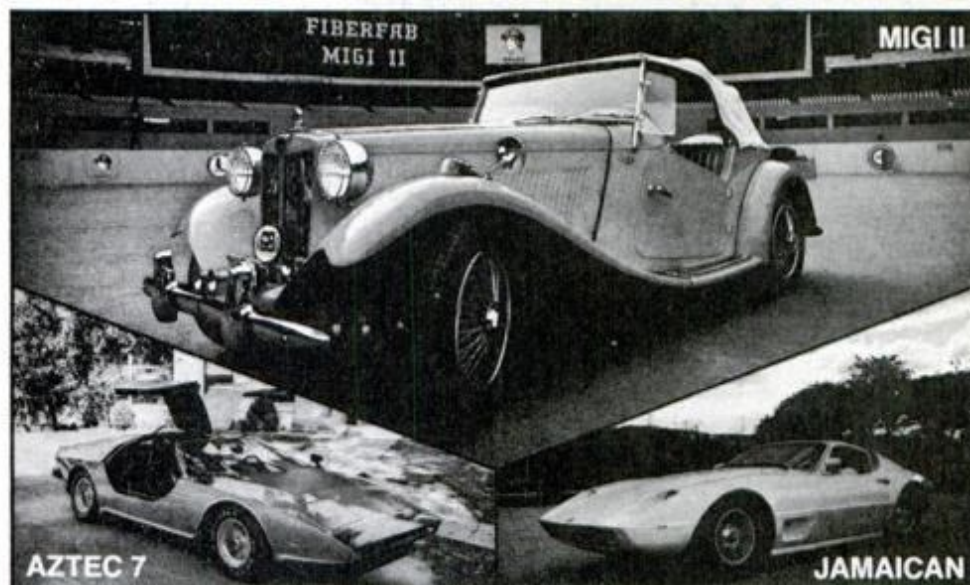
That particular MiG, however, was flown by more than one pilot. According to best available information, the leading ace of the Vietnam War was a certain Major Tomb, a North Vietnamese who flew a MiG 17. Indeed, the record shows that a number of American pilots said that the subsonic, but extremely maneuverable, 17 was a harder foe to bring down than the supersonic 21. So with an aircraft that had flown some 15 years before in prototype, Tomb accounted for 13 American aircraft—before he was bused back by a Sidewinder missile.

Before Mikoyan died, he had laid the groundwork for the variable-geometry MiG 23, a "swing-wing" attack fighter that was beset with as many initial problems as was its U.S. counterpart TFX, and for its simplified variant, the MiG 27. But it is the Foxbat (MiG 25) that represents the carrying forward of the Mikoyan-Gurevich philosophy into the Mach 2-plus generation of fighters.

Over the years, the U.S. has "col-

(Please turn to page 140)

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MIG: ULTIMATE AIRPLANE KILLER

(Continued from page 139)

lected" some two dozen MiG aircraft through defections of Communist pilots and other incidents. (One of the most bizarre occurred during the Six-Day War when six Algerian MiG 21s landed routinely at El Arish airbase in the Sinai Peninsula, completely unaware that Israeli forces had just overrun and captured the field.) But it wasn't until September 1976 that the West got its hands on a Foxbat, courtesy of Victor Belenko, a Soviet pilot who left wife and family in the U.S.S.R. and swooped into Japan—easily avoiding the F-4s that scrambled to intercept him.

MiG 25 vs. world's best

The dust had barely settled around the MiG 25 before Western technicians were all over it. They found an aircraft that was large (by Russian standards) but designed with the same spartan simplicity that has marked Mikoyan-Gurevich efforts since the MiG 1. Most of its construction utilized steel, with the lighter, more expensive titanium used only where absolutely essential. An American or

European builder would probably have used far more titanium, allowing the cost to skyrocket.

Foxbats were overflying Israel five years ago and on one occasion one was detected warming up at Damascus Airport in Syria. An Israeli F-4 was scrambled, positioned itself, and lobbed up a long-range Sparrow air-to-air missile at it. The MiG 25 zoomed over at 80,000 feet and Mach 2.5. No intercept resulted. Since then, Foxbats have overflown much of Western Europe. Some unconfirmed reports have placed them over England and others have placed them over Iran, in spite of that country's purchase of a number of Mach 2 F-14s specifically to preclude Soviet overflights.

In the future of Cold War/Détente, it is possible that no power will be able to afford the bloated super aircraft designs of the past. In what seems a burst of perfect hindsight, the U.S. has now ordered into production two fighters, the F-16 and the Navy F-18, which are comparable to the compact MiG 21 Fishbed in size. But these aircraft can sprint only at Mach 2 or a little better—no match for the Foxbat or the mysterious MiG 29.

In the late 1950s, a number of

U.S. designs existed which, if they had gone into production, might have been more than a match for the U.S.S.R.'s finest. Republic Aviation's XF-103, powered by both turbojet and ramjet, was rated capable of Mach 4.0, while North American's XF-108, a scaled-down XB-70, would have flown at more than Mach 3. The Eisenhower administration cancelled the nearly completed XF-103 in favor of the XF-108—then, in a later economy move, killed the latter project as well. There was not to be another completely new fighter scheduled for production until the F-15.

Foxbat generation unmatched?

Whether the Soviet Union can maintain the pressure of its quest for air superiority remains to be seen. What is clear is that the West backed away from producing an entire generation of fighters—the Foxbat's generation. The ideas of Mikoyan and Gurevich are therefore still to be contended with. They put the relatively primitive, totally derivative military aircraft design capability of the Soviet Union nearly on a par with that of the U.S. in the space of a few decades. And that's no mean accomplishment. **PM**

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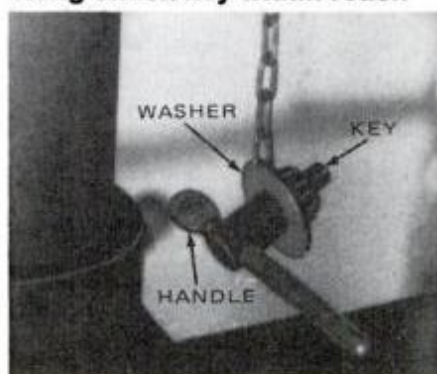
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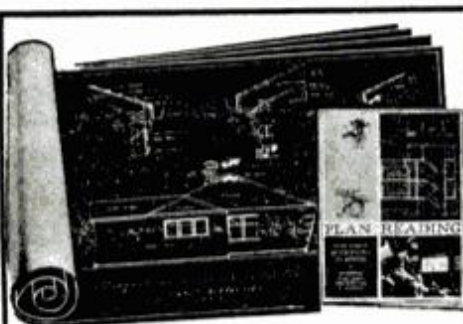
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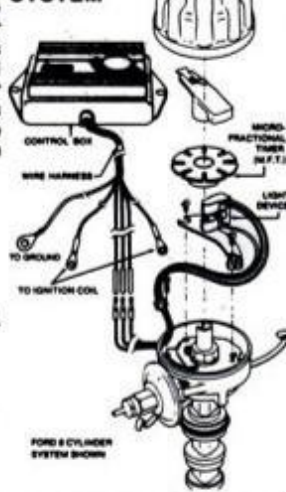
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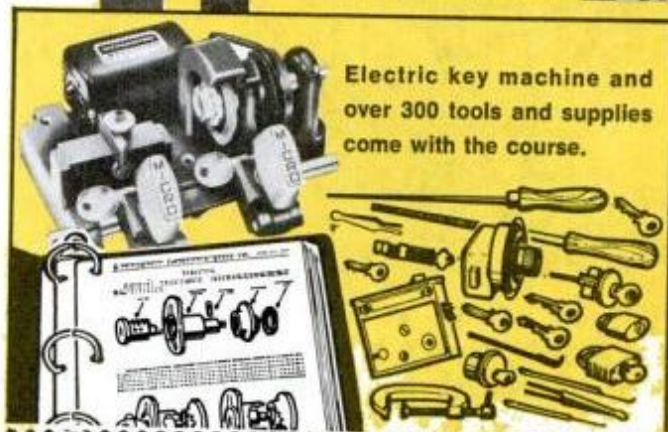
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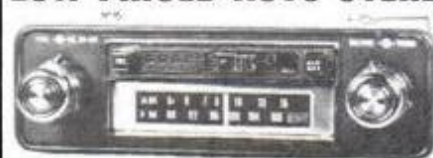
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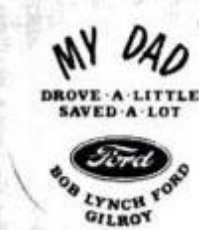
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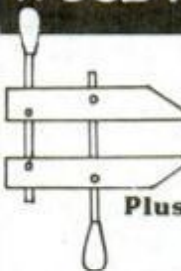


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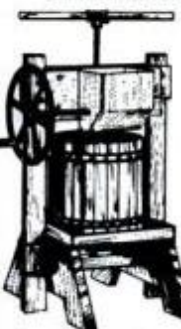
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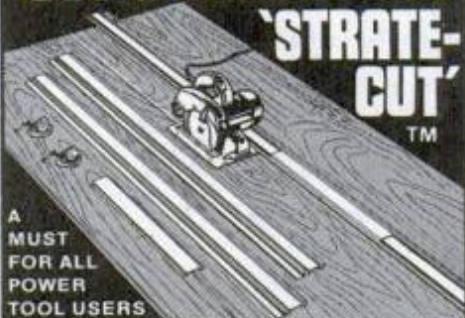
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(Continued from preceding page)

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