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# Popular Mechanics

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cigarette, FTC Report Mar. '83.

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# Popular Mechanics®



**ON THE COVER**  
 America's first high-speed bullet train, traveling at 165 mph, will soon make the Los Angeles-to-San Diego run in an incredible 59 minutes. Read how it compares with its French and Japanese rivals in the exciting story on page 90.  
 —PM painting by Ed Valigursky

VOLUME 160 NUMBER 5

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## AUTOMOBILES AND BIKES

- Imports and Motorsports **8**
- Detroit Listening Post **14**
- Car Clinic **20**
- The PM Garage **30**
- Saturday Mechanic:
- Troubleshooting valve train problems **35**
- New BMW 1000 bike departs from tradition **50**
- PM's long-term car tests:
- New Yorker, Cimarron, Audi 500S, Camaro Z28 **64**
- Firsthand Report:
- Driving the Isuzu Impulse **66**
- Firsthand Report:
- Driving Nissan's new 300ZX **85**
- PM Owners Report: Corvette **132**

## SHOP AND CRAFTS

- 48 The PM Workbench
- 62, 137, 176** Hints from readers
- 94 PM's Great Shop—
- A dream add-on packed with ideas
- 100** Add a new entry to your house and seal out drafts
- 104** 9 great woodworking jigs for your shop—Part I
- 108** How to refinish furniture beautifully

## HOME AND YARD

- 24** Homeowners' Clinic
- 26** Appliance Clinic
- 28** New Now for home and shop
- 54** How to fix 4 common plumbing problems

**82**



**88**



**100**

**86**



**73**



## SCIENCE AND ENGINEERING

- Science Worldwide **44**
- Daring high-wire ride to freedom from East Berlin **78**
- Coming—The fastest train in the West **90**
- Russia's chemical warfare garb **139**
- Radar locates deadly wastes **139**
- "Spotlight" for laser targets **139**
- Supertug is a real bear **142**
- Earthquake-resistant building **142**
- Time-released medicine bottle **142**
- Springy cement **142**
- Inside Mount St. Helen's **168**

## AVIATION

- Tomorrow's shifty new fighter planes **73**
- Nuclear-powered airplane **140**
- Return of the P-51 **140**
- Poor man's AWACS: Blimp with big eyes **140**
- Flying machines for the 21st century **141**
- Aerial net saves spy planes **141**

## ELECTRONICS, RADIO AND TV

- 12** PM Electronics Monitor
- 70** PM Software Monitor
- 88** Compact Disc players—
- Is now the time to buy?
- 154** Getting the most from your VCR

## BOATING AND OUTDOORS

- 42** All Outdoors
- 82** Flying the '84 snowmobiles
- 86** New outboards have more kick for '84

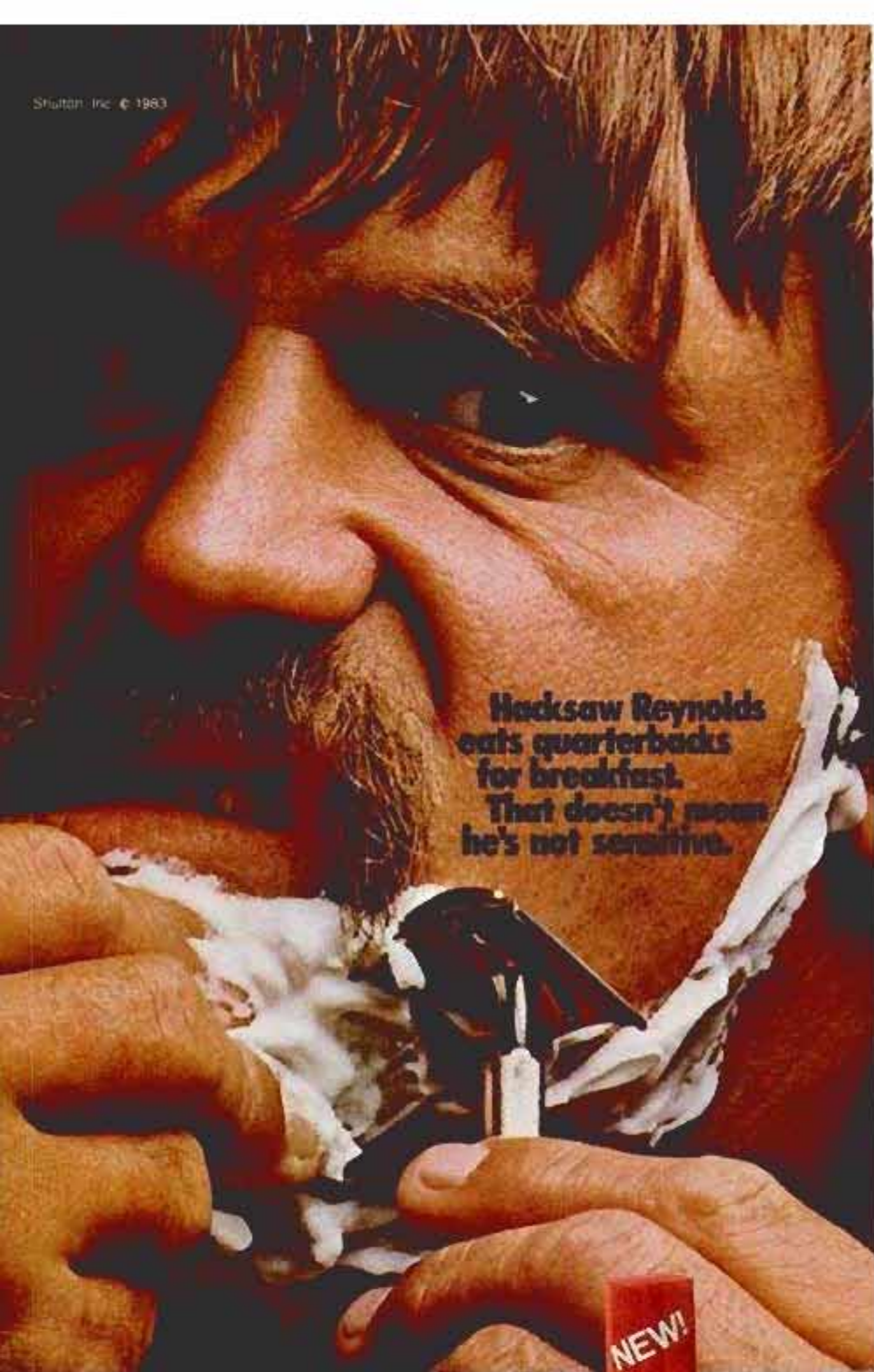
## PHOTOGRAPHY

- 69** Photo Hints
- 158** How to preserve your home movies

## EVERY MONTH

- 5** Editor's Notes
- 6** Letters to the Editor
- 139** Technology Update

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for breakfast.  
That doesn't mean  
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# EDITOR'S NOTES

**T**he very idea of flying at Mach 2 speeds in a *destabilized* airplane seems chancy at best. Generations of pilots have held, as an article of faith, that their planes were blessed with stability. It was a built-in stability that kept the plane straight and level, even if the pilot flew it hands-off. But a deliberately destabilized machine? One



Gallagher and one of America's newest jet fighters at the International air show on Le Bourget field near Paris.

that tumbles out of control if its computer fails? Well, that's the way things are these days when you're looking for the ultimate performance. That's just one of the many fascinating bits of information that Special Features Editor Shel Gallagher picked up in the course of researching *Tomorrow's Shifty Dog Fighters*, which starts on page 73. . . . **We'll probably be accused of cruelty** for showing our woodworking readers the home shop in this issue. It's the kind of workroom that everyone dreams about, and hopes he'll have . . . someday. Our *Add-On Dream Shop Packed With Ideas* (page 94) is in the home of August and Susan Capotosto. If the name seems familiar, August is the son of Rosario Capotosto, a long-time contributor (who also, of course, helped with the project). . . . **Are you ready for yet another import from Japan?** It appears that we'll soon have an American version of the Japanese bullet train streaking through Southern California. If everything goes as planned, you'll be able to put your Honda in a parking lot and ride from Los Angeles to San Diego at 165 mph in *The Fastest Train In The West* (page 90). . . . **It's bound to happen** when you try to fly a machine that's designed, essentially, for travel on the ground. That's what Outdoors Editor Ray Hill discovered when he flipped a Ski-Doo snowmobile while making exuberant leaps for photographer Jim Elder. No harm, though. Ray suffered only embarrassment, while Jim shot the excellent photos that accompany the article, *New Snowmobiles: We Fly The '84s* (page 82). **PM**



A motor-driven camera captured all but the red face as PM's Hill (1) tried a barrel roll in a snowmobile, (2) tumbled in the snow, and (3) sprinted to the finish line.

*John A. Lillenton*



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# LETTERS TO THE EDITOR



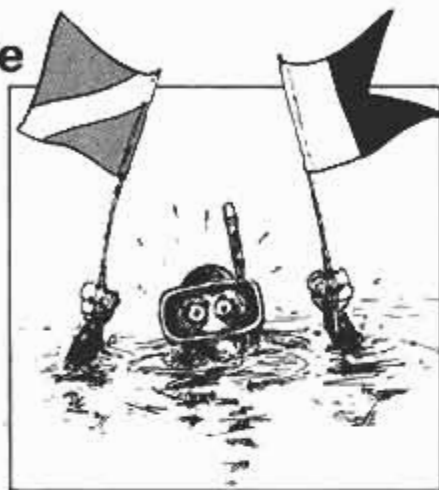
## Snorkel-Tow update

In your article *Build PM's Snorkel-Tow For Lazy Summer Fun* (page 68, Aug. '83), you showed the wrong diver's warning flag. The familiar square red flag with a white slash is no longer legally correct. According to a recently passed federal law, the proper dive flag is now a blue-and-white chevron known as "Alfa" (the letter "A" in international flag code).

The old flag will no longer provide legal protection in the event of an accident, and a diver could be cited for failing to display the new one. For the moment, the U.S. Coast Guard Auxiliary recommends that both flags be flown until the Alfa flag is more widely recognized.

CARLETON M. STEWART  
PUBLIC AFFAIRS OFFICER  
U.S. COAST GUARD AUXILIARY  
LONGBOAT KEY, FLA.

*Thanks for the update. As a remind-*



To be on the safe side, says the CG, show both flags—the old (left) and new (right).

*er to readers, both the old and new dive flags are illustrated above.*

Your electric-powered Snorkel-Tow looks like great fun, but I wonder if it's completely safe. You specify that the

battery must be enclosed in a plastic case to prevent shocks. I've heard that lead-acid batteries can give off explosive hydrogen gas. Could hydrogen build up inside the case and create a dangerous condition?

FRANK SCHMIDT  
CHICAGO

*It's true that lead-acid batteries can release hydrogen gas, but this normally occurs only during recharging, as was cautioned in the article. Little or no hydrogen is given off during the discharge cycle when a battery is in use. Also, the battery case, made specifically for marine use, is not designed to be airtight.*

*However, to be absolutely safe, PM recommends that a catalytor be installed inside the battery case under the lid. This is a small, inexpensive device that converts hydrogen gas to harmless water vapor. It is available from Seatech Corp., 985 Northwest 95th St., Miami, Fla. 33150.*

## Galvanized GIs

Unlike M. Sgt. Daniel Evans (*Letters*, page 6, Aug. '83), I do not object to the use of the term GI in reference to soldiers, but you should at least get its origin straight. Contrary to popular belief that GI stood for "government issue," it actually came from the letters stamped on Army supply cans meaning "galvanized iron."

In the cavalry regiment I served in some 50 years ago, the GI can had a special meaning. It was a receptacle placed outside the barracks at night for the benefit of those laggards who couldn't or wouldn't make the 200 yards to the regular latrine.

JOHN FOUNTAIN  
RIVERSIDE, CONN.

*Sounds logical, but it's a new one on us. Anyone want to confirm or contest this derivation?*

## Slick-looking saw table

Thought you might like to see a photo (right) of the radial-saw stand I built from your excellent plans (*Build PM's*

*Compact Table For Your Radial Saw*, page 122, Feb. '79).

The clever folding table extensions provide a large work surface without getting in your way when they aren't needed. The construction plans were easy to follow, and the work center is a joy to use.

BERNARD W. CRUSE JR.  
INDIAN TRAIL, N.C.



PM's radial-saw table, with folding extension wings, built by reader Bernard Cruse.

*Thanks for the photo; you did a great job. For others who may be interested, photocopies of the saw-table plans are available for \$2.50 postpaid from Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.*

## Welcome aboard

I just received my first copy of PM and am already glad I subscribed. In your *Homeowners' Clinic* (page 12, June '83), I found the solution to a blocked toilet problem that had been giving me fits. With your help, I fixed it myself.

The variety and value of just one issue have convinced me that I made the right decision. Thanks.

ALICE E. BECKER  
PITTSBURGH

A friend recently gave me several copies of PM to look over. I was so impressed with the content that I've now become a regular reader. I especially enjoy your features on woodworking, being a cabinetmaker myself.

KEVIN BRADSHAW  
CHRISTCHURCH, NEW ZEALAND





# Now America's #1 chain saw comes with yet another feature found on no other saw:



## Free Boots! \$55 Value

Homelite chain saws give you all the performance features and power you need to do the job like a pro.

And with our FREE boot offer, you can even dress like one!

When you purchase a Homelite® Super 2, 240, 245, 330 or 410 chain saw between September 1 and December 31, 1983, we'll send you a FREE

**WOLVERINE**  
798-Boots

pair of \$55 Wolverine genuine pigskin leather boots, for just \$3 postage and handling! Your Homelite dealer will give you details, and then he'll show you even more features, to boot.

## Innovation that puts us a cut above the rest.

It's not enough just being the leader in 2-cycle engine technology and pioneer of the modern chain saw. Our latest engineering breakthroughs result in the most advanced performance features imaginable! Features like advanced carburetor design on our updated Model 410, for improved engine idle and acceleration. Extended wear features



that let our new Model 245 go above and beyond the call of medium duty saws! Combine that with features like vibration isolation for more control and less fatigue, and you've got the best selling line of chain saws in America today!

## We're America's #1 chain saw because safety is our #1 priority.

Homelite chain saws continue to set an example for the industry, with safety features unheard of on other saws. Our exclusive SAFE-T-TIP® anti-kickback device totally eliminates kickback by preventing the nose of the guide bar from striking a solid object. And our Raker III™ Kickback Suppression Chain reduces kickback intensity by as much as 75% compared to conventional non-safety saw chains.



With so many features, you've got all the right reasons for walking away with a brand new Homelite chain saw. And with our FREE boot offer, you'll even get something to walk away in!

See your Homelite dealer for "FREE BOOT" details.

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AROUND THE  
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# IMPORTS & MOTORSPORTS



## The 1984 Mercedes 190 is here



You can now spend \$24,000 for the smallest Mercedes in the '84 line. The new 190D (diesel) and 190E (gas), which have just gone on sale, offer a new scale of Mercedes motoring. The U.S. models of the compact M-B keep the 190 designation that's used on the European versions. Power for the 190D is a 2.2-liter diesel Four of 72 hp. The 190E uses a 2.3-liter, fuel-injected gas Four of 130 hp.

Compared to the gas-engined 190 in European trim, there is a performance penalty with the 2.3, which is emissions-controlled for the United States. Still, it's a strong and willing powerplant for the 2,655-pound 190E. With the automatic transmission, it's our choice if we were buying a 190. The M-B compact is not a performance car, so we wouldn't opt for the five-speed. We also found that the sedan is sporty enough and handles so superbly that

**Sport 190, with 185-hp Cosworth engine, was just introduced in Europe. It's not joining new 190D and E models here—yet.**

we would not saddle ourselves with the diesel just for the sake of more mpg (29 for the gas vs. 39 for the diesel).

During several hundred miles of driving in hilly country, downshifting and trying to push the pedal of a five-speed 190D through the floor, we tested only our . . . patience. We would have preferred to have been driving the gas Four—with either transmission—to enjoy the 190 gracefully sure-footing it over some very challenging roads. (We already knew about the excellent 190 chassis and suspension from our European test—see *Driving The Mercedes 190 And BMW 318i*, page 105, Apr. '83—and the U.S. version is unchanged in that regard.)

European drivers have been clamor-

ing for an engine worthy of this chassis and Mercedes has delivered: The new Sport 190 has a 2.3 with Cosworth head that incorporates double overhead cams and four valves per cylinder. It's not yet in the model lineup here. Too bad. It would have been just the car to have driven at the Indy Motor Speedway, which is where Mercedes introduced its '84 U.S. 190 models. For a look at real performance cars, we had to content ourselves with a walk over to the Hall of Fame Museum at Indy. There's a zillion horsepower packed into that building—don't miss it.

Here are the rest of the M-Bs for '84: The 380SEL and SEC get 5.0 liters and



**The 1908 Mercedes GP racer, author at wheel, is in Indy Hall of Fame Museum.**

become the 500SEL and SEC; a 380SE is added for a gas alternative to the 300SD; and carryover models are the 300D, 300CD, 300TD, 300SD and 380SL. The 240D is dropped.

## Looking up the road

Now that the automobile is almost 100 years old (Mercedes celebrates its centennial with its 1986 models), and

we're racing up on that magic number 2000, automakers are planning further ahead than usual. Volvo has even built a turn-of-the-century prototype.



Rear seats face aft in Volvo's LCP, a station wagon-like car.

The LCP is its Light Component Project, a wagon-like car weighing less than 1,500 pounds. Stressed components are aluminum and body panels are plastic. The turbodiesel has a magnesium block, possibly to be used with

a continuously variable ratio gearbox. It could be Volvo's first fwd car. For legroom and safety, the rear seats face aft.

Meanwhile, back in 1984, Volvo's DL models get raised trim level; the 760 turbodiesel gets a four-speed automatic; GLT turbos will have the intercooler factory installed by January; and, by March or April, the turbocharged, gas-engine 760 will make its appearance in the United States.

Following '83, Volvo's all-time record-breaking year, prices should be up no more than a percent or two, with DLs starting at \$11,000 and 760s selling for \$19,000.

**PM**

The New Car.  
It was designed  
to move people.  
In comfort and  
with unrivaled  
efficiency. EPA  
est. **51** mpg, 67  
mpg hwy. It is  
based on what

Gas mileage only. 1.3 liter engine. Use 51 mpg for comparison. Your mileage may vary with speed, weather and trip length. Hwy. mileage will probably be less. Calif. figures will be lower.

your driving  
needs are today.  
And what your  
needs will likely



# be in the future. The New Car, the Civic CRX

**H O N D A**



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Моторная компания Хонда

# PM ELECTRONICS MONITOR



## Computer bug 'bytes' photographers

Cameras, because of the need for both miniaturization and accuracy, have always been packed with the latest in technological advances. So, it's no wonder that a talking camera and a thinking strobe light have recently made their retail debut.

The new Minolta AF-Sv is a 35-mm autofocus camera that's having so much fun being your photographic friend that it just can't shut up. While it doesn't have the vocabulary of a William F. Buckley Jr., its handy reminders of "Load film," "Too dark, use flash," and "Check distance" will tend to make all other cameras appear incommunicative, if not downright recalcitrant.

Of course, if you are taking pictures during solemn marriage vows, for example, you may crave less conspicu-

ous peace and silence. If so, the voice module can be gagged via a simple on/off switch.

But, as many wives and husbands may attest, it is all too easy to ignore the voiced warnings of a loved one, so the AF-Sv also has the usual style of warning LEDs as backup. All in all, this is a nice camera for the autofocus crowd and the added voice can serve as more than just a gimmick.

Then, there is the Albert Einstein of flash units—the brand-new Vivitar 5600 modular LCD flash. Basically, all that the photographer must do is select an f/stop (after punching in the film speed). The flash itself computes all info and displays its shutter speed choices on the built-in LCD screen. It even will automatically set cameras

that are equipped to accept "dedicated" strobe units such as this. The unit is really three pieces hooked together atop your camera in a miniaturized, modular fashion.

The head, which is the light on top, is available in three versions: bare bulb, a standard model that throws light 111 feet at ASA 100, and a super-deluxe with a motor zoom front that can do wide-angle coverage and telephoto. The main unit, or body module, holds the LCD display and the control electronics. The processor module is the interface between your camera and the other two modules. Processor modules can customize the 5600 to just about any setup.

Anyway, the next time someone accuses you of taking boring pictures, at least you'll be able to talk about your exciting, high-tech equipment!

## Super new cartridge

Once in a while, our Auto Editor may get to drive a Ferrari, or our Outdoors Editor may fly in a combination kite and airplane, but being Electronics Editor has its rewards, too. For instance, we just test-drove a new V15, type V, Mark II stereo cartridge and found that it tracked tighter than a Ferrari and soared higher than a ParaPlane.

When you open the case and inspect the V15's included toolkit of miniature screwdriver and jewel-like bearings, you know you're dealing with a quality product. We found the V15, along with its kit, to be the easiest to mount and balance properly of any cartridge we've used. Ease of mounting is important: With an improper alignment, a cartridge cannot perform up to its maximum specs.

And, the V15 has an impressive list of specifications. Made to track at one gram, the V15's hyperelliptical stylus can search out any information the record groove has cut into its sides.

Each cartridge is packaged with a computer readout which details test results that were made at the factory on each individual unit. Everything from trackability (the ability of the stylus to keep in contact with the record groove) to channel separation is detailed. But the bottom line has to be

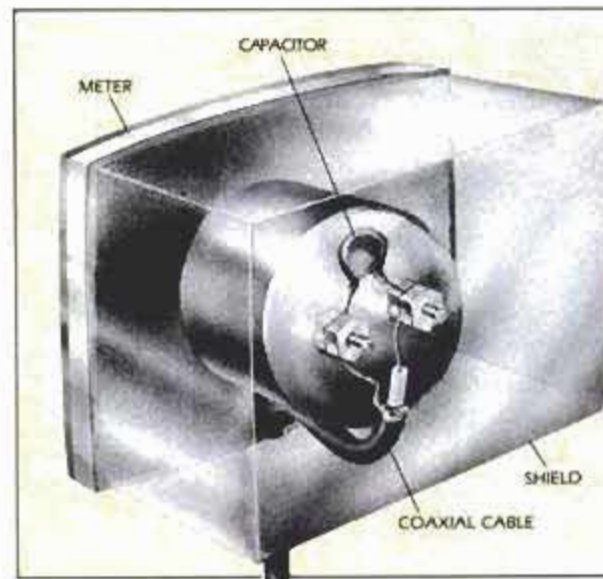
how the cartridge sounds—what nuances of the music it can make clearer and truer.

Listening tests proved to us that we could detect an improvement in sound from another expensive cartridge. At \$250 retail, this is indeed a luxury item—but if your music is worth it, then talk to your pocketbook. Even more enhanced versions of the V15 will be on the market soon. Get yourself an earful.

## Spreading the word

If you have a computer, the odds are pretty good that you will have a spreadsheet program such as VisiCalc or SuperCalc.

If that's the case, here's a tip: There is a very good users' group for calc people called "Intercalc." The Intercalc group publishes its own newsletter of hints and techniques. You can contact Intercalc at Box 254, Scarsdale, N.Y. 10583. **PM**



### Meter Bypass

If you build a circuit for RF (radio-frequency) levels, be certain RF energy doesn't stray into meters and throw off readings. Shield all meters with metal grounded to chassis ground. Bypass connection points with a small disc capacitor. This will short RF, but allow normal (lower) frequency power to be metered.

# Pall Mall A Step Ahead

Step up in taste,  
step down in tar



9 mg. tar  
0.8 mg. nic.

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

9 mg. "tar", 0.8 mg. nicotine av. per cigarette, FTC Report Mar. '83.

# DETROIT LISTENING POST



## Chrysler's '84 imports

Chrysler introduced its 1984 line of imported Mitsubishi vehicles recently at the beautiful race circuit in Bridgehampton, N.Y. Mitsubishi has dropped the Challenger and Sapporo models for '84, so Dodge and Plymouth dealers have been given a cleaned-up version of the turbo-charged Mitsubishi Starion, dubbed the Conquest.

The '84 version of the Starion/Conquest has smoother styling, with no fake hood scoops, and neat driving/flasher lights built into the front bumper. But the 145-hp, 2.6-liter, ohc engine still produces a lot of wheel hop, especially when you dump the clutch in second—it feels like you've just been



Front-drive Colt Vista wagon has van-like styling and versatile seating for seven.

rear-ended! Figure on a \$12,500 to \$14,000 price range.

Chrysler is offering a turbo option on the Colt hatchbacks this year, making them modern-day versions of the old Mini-Cooper. The 102-hp, 1.6-liter engine rockets the tiny Colt from 0 to 60 in 8.1 seconds and through the ¼-mile in 16.3 seconds at 83 mph—all figures slightly better than the Conquest. Michelin XVS tires and gas-filled shocks are standard on the \$7,500-\$8,000 Turbo Colts.

But the real show-stopper was a seven-passenger family wagon—the van-like Colt Vista with its space shuttle

styling and clever seats that fold and flop to form everything from lounge chairs to a double bed. They even accordion out of the way for maximum cargo space. Unlike Chrysler's T-Wagons, the Vista's seats can't be removed, and its floor isn't flat, so it's called a wagon, not a van. It's 4 in. narrower and 5 in. lower than the T-Wagons, but the same length. Fwd is supplied by an 88-hp, two-liter Four with the choice of a three-speed automatic, five-speed manual, or the 2-by-4 Twin-Stick transmission. Only about 8,000 will be imported in '84, so they'll likely sell at or above the list price of \$8,000.



Conquest sports coupe has clean lines and neat driving/flasher lights in bumper.

## Ciera HO diesel!

Strange, but true. At present, the Ciera high output diesel is just a study, but insiders tell us it is being worked on with uncharacteristic zeal.

The engine is Oldsmobile's 4.3-liter V6 oil burner. Why the Ciera? It's already set up for the transversely mounted powerplant and, though it might seem otherwise, the venerable Cutlass Supreme won't be with us forever. Ciera is to step into the breach as the Olds flag carrier when the full-size car is retired—and that means it must also pick up the Hurst/Olds mantle the Cutlass Calais will leave behind. Will the 1985 Hurst/Olds be a hot Ciera diesel? A performance diesel would certainly find immediate acceptance, except in California, where NOx standards would likely ban the car. At the very least, such a unique performance car would cause a stir among automotive enthusiasts.

## Front-drive C-cars

We've seen Oldsmobile's version of the '84 fwd C-car. It was a 98 Regency Brougham, had a very roomy interior and a roofline formal enough for the Queen Mother's limo. Engine choices are the Olds V6 diesel or Buick's port-injection gasoline V6. Still, no introduction date has been set due to a combination of development snags (which no one will talk about) and marketing considerations. After all, with the rear-drive cars selling like crazy, why rush to market with an unperfected front-driver, especially a market where the average buyer probably couldn't care less about which end of the car was driving?

## Cherokee XJ Pickup

Coming soon—in about a year—is the pickup version of the new downsized Cherokee XJ utility vehicle. It will be

powered by the same 2.5-liter, in-line Four or 2.8-liter V6 that Jeep is putting into the enclosed trucks. The new Jeep pickup reverses the trend set at Chevrolet/GMC and Ford, where the pickup trucks were followed by the enclosed versions. The Jeep pickup will continue the downsized look of the new Cherokees, in that it will just be a Cherokee cab cut off at the trailing edge of the doors and at the lower edge of the rear windows. Expect equipment and trims to be the same as on the enclosed versions.

## All-wheel-drive Alliance?

AMC has tested four-wheel drive under a dechromed Renault R14 mule body, using the Alliance/Encore 1.4-liter engine. "We must capitalize on our greatest strength," an AMC design executive says, and 4wd technology is it. The

(Please turn to page 16)



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## DETROIT LISTENING POST

(Continued from page 14)

secret project awaits "a suitable platform," which our mole believes will be a station wagon version of the Alliance. The all-wheel-drive vehicle would use the 2.2-liter French engine that is going into the U.S. Fuego just about now. A 4wd version of the Renault 18 wagon is already on sale in Europe with a two-liter engine and five-speed transmission.

The scrambling Alliance 4wd unit is seen as the replacement for the Eagle line, though at present that car isn't



This 4wd Renault 18 station wagon may be the basis of an upcoming Alliance 4x4.

scheduled for retirement. How the sheet metal will be bent around the mechanicals, we're told, is still open to study.

Some AMC higher-ups believe the

company has seen its last totally French-designed car. AMC will continue to use Renault resources—primarily Renault engines—but modified with AMC fuel delivery philosophy.

AMC sees Renault as a shopping center, the design man told me, where the American firm can select an engine here, a suspension there, whatever it needs to do its own cars. And the Americans are hot to whip up their own vehicles, not Shake-and-Bake a French design for U.S. consumption—no matter how "down home" the breeding.

The new 4wd Alliance could even be turbocharged. If it were, it would offer a serious threat in several segments of the market. When we asked an AMC spokesman about the potential for a turbocharged Alliance, he merely smiled cryptically and murmured, "That would be an interesting possibility, wouldn't it?"

### Prepare to cross out Xs

In the wake of a history replete with mechanical problems and an interminable series of highly publicized recall campaigns, Chevrolet will retire the Citation X-car by 1987 in favor of an L-body, front-wheel-drive car.

The car, debuting in late 1986 as an '87 model, will be available in coupe, sedan and hatchback versions, with GM's standard mix of four- and six-cylinder powerplants. It will measure a bit larger than Chevy's Cavalier in order to nestle in between the J-body and A-body cars. Other X-bodied cars in the General's stable—Pontiac Phoenix, Buick Skylark and Olds Omega—apparently are spared the chopping block for now, though rumors still circulate that Buick will replace the Skylark in '87 with a model that is still unknown.

### Speculative survey

A survey of 300 vehicle manufacturer and auto parts executives by the consulting firm of Arthur Anderson & Co. had some interesting results. The executives believe that:

- There will be another energy crisis between 1988 and 1992.
- By 1992, the import share of the U.S. auto market will decline from 27 to 24 percent. However, foreign auto companies with U.S. plants will account for 4 percent of the market.
- The \$1,500-\$2,000 per car Japanese cost advantage over U.S. companies will drop to \$500-\$700 by 1992, while prices of U.S. cars and parts will rise only 3 percent a year over the same period.
- Average passenger car fuel economy will increase to 30 mpg by 1987 and to 35 mpg by 1992. **PM**

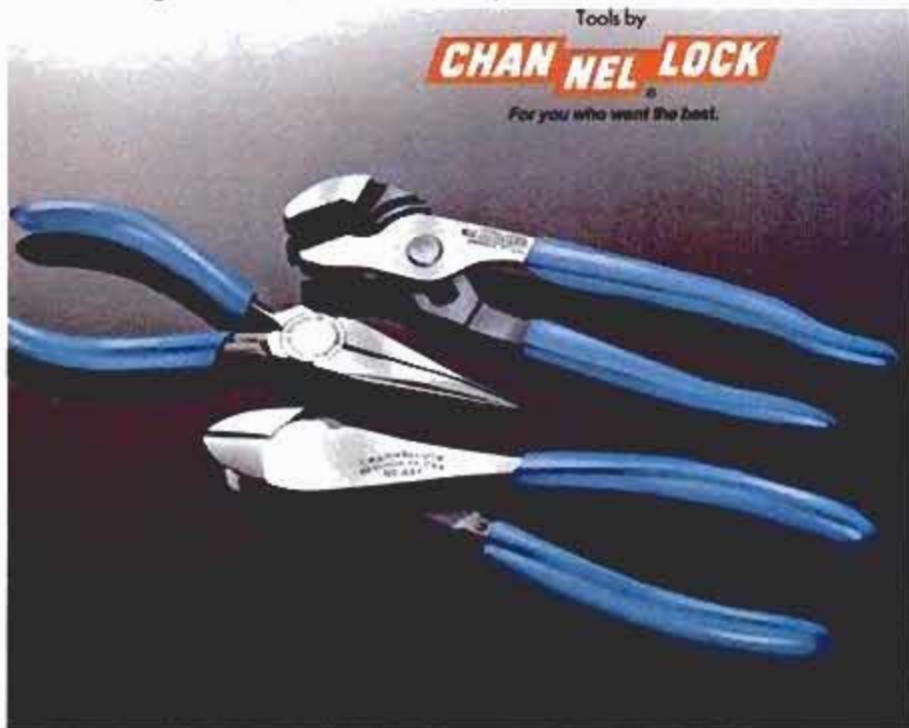
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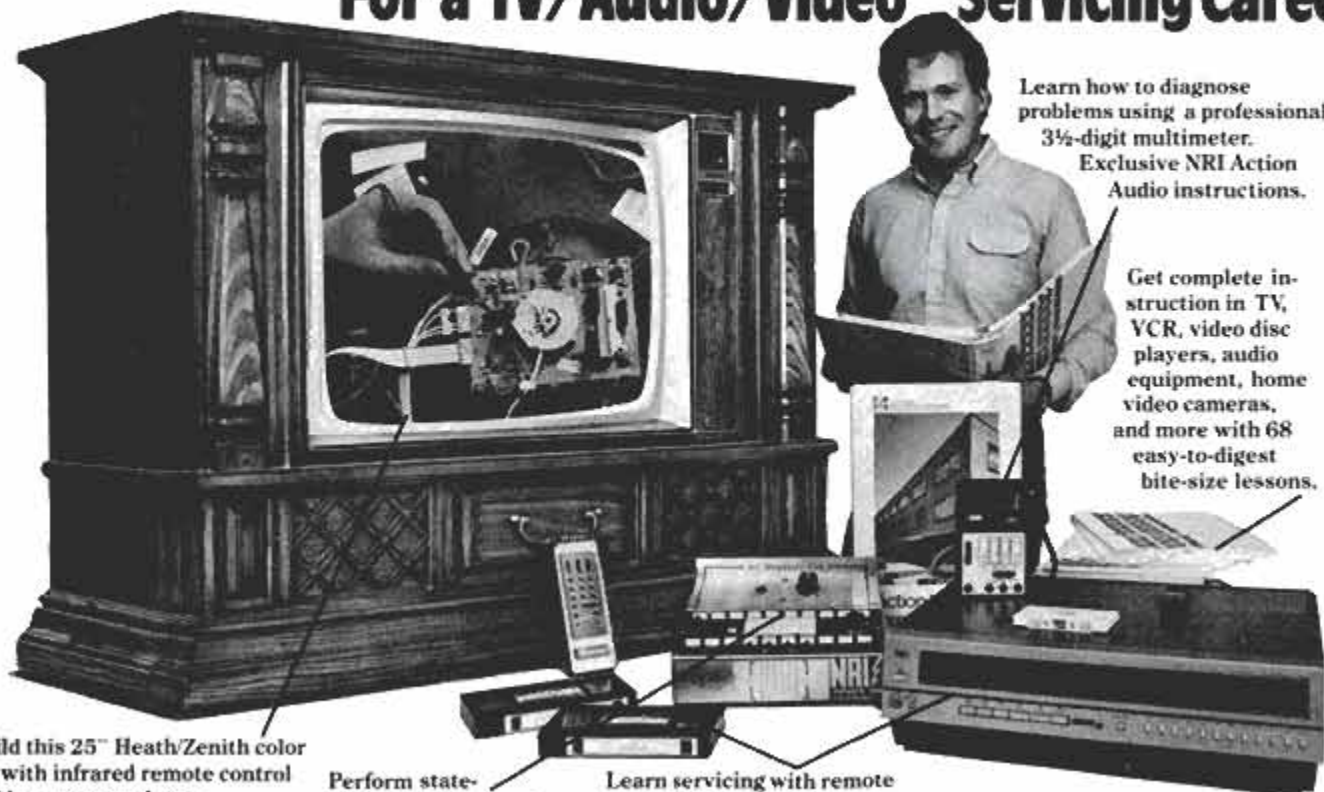
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# CAR CLINIC



## Winter woes from up north

*My 1981 Chevrolet station wagon has had a problem with rough idle and rough low-speed operation every winter since it was new. Once it warms up, it's okay. I've tuned up the engine and swear all adjustments are to spec. Is there something I'm not doing?—Frank Chapman, Duluth, Minn.*

Any number of things can cause poor cold-engine driveability. Chief among these, for your vehicle, are the various choke-system adjustments. There are at least four different adjustments that must be made to assure proper operation of this choke system. A tool called a choke valve angle gauge is needed for most of these (see *Pre-winter Car Care*, page 126, Oct. '83).

If the cause of your problem is not a choke-system malfunction, the driveability woes may be the result of a faulty thermal vacuum switch or coolant tem-

perature sensor. Vacuum switches control the operation of the EGR system and the air cleaner hot air system. If either of these fails, poor cold driveability will result. A coolant temperature sensor keeps the computer control system up to date on engine temperature. If this system fails, cold driveability problems will result, but a defective sensor should trigger the C-3 system's "Check Engine" light.

Another possibility is the computer system itself. Some 1981 Chevrolets were reportedly equipped with the wrong PROM (Programmable Read-Only Memory). The PROM tells the engine control system how to operate, and some that were installed on 1981 Chevrolets may be operating the engine at an overly rich calibration when engine temperature is low. Have your dealer check the number of your PROM.

## Guest commentator

*I'd like to tell your readers who own Rabbit diesels how I got rid of two problems, both caused by engine vibration.*

*The first problem concerns the fuse block for the glow plugs, which is mounted on the firewall. This block has two heavy wires connected to it. Should either wire loosen, the glow plugs won't work, and the engine won't start. And loosen they do, as I discovered twice in 15,000 miles.*

*Unless VW made a mistake when they built the engine for my car, lock-washers weren't installed. I saw no reason why they shouldn't be, so I added them. However, I still check wire connections about once a month.*

*The other problem concerns the roof. It was emitting humming sounds that got louder or softer according to the speed at which the engine was operating. Two cross braces vibrating against the roof caused the noise. One is about 3½ inches from the windshield. The other is just above the front edge of the rear seat. I removed the plastic trim piece from over the right (or left) front door, pulled the cardboard headliner down and slid a foot-long piece of corrugated paper be-*

*tween the braces and roof. The paper acts as a cushion. Any comments?—Bruce L. Flaughes, Centerville, Ohio*

Just two:

1. Good work.
2. Thanks for telling us about it.

## Not a lone Ranger

*I own a 1983 Ford Ranger XLT pickup truck that worked fine for 3,000 miles. Then, the 2.3-liter four-cylinder engine started missing. I know of four other people in this area who have the same problem with their Rangers. Dealers haven't helped any of us. Is this an inherent problem?—Hubert Charbonneau, Ridgeway, Ont.*

No—just a problem for which a solution may or may not yet have been found. Yes, the Ranger's four-cylinder gasoline engines (both the 2.0- and 2.3-liter) have been hampered by hesitation, stumbling, missing—call it what you will—but some field fixes have been issued. Do they work? You won't know until you try them.

If you're having the problem only when the engine is cold, it's possible that retarded engine timing is the cause. If so, get the dealer to install a vacuum control switch (part No. D5ZZ-8A564-A) and vacuum restrictor (No. D7AZ-12A225-A). If he doesn't know how to do this, let him ask the Ford zone office.

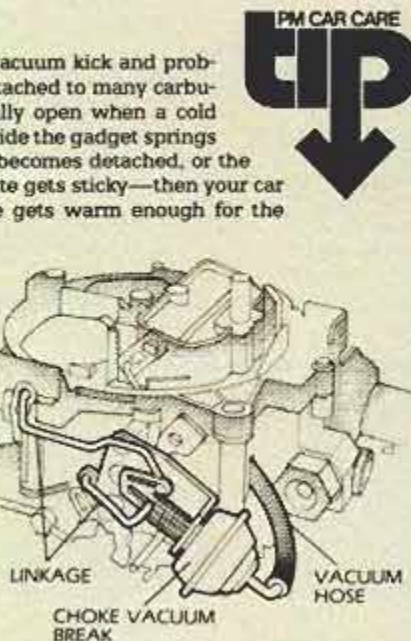
If this doesn't work or your problem occurs all the time regardless of engine heat, then it may be caused by a bad feedback control solenoid (FCS), which

*(Please turn to page 22)*

## Give a kick a break

It's called a choke vacuum break, choke vacuum kick and probably other names. It's that little gadget attached to many carburetors and it pulls the choke plate partially open when a cold engine is first started. If the diaphragm inside the gadget springs a leak, or the hose attached to it splits or becomes detached, or the linkage between the gadget and choke plate gets sticky—then your car will stall and run rough until the engine gets warm enough for the choke plate to open by itself.

There's no big deal about checking this thing. In the morning, take off the carburetor air cleaner and locate the gadget. Keep your eyes on the linkage as someone starts the engine. Does the linkage move? Does the choke plate open? If not, pull the hose off the vacuum break, see that the other end is tightly connected and cover the open end of the hose with a finger. If you don't feel a pull, see if the hose is split. What it comes down to is this: If the hose has vacuum and the linkage is clean, replace the vacuum break. *Note:* Some carburetors have two vacuum breaks to check.



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DODGE RAMPAGE

BUCKLE UP FOR SAFETY



## CAR CLINIC

(Continued from page 20)

is on the carburetor just to the left of the choke vacuum break. This is assuming that your truck is calibrated for operation at high altitudes, and it might be if I remember the geography of your area.

If the carburetor has an FCS, turn the ignition key to the ON position (don't start the engine) and hold your finger on the FCS. You should feel it oscillating at a constant frequency. If it doesn't, replace it with an FCS with part No. E3PZ-95565-A. You'll also need gasket E1PZ-95521-A.

### Pitch 'de tent

*I've been told by a transmission shop that the five-speed gearbox in my 1980 Accord will have to be overhauled, because the transmission slips out of FOURTH gear. That's a considerable amount of money to spend on a car which has been driven only 35,000 miles. What do you say?—Roger Hoffman, York, Pa.*

Before you go the overhaul route, replace the shift detent spring for THIRD and FOURTH gears. If the spring, which costs a couple of bucks, is weak, the transmission won't stay in gear.

You may be able to do this job yourself. Raise and support the car. You'll find three plugs on the side of the transmission housing. Two are almost in line with each other; one is to the right of the others.

Remove the plug in the center. Don't lose the washer. The THIRD and FOURTH

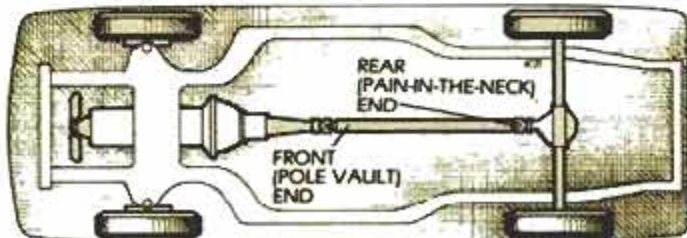
gear-shift detent spring will drop out of the hole, along with the THIRD and FOURTH gear detent ball. Don't lose the ball. Now, get a new spring (Honda Code No. 103289) from a Honda dealer. Place the ball on top of the spring and shove the two into the hole. Install the plug and washer, and tighten the

### One ornery pole cat

It was a sorry sight I saw the other day—that car with the back of its drive shaft lying on the road. The shaft broke loose because the rear universal joint had failed. But suppose the front universal joint had gone kaput instead? The front of the shaft could have dug into the pavement and pole-vaulted the car out of control.

Drive shafts don't usually drop off without warning. When they begin to fail, universal joints almost always make clicking or clunking sounds you can hear at low speeds. Heed the warning—check the joints. If you can move one or both ends of the shaft back and forth by hand, replace them. If no play is felt, just to make sure, raise the rear wheels, start the engine and place the car in gear so the shaft turns. If you hear noise, don't take a chance. Replace the joints. Universal joints of most older model cars aren't sealed. They have grease fittings, so lubricate them every time you change engine oil. Newer model cars have sealed universal joints that are lubed for life.

**Note:** For cars that are front-wheel-drive, do not worry. They do not have any drive-shafts or universal joints.



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plug to 14 to 17 ft.-lbs. If FIFTH or REVERSE gears were popping, replace the spring behind the plug that's above the THIRD-FOURTH gear plug. If FIRST or SECOND gear were slipping, you'd have a go at the spring behind the plug lying to the right of the other two plugs. All springs carry the same Honda code number.

### Doing the huckle buck

When my 1980 Aspen six-cylinder engine is cold, and only when it's cold, the engine bucks as I let up on the gas pedal at about 35 mph. It doesn't happen at any other speed, and it doesn't happen when the engine is warm.

The dealer blames the carburetor; a transmission repair shop blames the torque converter (the vehicle has an automatic transmission). Can you tell me who to believe?—Phillip E. Deehan, Tipp City, Ohio

I'd believe the transmission specialist. With the 1980 Chrysler Corp. six-cylinder engine having automatic transmission, the primary reason for cold bucking, as it's called, on deceleration, acceleration or both is the torque converter lockup spring. The spring allows the torque converter to engage or disengage (or both) too soon. A new spring (part No. 4202672) raises the

lockup engage speed to about 40 mph and the disengage speed to about 35 mph.

### We don't need Ripley

My Pontiac J2000 developed a shaky steering wheel soon after I got the car. But the wheel shakes only when the engine is idling. On the roll, there is no shake. My dealer says it's the oddest thing he's ever seen. Is there a solution or do I, indeed, have the only J2000 with a steering wheel that shakes at idle?—Anthony Perrone, Framingham, Mass.

You don't mention the type of transmission, but I'll bet it's an automatic. If so, your car is not an oddity. There are others like it. They were put on the road with transaxle mounts that were too stiff. If your dealer installs a new mount (part No. 14C67053), it will take care of this problem.

By the way, the dealer didn't do his homework. There is a service bulletin (82-T-95) that describes the job. **PM**

### DO YOU HAVE A CAR PROBLEM?

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 discussed in the column.

### SERVICE TIPS

■ If your 1983 1.8-liter GM engine has AC R42XLS6 sparkplugs (original equipment) gapped to .060 inch, GM no longer wants you to use them. You'll do better with AC R44XLS plugs or equivalent gapped to .035 inch.

■ Ford advises that an oil-consumption condition in some 1983 2.0- and 2.3-liter engines could be from valve stem seals installed improperly. Your dealer should first follow the diagnostic procedure in the shop manual to make sure no other condition is causing oil loss. Then, he should replace the valve stem seals with new ones (part No. D4FZ-6571-A).

■ "Failure to use the proper antifreeze could cause radiator plugging, engine overheating and premature engine failure," Chrysler warns in reference to its 1983 front-wheel-drive cars. But the warning applies to all makes of cars. Use the antifreeze recommended by the carmaker. This is especially important if the engine has aluminum components. For example, Chrysler says that if you don't use antifreeze with a silicate inhibitor conforming to the carmaker's specifications, MS-7170, you won't be covered by the warranty if something happens. Check the label carefully. An antifreeze/water solution that is at least 50 percent (but no more than 70 percent) antifreeze must be used.

# HOMEOWNERS' CLINIC



## Repairing a wood surface

We recently purchased a wood coffee table and matching end table with a veneered top. My 1½-year-old made chips in the top by pounding on it with his toys. I can't cover them up with scratch cover. Is there a way to repair this and keep the woodgrain look, or will it always look spotted?—Tammy Zeigler, Spencerville, Ohio

The Dec. '82 Homeowners' Clinic ("Repairing Scratched Tabletop," page 16), mentioned the use of an iron to

raise some dents, but it sounds as though you have dents that have broken through the wood veneer. If the colored furniture "crayons" haven't worked, you might want to try stick shellac in the appropriate color. First, clean the area of oil and wax with a few drops of turpentine in a quarter teaspoon of stain. Let it dry at least 12 hours. The stick shellac is heated and allowed to drip into the scratch or dent. Rub the softened end of the stick back

and forth across the area. Finish in a matching oil stain with a soft brush.

I think that even a pro may have problems keeping the repair from looking spotted. I suggest that you try the repair yourself.

*Practical Wood Finishing Methods*, a Rockwell publication, is an excellent book that can help you with a repair or a complete refinishing job. It's \$5.95 postpaid and is available by writing Rockwell International, 4290 Raines Rd., Memphis, Tenn. 38118. Ask for booklet No. 11-407.

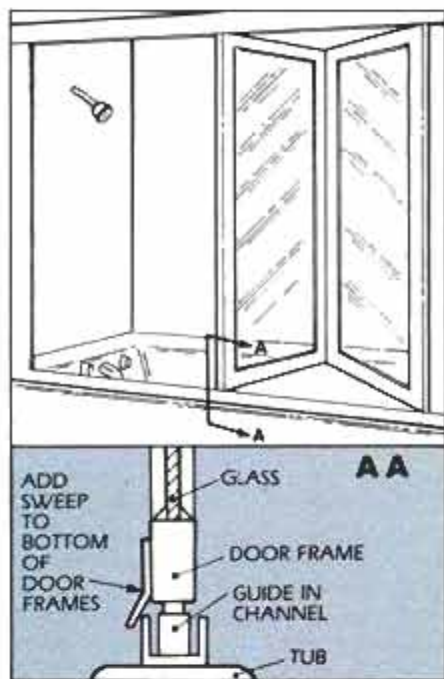
## Toilet follow-up

In the June '83 Homeowners' Clinic ("Blocked Toilet," page 12), I discussed several possibilities for obtaining a more thorough flush from your toilet. George Bour mentioned the hole (about ½ in. in diameter) in front of the trap, which is called the jet. A clogged or partly blocked jet produces a lazy flush. Since the jet handles water with very high pressure, I called American Standard and asked if it could become clogged. A spokesman said it would take extremely hard water a number of years to clog the jet, but occasionally, in very hard water, the small holes around the rim may become clogged. You can clean out these holes periodically with a fine wire or bent coat hanger. If the jet develops lime deposits, scrape them away with a piece of dowel or a paring knife.

## Tub door seal

I need help in the repair of a folding glass shower door in my bathroom. It's about 15 years old, and the maker is out of business. The rubber molding along the bottom of the door has deteriorated, causing the door to leak. I can't find a replacement molding.—W.E. Wistehuff, Saginaw, Mich.

Like you, I had no luck finding a replacement. Maybe a reader knows of a firm that extrudes special sealing strips and shapes. You don't say what type of door you have, but I installed a folding door on my tub/shower (see drawing). I think a door sweep, as shown, would work for you. This one, available in hardware stores, sells for



When the shower doors are closed, this self-adhesive vinyl sweep seals the door bottom and keeps water from leaking onto floor.

about \$2.25 per 1½ × 36-in. strip (you'll need two). W.J. Dennis and Co., Elgin, Ill. 60120, makes the self-adhesive, extruded vinyl door-bottom weatherstrip. After cleaning and drying the door frame, apply the sweep.

## Gate opener update

In the Jan. '82 Homeowners' Clinic ("Automatic Gate Opener," page 32), a reader asked if it were possible to convert a garage door opener into a gate opener. Gus Fossom sent us a note

which we ran in our *Letters* column (page 6, June '82) saying he had done that very thing and would supply information on request. Mr. Fossom, unfortunately, was unable to handle the flood of requests. Our apologies to any disappointed readers.

## Patio sweating revisited

If you're gonna "blow" one, blow it big. James Benner, Phil Mangum, Rod Goettelmann, James Files and Eric Jones were the first of many to catch a gross blunder I made in explaining condensation in "Sweaty Patio." (*Homeowners' Clinic*, page 28, Aug. '83). I do know better! Please accept this:

Because of the lack of a thermal break, heat is transferred to the inner roof, which, in turn, heats up the room (in addition to the normal heat gain through the glass). In the evening, when the temperature drops, the metal deck will cool. Then the coolness is transferred to the inner roof. When the warm, humid air within the room hits it, moisture condenses and drips off.

The same theory applies to metal mullions and joining strips. I stand fast on the remaining advice regarding insulation. Folks, thanks for your attentive reading and prompt replies. **PM**

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 the column. For more home-repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send your order(s) to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.



# Save Gas, Save Engine with 'POLY'

The following introduces one of the most fully tested and credentialed gas-saving, friction-reducing engine treatments ever to reach the market!

**WHAT IS POLY?** "Poly" is short for polytetrafluoroethylene (TFE). It is the slipperiest substance known to man (1981 Guinness Book of World Records, p. 188). The Petrolon Corporation, makers of Slick 50, has invented a way to permanently bind this slippery chemical to your engine with one treatment. All you do is add one quart of Slick 50 to your oil during oil and filter change. By reducing engine friction, Slick 50 increases gas mileage and horsepower and reduces engine operating temperature, thus causing your oil and engine to last longer. Just as important, it reduces metal wear, defraying costly overhauls.

**HOW DO I KNOW THIS ISN'T A FRAUD?** Slick 50 has some very impressive credentials. The "Consumers Digest" magazine (March/April, 1982, p. 35) states "Slick 50 does reduce engine heat and ordinary wear, and our informal tests indicate that it will improve gas mileage by about 2 or 3 miles per gallon." Researchers at the Franklin Institute Research Laboratory, after applying a powerful ultrasonic cleaning process to a Slick 50 treated engine, were surprised at its permanence. They stated, "We actually expected the Petrolon Slick-50 TFE Resin coating to also be removed, but later found it was still there."

The FAA (Federal Aviation Administration) has fully accepted Slick 50 Aircraft Piston Engine Treatment (F.A.R. #33.49). An FAA test simulating 1400 hours of engine use (equivalent to about 70,000 miles on a car) showed almost zero engine wear!

2500 miles after removing Slick 50 from the crankcase, lab tests at a leading university engineering experiment station showed that the benefits of Slick 50 were still there. They reported a horsepower increase of 16.9% and 9.9% for light and heavy loading respectively. The senior engineering researcher at the University of Southern California in San Diego stated this, "Slick 50 does increase horsepower and decreases fuel consumption in tests done at the university." The Space Shuttle Columbia uses the chemical "poly" in its gears and bearings because it is the only chemical lubricant which can withstand the heat and corrosive elements of space.

Perhaps most dramatic of all is a tor-



ture test overseen by the Automotive Services Council for Pennsylvania and shown on television station WTVE. Three cars with between 75,000 and 129,000 miles on them were treated with Slick 50. Six months later the oil was drained from each vehicle, and the cars were driven without the oil plugs for about a half hour. The water temperature never rose, and the engines sustained no apparent damage. There are many more tests available. If you are still skeptical, send \$2.00 to defray printing and postage costs, and we will send you additional, more detailed test information, etc.

**HOW DO YOU TREAT AN ENGINE?** Very simply. A few minutes before oil and filter change, add engine flush (sent free with each order) to clean out the engine. Let the engine idle for 10 minutes. Then drain the oil, change the filter, and add the proper amount of oil less one quart. Add one quart Slick 50, drive for 30 minutes, and leave it in the crankcase for 3,000 miles. As the engine operates, the oil carries the polytetrafluoroethylene between the parts where it is burnished into the pores of the metal. Once impregnated, it is permanent, so you do it only once, not each time you change oil. One quart of Slick 50 will treat all standard 4-, 6-, and 8-cylinder gasoline and diesel engines.

**WILL IT WORK WITH MOST OILS?** Yes, Slick 50 will work with all petroleum-based oils and all synthetics that are compatible with petroleum-based

oils. An exception is graphite oils. However, once an engine is treated, you can go back to a graphite type if desired.

**WHAT ARE THE BENEFITS OF SLICK 50?** Your actual benefits in percentages may vary, depending on the kind of driving you do, vehicle condition, weather, and geographic area. By reducing friction, Slick 50 does all of the following: It increases gas mileage. It increases horsepower—small economy cars and large RV's really need this! It reduces operating temperatures, thus increasing the lubrication and life of the oil and the engine. Last but not least, the drastic reduction in engine wear defrays or eliminates costly overhauls which could save you up to \$1,000. Slick 50 eliminates the "lubrication starvation" that all cars experience when first started before the oil has a chance to circulate. Up to 90% of the engine wear on a car can be caused by this lubrication starvation. You receive all of these benefits for \$33.95, less than the cost of two tanks of gas.

**WILL SLICK 50 HARM MY ENGINE OR AFFECT MY WARRANTY?** No! Slick 50 is suspended in an excellent grade of petroleum oil which meets or exceeds every manufacturer's engine warranty requirements. In addition, Slick 50 is the only product of its kind to have both an API (American Petroleum Institute) and an SAE (Society of Automotive Engineers) rating imprinted on the package. It also has a SF-CC-CD service classification.

**ARE DEALERSHIPS AVAILABLE?** Yes. Here's an opportunity to make handsome profits. Having such solid test results from major institutions makes Slick 50 easier to sell than many other products. Free dealership information is sent upon request.

**Free engine flush sent with each order. Free shipping with orders of 2 or more.**

**For purchase or further information, call toll-free 1-800-525-8624 (in Colorado call 1-303-762-1385) or send to SLICK 50, 3148 S. York St., Englewood, CO 80110.**

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(Give street address if possible for UPS delivery)

# APPLIANCE CLINIC



## No-spin washing machine

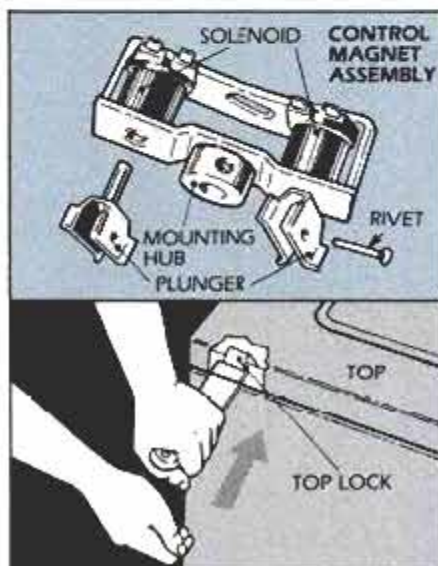
*My faithful but ancient Sears 500 clothes washer, Model 110-6304502, will not go into its spin cycle any more. It goes through the cycles and pumps out the water, but the tub will not spin dry. I'm wondering if there is a solenoid to control the spin cycle. Could you tell me how to get my washer to spin again?—Don Gress, Slater, Iowa*

There are about 14 things that could cause your problem. I would try the simplest and easiest things first. You'll need a continuity tester.

Unplug the washer before making any tests. First, check the lid switch. To get at it, raise the main top by pushing in the top locks with a putty knife. There is one lock about 2½ in. from each side on the front of the washer. Lift the top as you depress the lock.

The lid switch is toward the rear on the underside of the top. Disconnect the two wires from the switch. Check it for continuity with the lid closed. If the tester shows the switch is good and the lever that pushes the lid switch up and down works, reinstall the top.

Remove the service panel held on the back of the washer by two screws. Check the control magnet assembly



For access to lid switch, raise top by pushing locks with a putty knife (above). Also check control magnet assembly (top).

(also called the wigwag) which is mounted on top of the sector gear shaft or gear case. Remove the red and white wires from the coil and check the coil for continuity. If the coil is open, replace the entire assembly.

At this point, check all wires carefully, with particular attention to the area where they feed through the top of the control magnet assembly. Make certain that the rivets on the plungers which go into this assembly are not broken. Check the drive belt to make sure it's not slipping and that it's tight on its pulleys.

To check the water-level switch and timer, remove the escutcheon assembly or control panel which is held on the console cover by four screws, two on each side. Remove these screws and pull the control panel toward you. The water-level switch is on the left with a plastic hose on it. Remove the tan and violet wires from the switch. Check these terminals with your continuity tester. If the switch has no continuity (with tub empty), replace it.

Check the timer after pulling out and turning the timer knob to set it on the SPIN DRY cycle. Push the knob in. Pull the gray wire off the timer terminal. Touch one lead from the tester to this terminal and the other to any white-wire terminal on the timer. You should get a continuity reading. If there is none, replace the timer.

Replacement parts are available at any Sears parts and repair center.

## Abnormal on 'normal'

*I have a 5-year-old Sears Kenmore automatic under-counter dishwasher, Model 587.779500. It works fine on all cycles except NORMAL. When I select NORMAL and press the START button, the timer clicks down, the motor gives a sickening "ka-thunk" and doesn't start. No amount of waiting does any good.*

*The NORMAL cycle is between POTS & PANS and LIGHT, so the timer must pass through NORMAL when it's set for POTS & PANS, which works perfectly. Must we never use NORMAL again? Is there a way that I can check the timer?—Ed Spillet, Syracuse, N.Y.*

It sounds as if the selector switch is causing your problem. Apparently, the four-button selector switch has worn out or burned the contacts for NORMAL—which is the cycle you use most frequently, right? This means that the rapid-advance motor stops in a wrong

position, and that causes the strange sound you hear every time you try to use the NORMAL cycle.

The part number for the four-button selector switch for your dishwasher is 807138, and it costs about \$8.50 plus tax at any Sears repair part center.

To replace the switch, disconnect the power to the dishwasher. Remove the knob on the control panel which locks the door by pulling it straight out. Open the door and remove the screw which attaches the control panel to the door. Next, remove the screw which holds the four-button selector switch to the switch mounting bracket.

Remove the wires from the old switch, one at a time, and put them on the same numbered terminals of the new one. Put the control panel back on the door and reinstall the door locking knob. Reconnect the power to the dishwasher and your "ka-thunk" should be gone.

## SERVICE TIP

Many forced-draft condenser-type refrigerators with the condenser on the bottom and a fan for air circulation are designed to use the floor surface under the refrigerator to direct the airflow. Setting one of these on appliance rollers or otherwise raising it above the floor reduces the volume of air being pulled through the condenser and compressor areas. This will reduce efficiency, increase running time and raise operating costs.

One way to correct this is to install a plywood baffle cut to fit the bottom of the refrigerator. This means that the air gap under the appliance is the same as it would be if the unit were standing directly on the floor. Put the baffle on top of the rollers and the refrigerator on top of the baffle—or do without the rollers. **PM**

*If you have a problem with any appliance, send your question, along with the model and serial numbers, 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.*

**SLASHED TO \$39!****PRICE SLASHED****Suggested Retail Price \$115, March 1983 Dealer Cost \$75, Now Cut to \$39.**

**Prepare yourself for the most aggressive attack and the most challenging game of your life. This chess computer has 7 levels of difficulty. Plus you'll save \$76.**

It's you against the computer. Chess comes alive with this awesome space age computer opponent.

You'll be challenged by 7 levels of difficulty and a program that can actually analyze over 3,024,000 board positions. So, you had better come out fighting.

The only thing you won't have to fight about with this computer is the price. We've already chopped Fidelity's \$115 price down to just an incredible \$39.

March 1983 Dealer Price List

NAME	MODEL #	WATER PROOF PRICE	30 DAY RETURN PRICE	SUGGESTED RETAIL PRICE
CHESS CHALLENGER	RCC	1.81	3.29	1.115

**SIMPLE TO USE**

Notice that I said, "Simple to use," not simple to beat. Using this computer is incredibly easy. You don't even have to tell the computer which piece to move.

Just tell the computer which square you want to move from and to. The computer knows the exact location of every piece on the board, so it automatically knows what piece you are moving.

When the computer wants to move, it shows you the square it wants to move from and the square it wants to move to, on its 'From/To' LED display.

It's simple. It's easy. And, best of all, it lets you concentrate on your game, not on how to use the computer.

**OUTSMART THE COMPUTER**

Even at level one you may need help beating this super smart computer.

There's help. Just touch a button, and the computer will join your team. He will pick your best possible move. A second button touch will send him back to his own side to pick his best response.

You can cheat. Let's say you make a really dumb move. After you see what

the computer does (horrors, he's taken your man), all is not lost.

If you're the type of person who says, "if I only had my Queen back, I could beat this thing," no problem. You can add back in any piece, anywhere.

And, that's not all. Not only can you add back in any piece you've lost, you can take any of the computer's away. So, you can get rid of a pesky Bishop, Knight or even a Queen.

But there are limits. This computer won't let you make an illegal move. And, it won't make any illegal moves itself.

There's more. The computer has a broad vocabulary of chess master book openings such as: Sicilian, Ruy Lopez, or Queen's Gambit Declined. Plus, you can set up any classic chess game in mid-play and see how you would do.

It does everything a real chess master would do. It castles, it has pawn promotion and en passant. So, best of luck.

I can't beat this computer at level 3 which it calls its 'advanced level'. And, I don't even want to talk about my games at its level 7 'tournament level'.

**WOW, IT'S REAL CHESS**

But, when all is said and done, playing chess is what it's all about. And this game is very smart, very tough, but incredibly easy to use.

It is full sized, measuring 12 1/4" wide, 8" deep and 1" high. It comes complete with regulation Stauton design magnetized chess pieces. And, it simply plugs into any standard wall plug.

It's made in the United States (isn't that a change) by Fidelity Electronics. They are the largest and best known of the chess computer manufacturers. And, it's backed by their limited warranty.

**SO WHY IS IT SO CHEAP?**

Fidelity is in the forefront of new chess technology. Their new line has a new cosmetic look and a new way of entering 'your' moves into the computer called sensory (the computer moves are still the same, they're shown on a display or with lights).

The new system doesn't make the computer any smarter, but since this computer doesn't look like the rest of their line, they sold all 16,000 of these smart but nonmatching computers to DAK for cash. So, you'll save a bundle.

**TRY TOUGH COMPUTER CHESS RISK FREE**

If you like a challenge and your ego is strong enough to withstand losing to a computer, why not play just one game.

If you aren't 100% satisfied, you can return this computer within 30 days in its original box for a courteous refund.

To order your Fidelity Chess Challenger 7 Computer Chess, risk free with your credit card, call toll free or send your check not for the suggested retail price of \$115. Don't even send the dealer cost shown on the current March 1983 price list of \$75. Send just \$39 plus \$3.50 for postage and handling to DAK. Order No. 9682. CA res add 6% tax.

Whether you're a novice or a master, one of the 7 levels will keep you humble. Plus it's a fabulous \$115 value gift for someone really important, like yourself.



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## Storm door coverup keeps out cold

The Patio DoorMiser sliding glass panels mount to an existing patio door for additional cold-weather protection.

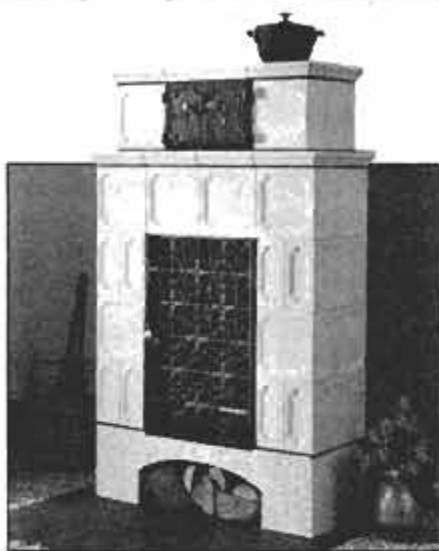
The DoorMiser is installed over each



panel of virtually any size patio door opening. It creates an insulating dead-air space between the interior and exterior glass surfaces that effectively

reduces cold-air infiltration, ice and condensation buildup and heat loss. In addition, since the DoorMiser doesn't interfere with the door operation, it can remain installed year-round.

The DoorMiser is available at lumberyards and building material suppliers in five sizes, from 5 to 12 ft. The door frame comes in a white or bronze finish. Prices range from \$151 to \$292.50. For more information, contact Noranda Building Products Co., 7120 Krick Rd., Cleveland, Ohio 44146.



## Ceramic tile stove

Ceramic Radiant Heat introduces four new ceramic tile stoves that burn wood and coal. The stoves feature cast-iron fire chambers surrounded by 1 1/4-in.-thick ceramic tile. Air space between the stove and tiles allows warm air to rise for natural warm air circulation. Prices range from \$850 to \$2,800. Contact Ceramic Radiant Heat, 603-B Pleasant Dr., Lochmere, N.H. 03252.

## Talking timer



This innovative alarm clock not only displays the time, but tells it in a clear voice. Features include a programmable announcement which tells the time every hour. Model ETC (\$39.95) is at department stores. Contact Spartus, Box 1200, Skokie, Ill. 60076.

## Versatile typewriter

Smith-Corona's Memory Correct III electronic typewriter can be upgraded to a computer printer when, and if, you purchase a computer. The typewriter is \$499. Upgrading costs about \$75. Write to Theresa Conetta, Smith-Corona, 65 Locust Ave., New Canaan, Conn. 06840.



## Deep-cutting saw

Garrett Wade's new coping saw has greater depth-of-cut and blade tensioning capabilities. Features include a



10-in.-deep, cast-aluminum frame with removable blade holders. It costs \$17.50, plus postage, from Garrett Wade Co. Inc., 161 Avenue of the Americas, New York, N.Y. 10013.

## Do-it-yourself flooring



Congoleum's do-it-yourself Accent vinyl flooring line offers four new designs. "Hearthside," shown, has the natural look of 2x2-in. earthen tile. It's \$7.95 per sq. yard from Congoleum Corp., Dept. A, Resilient Flooring Div., 195 Belgrove Dr., Kearny, N.J. 07032.

## Big wheels



Black & Decker's new bench grinder (Model 6816) accommodates either 6-in.-dia. or 7-in.-dia. wheels. It uses a 1/2-hp motor with a no-load speed rating of 3,450 rpm. The price is \$152. Write to John Butler, Black & Decker, 626 Hanover Pike, Hampstead, Md. 21074.

## Custom-look roofing



Johns-Manville's Designer125 shingles incorporate a rugged texture with random-tab pattern installation and look like wood shakes or slate. The 13 x 40-in. shingles cost \$50 per 100 sq. ft. Contact Manville Service Center, 1601 23rd St., Denver, Colo. 80216. **PM**

**\$49<sup>50</sup> BREAKTHROUGH!**

When you are at rest, so is your heart. A low resting heart rate usually means you're in good condition. Have you checked yours?



When you exercise, you should reach your heart's target zone. But, have I reached my exercise target zone, or just had too much coffee?



It's a high fashion dress watch and a sharp looking sports watch depending on which band you use. You get two luxurious bands with this watch.

# Wrist EKG

**Now you can exercise, rest, swim or go out to dinner wearing the latest in computer pulse takers on your wrist. Plus, it's a talented sports watch and a formal dress watch too.**

By Drew Kaplan

It's a fact. You can tell a lot about yourself from your heart rate. You can evaluate the condition you are in, how much stress you are under, and how hard you should be exercising.

Think about it. How fast does your heart beat when you climb a flight of stairs? And how long does it take for your heart rate to return to normal?

Well, if you're at all like me, you may be a little out of shape. While I'm only 36, several friends my own age have recently had heart attacks. And frankly, I'm getting just a bit worried.

You see, I am getting past the point where I can simply say, "I'll get back into shape next year."

So, whether you're a long distance runner (this is the ultimate jogging companion), or just a few pounds overweight like I am, your heart rate will give you a definitive picture of your heart and body.

Now you can take your heart rate anytime, anywhere with the newest in sophisticated electronic pulse takers.

And best of all, this heart computer is contained in a beautiful 24 hour alarm, 24 hour chronograph, LCD watch, that you will be as proud to wear with a coat and tie as you are when you're running.

### YOUR HEART'S TARGET ZONE

Your heart, just like any other muscle in your body requires exercise. Unfortunately, unlike your arms, you can't see your heart's condition just by looking.

The type of exercise called aerobic exercise is specifically designed to exercise your heart. The purpose of aerobics is to reach your heart's target zone.

So what is your target zone? Your target exercise zone is between 60 and 80% of your maximum heart rate. And here's an easy way to figure it out.

Simply subtract your age from 220 beats per minute. So, for me at 36, my maximum heart rate is (220-36) or 184.

So when I exercise I should get my heart rate up to at least (184 X 60%) or 110 beats per minute, and no higher than (184 X 80%) or 147 beats per minute.

With the Wrist EKG to help me, I can be sure that my workouts are valuable for

my heart and neither dangerous escapades nor total wastes of time. Of course, before beginning any exercise program you should consult your own doctor.

### BUT ISN'T EVERYONE DIFFERENT?

Here's the really exciting part. The worse shape you're in, the faster you'll reach the target zone and the less work you'll have to do to stay in the zone.

You see, as you get in shape, your heart doesn't have to beat as hard to do the same amount of exercise. Just as when you work out with weights, your arms become stronger, your heart becomes stronger with aerobic exercise.

So the Wrist EKG is safe for the beginner or the athlete. And, you'll really see your improvement as you exercise.

But you don't have to exercise. Just wearing the Wrist EKG and using it at the office when you're under stress, after you've walked up some stairs or around the block will make and keep you aware of your body's physical condition.

And look at this. Sit down at your desk and take your pulse. Then drink a couple of cups of coffee and take your pulse again. You'll see just what your morning 'pickup' actually picks up, and if God forbid you smoke, take your pulse before and after a cigarette. Wow!

### JUST LIKE A HOSPITAL EKG

With Innovative's new Pulsemeter watch, you'll have supreme accuracy. It's like a direct electronic line to your heart.

You see, unlike other pulsemeters that use a light shining through your finger, this instrument works just like a hospital EKG. It measures the electrical impulses that cause your heart to beat.

The back of the watch is one receptor, and the metal touch sensor on the front of the watch acts as the other EKG sensor. Just touch the sensor, and you'll see your pulse on the large LCD Display.

### IS IT A DRESS OR SPORTS WATCH?

Innovative time thinks that everyone interested in their pulse must be a professional athlete. So, they've built this watch with all the athletic extras.

It's not only waterproof, it's guaranteed down to 60 feet (although you can't actually take your pulse underwater). It

has a stopwatch, a lap timer, and dual finish mode. Its band is made of very tough polymers. So, it's a sports watch.

But wait, I don't like black watches for dress. So, I've gotten Innovative to add a deluxe matching stainless bracelet to the watch. It's rendered in stainless and black and is a perfect high fashion choice. So, it's a dress watch.

Plus, there's a 24 hour alarm and an hourly chirp. The stainless band is great for sports or dress. So, you'll get the watch with the black band on it and the high fashion band packed with it, compliments of Innovative Time's superb engineering and DAK's good taste.

The Wrist EKG is backed by Innovative Time's 1 year limited warranty and comes with a 1 year battery in place.

### TRY THE WRIST EKG RISK FREE

Now you can look at your heart as easily as the time. You'll see how you react to stress, foods and exercise. Don't let DAK's low price confuse you. Take this pulse watch to your own doctor and have him compare it with his EKG.

Why not take a copy of this ad too. Chances are that he'll also want one.

Try the Wrist EKG risk free. Try exercising and then check your cardiac recovery rate. If you don't like what you see, you'd better keep the watch. But if you just don't like the pulse watch, simply return it within 30 days in its original box for a refund.

To order your Wrist EKG, Pulse Sports/Fashion Watch, complete with two bands risk free with your credit card, call toll free or send your check for just \$49.50 plus \$3 for postage and handling to DAK. Order No. 9638. CA res add 6% tax.

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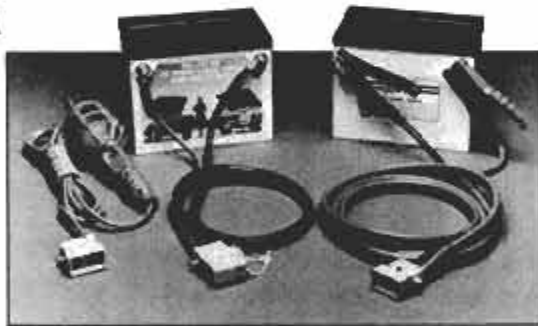
# THE PM GARAGE



## Jumper system

A safer way to jump a dead battery than with traditional jumper cables is with Safe-T-Plug—a permanently installed, two-piece system for jump starting.

One piece, called the whip, consists of two cables and a plug. It's permanently attached to the battery. The second piece of the system can be either a second whip or a plug with two conventional jumper cable clamps attached. To use the system, you hook up the second piece to a live battery and plug the two whip sections together. The plugs fit only one way, so that you get a proper connection with no spark. An accessory drop



Whip (center) is attached to your battery. The second section (right) is connected to the jumper battery.

light that plugs into the whip is also available.

The jumper system is sold at auto parts stores for \$29.95 and is made by Safe-T-Plug Inc., Mokena, Ill. 60448.

—M.L.

## Flex light



Light with a flexible neck enables you to look into those dark nooks and crannies.

Among the special tools for tight engine compartments is a \$30 flashlight with a flexible head and a magnetic attachment. I found a new model that is only \$8.95 and works almost as well. It has no magnet or other attachments, but the flex head is available separately in case its bulb burns out. Its maker, Lisle Corp., Clarinda, Iowa, 51632, sells it through auto parts stores.

—Paul Weissler

## Fiberglass polish



Duragloss is a polish that's specially formulated for use on fiberglass auto bodies.

If you own a Corvette or other fiberglass-bodied vehicle, Duragloss polish is for you. It forms a durable elastic bond with fiberglass and gives it a deep, "wet-look" sheen. Special additives remove oxidized paint, road tar and tree sap, and protect against the sun's ultraviolet rays. The polish is not affected by repeated washing, can be applied in sun or shade and will not leave an oily film that shows fingerprint marks. Duragloss costs \$8.20 for an 8-oz. bottle from Vette Products, Box 340, Staten Island, N.Y. 10312.—M.L.

## Reel easy

Keeping extension and droplight cords in line is a problem in my garage. EZ Cord Control let me roll up those long wires and hang them neatly on the garage wall. Three sizes hold 25, 100, or 150 feet of cord, clothesline, kite string, mike cords or Christmas lights. Suggested price for the 100-ft. reel is \$2.25 at most auto and hardware stores.

The manufacturer is Colton Creators Inc., 2095 New Highway, Farmingdale, N.Y. 11735.—M.L.



EZ Cord Control is an inexpensive cure for tangled and knotted cords of all kinds.

## Easy bleeder



Inexpensive syringe bleeds master cylinders faster and easier than the high-priced kits.

Installing a master cylinder with air in it can result in a tedious and often unsuccessful job of trying to bleed air at the wheels. There are many kits for bleeding a master cylinder, but this simple syringe tool makes the job easy. You just hold its tube against an outlet fitting and draw out brake fluid, along with any entrapped air. Invert the syringe and the air bubbles rise to the top. Expel the air by pushing up the plunger, then hold the tube against the outlet and reinject the fluid. Repeat the operation on the other outlet and the master cylinder is bled.

The tool is under \$5 at auto parts stores. It's by Eis Div., Parker Hannifin Corp., 129 Worthington Ridge, Box 1315, Berlin, Conn. 06037.

—Paul Weissler

*INTRODUCING  
A NEW WAY  
TO MAKE  
SPORTS COUPES  
PERFORM.*



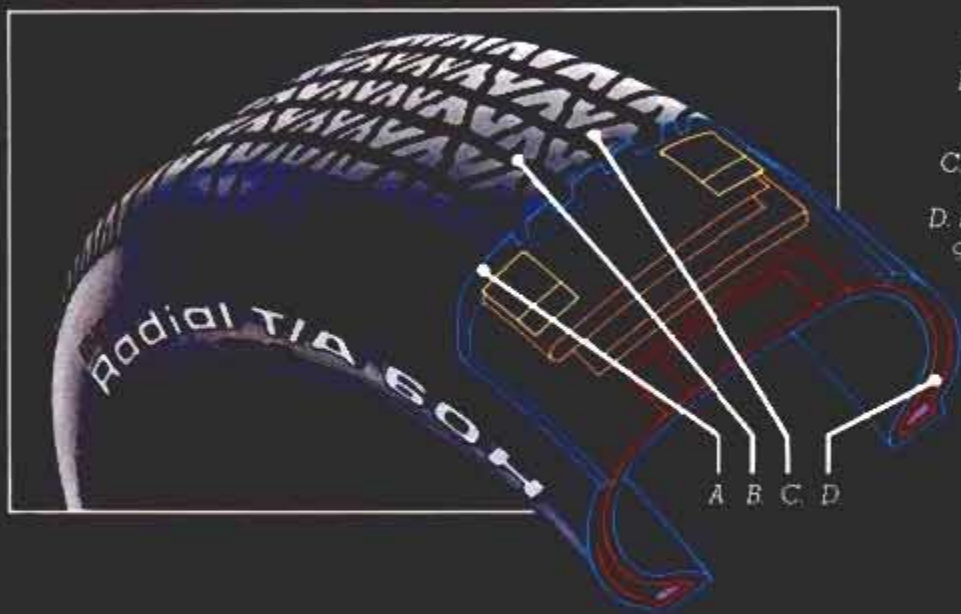
*BF GOODRICH* **T/A** HIGH TECH  
RADIALS

# BF GOODRICH INTRODUCES AN EXCITING, SPEED-RATED TIRE FOR HIGH-PERFORMANCE SPORTS COUPES: THE NEW RADIAL T/A 60H.

The new Radial T/A 60H—and new Radial T/A 70H—were designed specifically for outstanding car performance. Professional test drivers recently tested the Radial T/A 60H on unmodified foreign and domestic sports coupes. The result: impressive performance. The test vehicles generated as much as 0.812 g's during lateral acceleration under dry road conditions and as much as 0.768 g's in the wet. 60 to 0 mph dry stopping distance was as low as 158.0 feet. Most importantly, in autocross and road course evaluations, the tire provided the cars with a high level of predictability and control at the limit of adhesion.

The new speed-rated Radial T/A 60H and Radial T/A 70H are engineered with advanced materials and technology:

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- B. High void-to-rubber ratio reduces hydroplaning for optimal wet traction.
- C. Computer-optimized tread design offers excellent handling.
- D. High modulus bead fillers help generate quick steering response.



BF GOODRICH **T/A** HIGH TECH  
RADIALS





The new BFGoodrich Radial T/A 60H and Radial T/A 70H - a unique combination of advanced handling characteristics derived from the world recognized Comp T/A<sup>®</sup>, raised white letter styling, and the European H speed rating. These tires are designed to make sports coupes perform.

**WE MAKE CARS PERFORM**

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ASTON MARTIN	DODGE CHARGER 400 600	MAZDA GLC RX-7 626	SUBARU
AUDI COUPE 4000 5000 5000 TURBO	FERRARI 308	MERCURY CAPRI LN7 LYNX	TOYOTA CELICA CELICA GT CELICA GT-S COROLLA CRESSIDA SUPRA TERCEL
BMW 320i 528e 528i 733i	FIAT SPIDER X1/9	MITSUBISHI CORDIA STARION	VOLKSWAGEN JETTA RABBIT RABBIT GTi SCIROCCO
CHEVROLET CAMARO Z28 CITATION CORVETTE	FORD ESCORT EXP MUSTANG THUNDERBIRD	NISSAN PULSAR SENTRA STANZA	VOLVO DL
CHRYSLER E-CLASS LE BARON	ISUZU IMPULSE	PLYMOUTH TURISMO	
		PONTIAC FIREBIRD TRANS-AM 6000 STE	

## SIZE AVAILABILITIES AND ENGINEERING DATA:

### RADIAL T/A 60H

TIRE SIZE	BF GOODRICH RECOMMENDED RIM WIDTH RANGE	INFLATED DIMENSIONS @ 28psi			REV / MI @ 45 MPH	MAXIMUM LOAD (lb) AND INFLATION (36 psi)
		OVERALL DIAMETER (inches)	TREAD WIDTH (inches)	SECTION WIDTH ON MEASURING RIM WIDTH (inches) (inches)		
205/60HR13	5.5- 8.0	22.68	6.20	8.19 on 6.0 rim	903	1160
195/60HR14	5.0- 7.5	23.23	5.76	7.80 on 6.0 rim	886	1210
215/60HR14	5.5- 8.5	24.17	6.54	8.50 on 6.0 rim	859	1365
235/60HR14	6.0- 9.0	25.12	7.11	9.45 on 7.0 rim	830	1580
205/60HR15	5.5- 8.0	24.69	6.20	8.19 on 6.0 rim	843	1365
235/60HR15	6.0- 9.0	26.10	7.11	9.45 on 7.0 rim	801	1630
255/60HR15	6.5-10.0	27.05	7.77	10.05 on 7.0 rim	773	1890

### RADIAL T/A 70H

TIRE SIZE	BF GOODRICH RECOMMENDED RIM WIDTH RANGE	INFLATED DIMENSIONS @ 28psi			REV / MI @ 45 MPH	MAXIMUM LOAD (lb) AND INFLATION (36 psi)
		OVERALL DIAMETER (inches)	TREAD WIDTH (inches)	SECTION WIDTH ON MEASURING RIM WIDTH (inches) (inches)		
175/70HR13	4.5-6.5	22.83	5.06	6.92 on 5.0 rim	899	1025
185/70HR13	5.0-7.0	23.54	5.47	7.31 on 5.0 rim	877	1140
185/70HR14	5.0-7.0	24.57	5.47	7.31 on 5.0 rim	847	1210
195/70HR14	5.0-7.0	25.04	5.70	7.74 on 5.5 rim	833	1340
205/70HR14	5.5-7.5	25.67	6.08	8.10 on 5.5 rim	814	1490
225/70HR15	6.0-8.5	27.40	6.43	8.65 on 6.0 rim	763	1730

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**BF GOODRICH** **T/A** HIGH TECH  
RADIALS

# Troubleshooting Valve Train Problems

**I**s your engine plagued by the annoying tick of a noisy valve lifter? Does it lack the power it once had, or does it idle unevenly? It may be suffering from a valve train malfunction.

Perhaps the most annoying of all common powerplant problems is the noise that is produced by excessive clearance in the valve train of a pushrod engine.

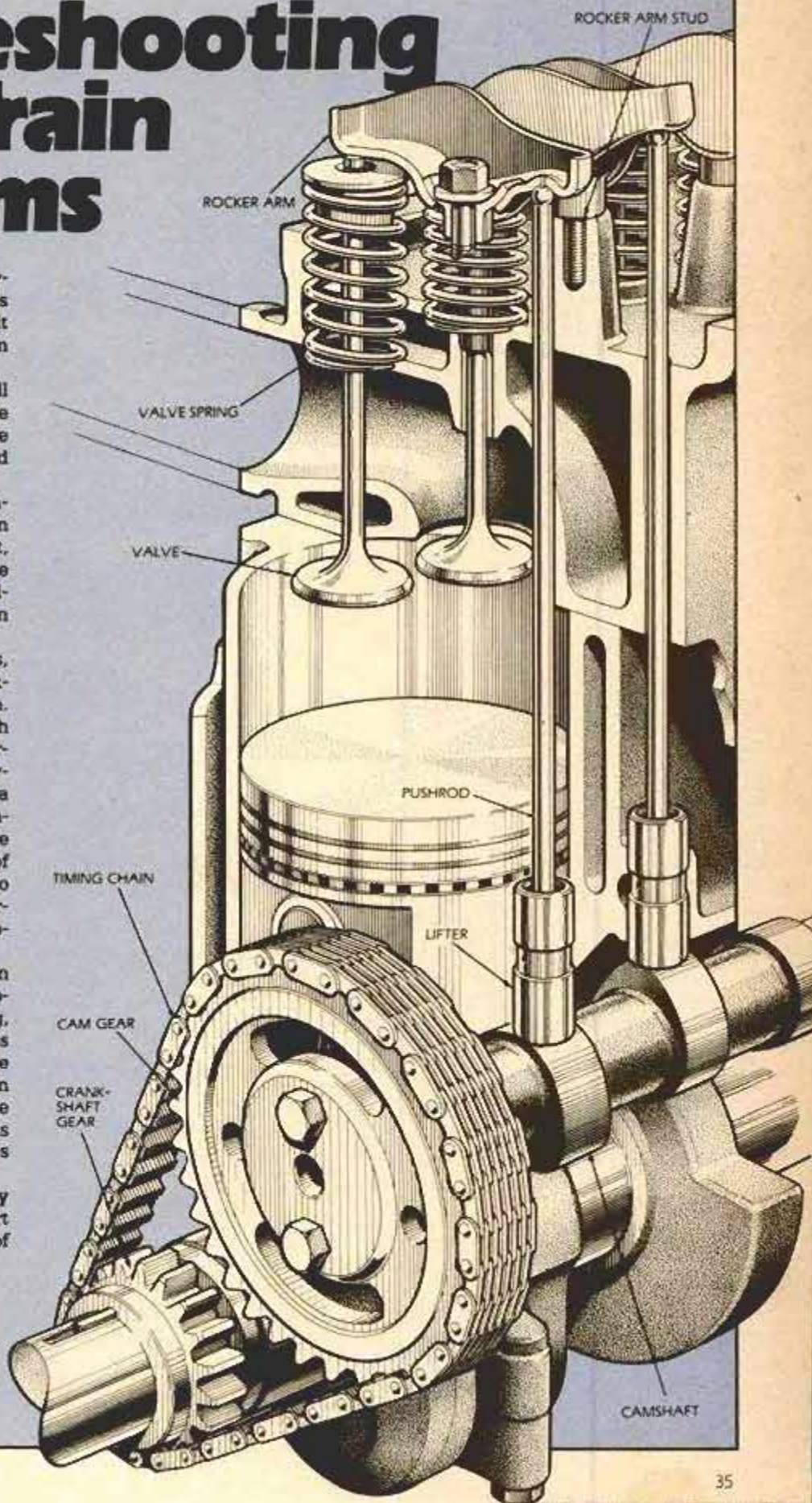
This noise is distinguished from other taps and ticks that can trouble an engine by its regular, measured beat, which increases in frequency as engine rpm increase. If the condition is allowed to continue, expensive valve train parts will eventually be damaged.

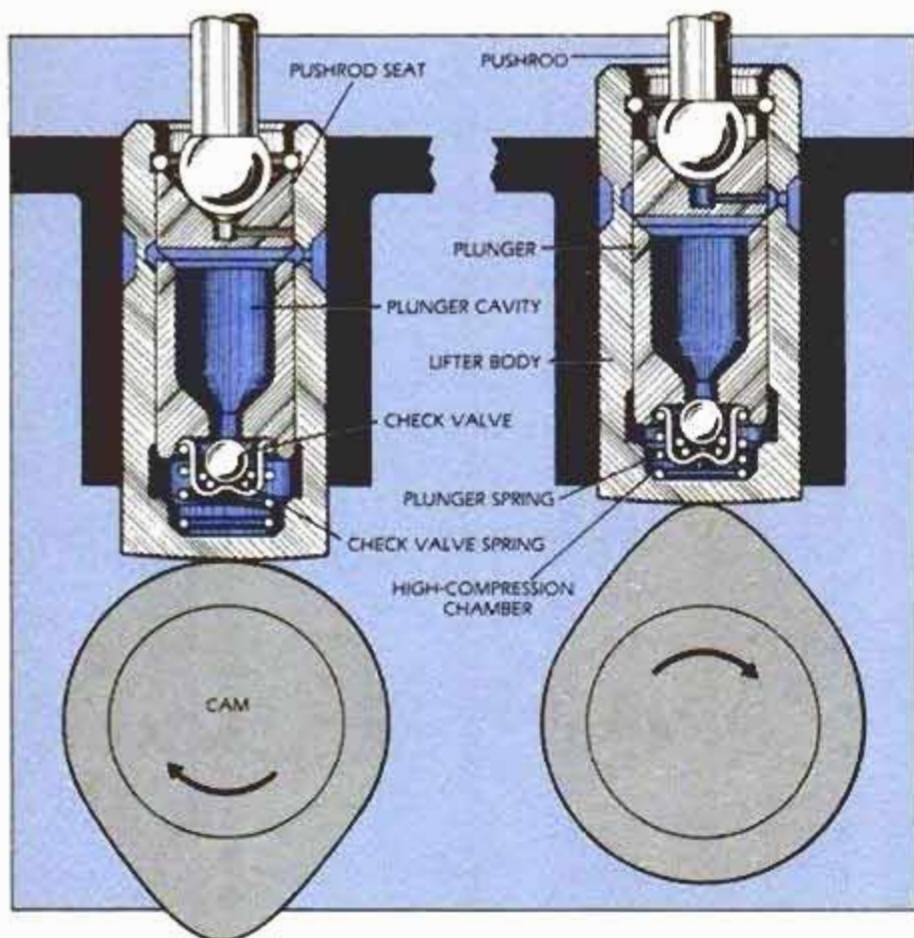
In most modern pushrod engines, hydraulic lifters are responsible for taking up the slack in the valve train. When the cam rotates to the zero lash position and the valve closes, pressurized engine oil is supposed to fill a cavity in the lifter, taking up any extra clearance and providing a cushion within the lifter that will dampen the mechanical forces acting on the rest of the valve train. If the lifter is not able to retain this oil, or if there is more clearance in the valve train than there is supposed to be, noise will result.

If the ticking noise occurs only when the engine is first started and disappears after several minutes of running, it should be considered normal. This happens because valve spring pressure forces the oil out of lifters that were on the top of the cam lobes when the engine was shut off. When the oil is cold, the lifters may take a few minutes to refill.

If the lifters are intermittently noisy at idle or low speeds, there may be dirt in the lifter valving system, or some of

Typical valve train in a pushrod engine consists of the crankshaft and camshaft timing gears and the timing chain that connects them, the camshaft, lifter, pushrod, rocker arm, valve and valve spring. Hydraulic lifter takes up play.





When a hydraulic lifter is down (left), pressurized engine oil enters the plunger cavity via tiny holes. This pushes the two parts of the lifter body apart, increasing the effective height of the lifter and eliminating any play that may be present in the valve train. As the cam raises the lifter (right), the check valve closes, trapping the oil as a result. When the lifter falls, oil is allowed to escape so that the valve can close completely.

the lifter's internal parts may be worn. The only certain cure is to replace the lifters. You can sometimes locate the lifter that is making noise by applying considerable pressure to the pushrod end of the rocker arms, one at a time, while the engine is idling with the valve cover(s) off. Use a piece of wood or a hammer handle to push on the pushrod ends of the rockers. Each lifter should collapse and begin to make noise. If one of them doesn't, it is probably already collapsed and making noise.

If your engine is equipped with stamped rockers that are retained on a stud by a ball and nut, they'll squirt oil all over the engine compartment if you start the engine with the valve covers off. Oil shields that prevent this are sold at parts stores.

Of course, an intermittent lifter noise cannot be detected unless it is present while you're looking for it. Most professional mechanics advise their customers to replace all the lifters if the noise is frequent enough and loud enough for a repair to be necessary. If one lifter is worn or dirty enough to make noise, the

others are probably the same.

If your lifters are continually noisy while the engine is at low speed or idling, but become quiet at high speeds, they probably are worn and should be replaced. The wear causes excessive clearance in the working parts of the lifter. However, the same condition can result from low oil pressure or an engine oil that is too light in viscosity. Measure engine oil pressure at idle before you spring for a new set of lifters.

If your engine is not equipped with an oil pressure gauge, you can connect one to the engine oil gallery to get a reading. In most cases, you can remove the sending unit for the oil pressure light and insert the gauge's hose fitting in its place. Specifications for oil pressure can usually be found in a shop manual. The manual should also be able to pinpoint the location of your engine's oil pressure sending unit.

If your engine is quiet at idle and low speeds, but develops a ticking noise at higher speeds, the lifters may be drawing air along with their oil supply. A

low engine oil level can cause air bubbles in the oil, as can a leak in the suction side of the oil pump or oil foaming due to overfilling the crankcase.

If your lifters are noisy both at idle and at high speed, they are probably badly worn or clogged with sludge and varnish. On the other hand, this kind of lifter noise can result from wear or damage in other parts of the valve train. If the cam lobe or lifter face is worn, if a rocker arm or valve stem is badly worn, or if a pushrod is bent, constant valve train noise will result. Engine oil pressure that is excessively low, both at idle and higher speed, can also produce a constant valve train noise.

### Valve train inspection

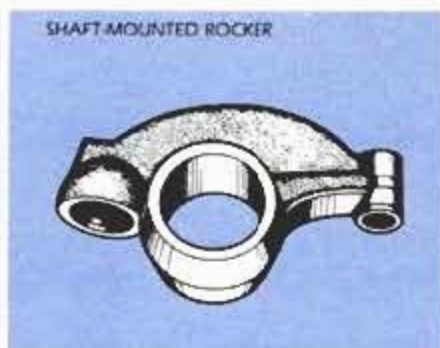
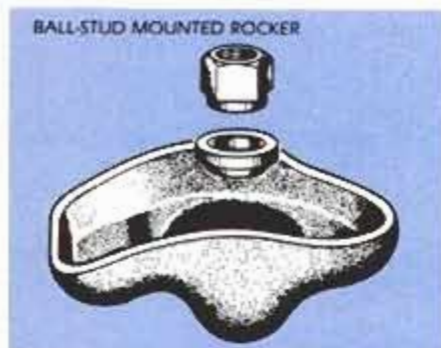
First, check engine oil pressure. There's no point in doing extensive valve train repair if the parts aren't being lubricated.

If the noise is rather loud, you probably can determine which cylinder and valve it's coming from while the engine is shut off. Just remove the valve covers and rotate the engine, stopping approximately 30° after each valve returns to its seat. With the engine in that position, check for clearance by wiggling the rocker back and forth. There should be virtually no clearance. If you are able to move the rocker back and forth from pushrod to valve stem, something is wrong.

Once you've located the offending members, begin disassembling valve train pieces and look for excessive wear. To remove stud-type rockers, turn the engine until the rocker has released the valve and spring, then remove the nut from the stud and lift the rocker off. On most modern engines, the nut locks against the stud, and only has to be torqued down to specs for reassembly.

Some engines mount all of the rockers on a single shaft that is secured to the cylinder head by support stands and bolts. On most engines, the entire rocker stand can be unbolted without causing any difficulties. However, on some engines the rocker stand bolts also serve as head bolts. In those cases, check the shop manual for specific disassembly recommendations. (You can tell if the rocker stand bolts are doubling as head bolts by their size. If they're as big as the head bolts, they probably serve a dual purpose.)

Inspect the rocker arm. Is it smooth and free from galling at the points where it contacts the pushrod, valve and ball? Or, if it is a shaft-mounted rocker, does it rotate freely and with lit-



Stamped rocker arms (left) pivot on ball studs and are held to studs by a locknut and washer. Studs can be staggered. Cast rocker arms (right) are mounted on shafts, so all rockers must be in a straight line. Rockers with adjusting nuts have solid lifters.

tle noticeable clearance on its shaft?

If a rocker arm is damaged in any way, replace it. To replace a shaft-mounted rocker, the cotter pin on the end of the shaft must be removed, and the rockers and the springs that separate them are then removed from the shaft. If the shaft is worn, it, too, should be replaced. When reassembling the rockers and shaft, lubricate the parts with engine oil, and make sure you install all springs and washers in the correct sequence.

If you find a bad rocker, don't stop there. Remove the pushrod of each suspect valve mechanism. Examine the ball or cup at each end for chipping or galling. Roll the pushrod on a flat surface. It should roll smoothly. If it goes, "kathump, kathump," it's bent and must be replaced.

### Digging deeper

If you found only a damaged rocker, you may want to button up the motor and hope there's no further damage within, because on most V8 and V6 engines, the intake manifold or the val-

ley cover under the intake manifold must be removed to inspect the camshaft or to replace the lifters. If you found a bent pushrod, chances are that something else—perhaps a worn camshaft—caused the pushrod to bend.

If you have a dial indicator, you might be able to tell if the cam lobes are worn without removing the manifold. Warm up the engine and remove the valve cover. Then rotate the engine until the valve in question closes, and mount a magnetic-base dial indicator on the cylinder head so that its shaft rests against the top of the valve retainer and is parallel to the valve stem. Find the valve lift spec for your engine in a shop manual, and rotate the engine until the valve opens.

If the valve doesn't open as much as the manual says it should, the cam may be worn. Check a few other lobes for comparison. If they're all within 0.010-inch of the spec and each other, the wear is probably normal and should not be a problem. However, if there is considerable variation from lobe to lobe, the cam might be excessively worn and

some further inspection is in order.

Don't condemn the cam just on the basis of the indicator test. The readings can be distorted by lifter leakdown. On the other hand, don't be surprised to find, upon inspection, that you need a new cam. They don't seem to last very long on many recently built powerplants.

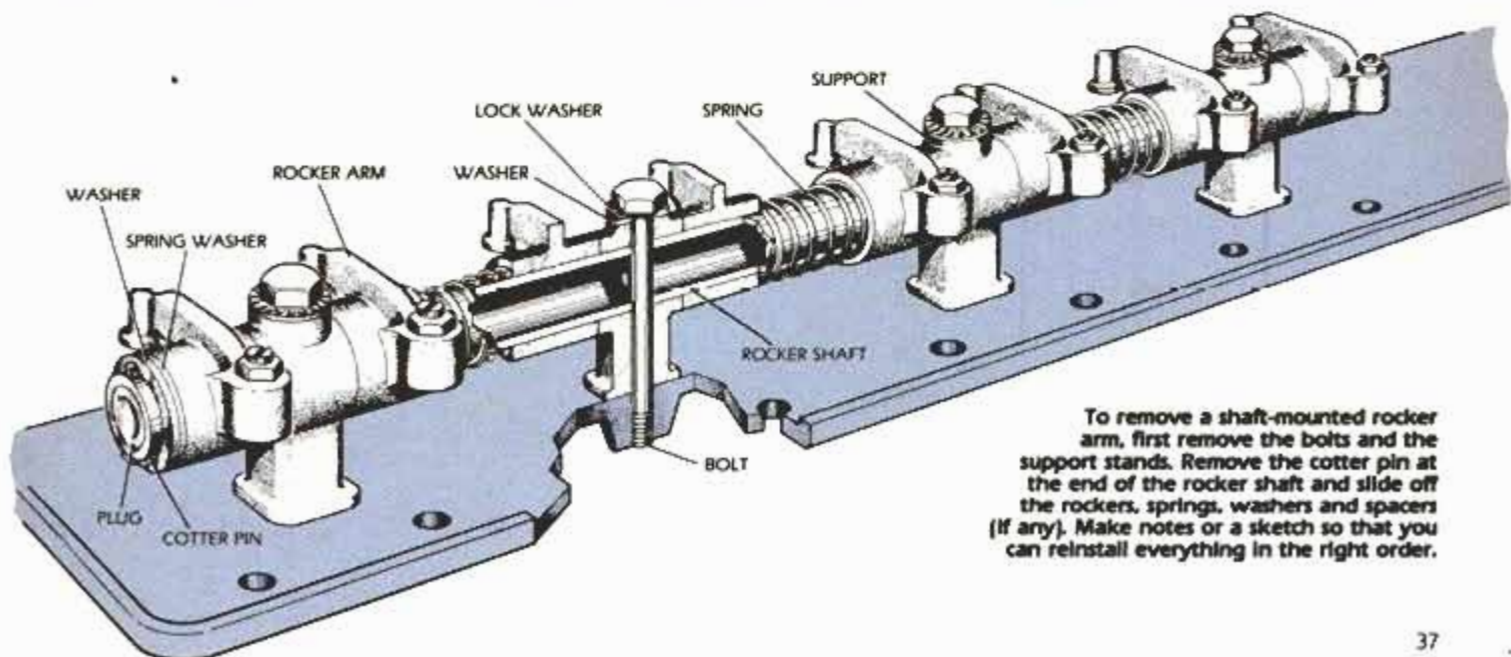
The cam and lifters may be accessible for inspection through a side cover or lifter cover on some six- and four-cylinder in-line engines. However, after removing the cover, you may also find that only the lifters can be examined, and that the camshaft must be removed for inspection.

The same is true of some V8 and V6 engines. Sometimes, even after removing the valley cover and intake manifold, the camshaft cannot be easily examined.

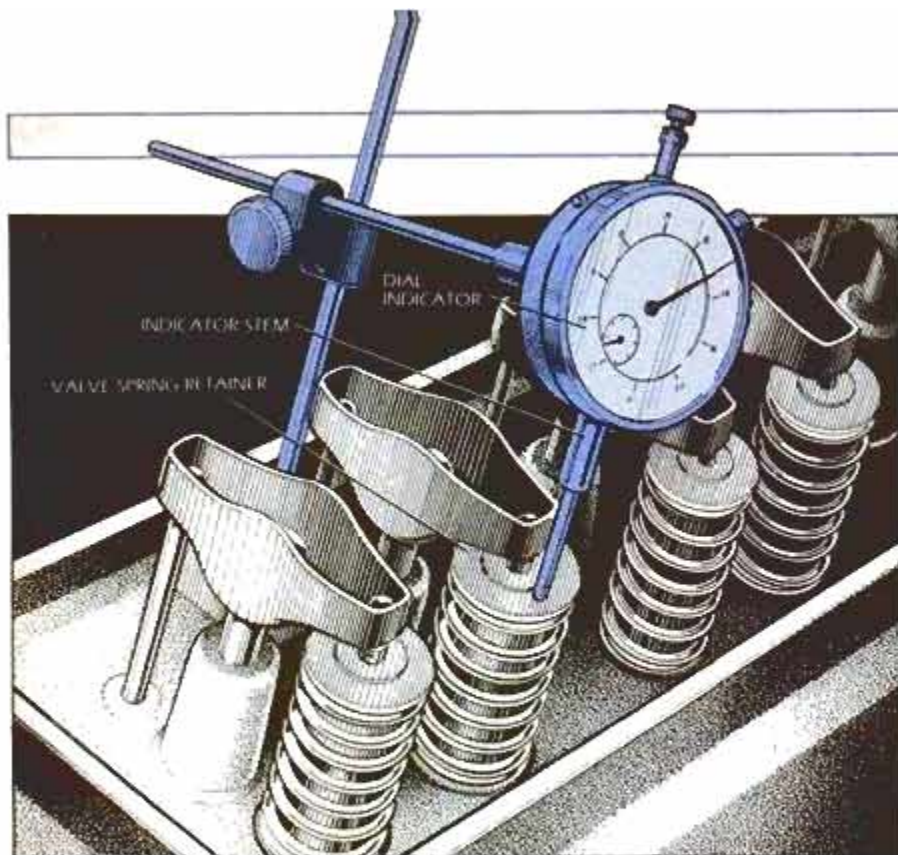
If inspection is necessary, the only alternative may be to remove the cam. This involves removing the fan and water pump assembly, the front timing cover, the timing gears and chain, the radiator and grill. Once these parts are out of the way, and the lifters have been pulled out of their bores, the cam can be removed. A shop manual will include specific instructions for camshaft removal.

Sometimes, simply removing and examining the lifters can give you a good indication of camshaft condition. If you're willing to climb right in on top of the engine with a small illuminated probe, you may be able to do a fair job of examining the cam through the lifter holes.

Once you've removed the lifter galley cover, valley cover and/or intake manifold, you may find that you can't extract the lifters from their bores, even with



To remove a shaft-mounted rocker arm, first remove the bolts and the support stands. Remove the cotter pin at the end of the rocker shaft and slide off the rockers, springs, washers and spacers (if any). Make notes or a sketch so that you can reinstall everything in the right order.



Use a magnetic-base dial indicator to check camshaft lobes without disassembling the engine. The indicator should be mounted to the cylinder head with its shaft parallel to the valve stem and touching the retainer. If valve does not open to specs, suspect a worn cam.

the special extractor tools sold for this purpose. This is the result of a slight ridge that sometimes forms on the bottom of the lifters. On some high-mileage engines, you may have to pull them out with locking pliers; on other engines, you may have to disassemble the engine.

If you have to resort to locking pliers, you might as well replace all of the lifters, because you'll certainly damage them. If you intend to just inspect and reinstall lifters, keep them in order by placing them in a numbered egg carton. Each one must be reinstalled on the same cam lobe. If all valve train components on the offending valve mechanism appear to be in good condition, the lifter is the source of the noise.

With the lifter out of the bore, inspect the cam lobe if possible. Is it pitted or flaking? Is the top of the lobe ridged or does it appear to be flattened out in comparison to the other lobes? If so, or if the bottom of a lifter is cup-shaped or galled, the cam is damaged and must be replaced.

Some mechanics won't replace lifters without replacing the cam. Sometimes, a new set of lifters will wipe out an old cam almost immediately. You're always taking a calculated risk when you replace one or more lifters without renewing the cam. If you replace the cam, replace all lifters, too.

### Slop stop

Timing chain wear is probably the second most frequent valve train prob-

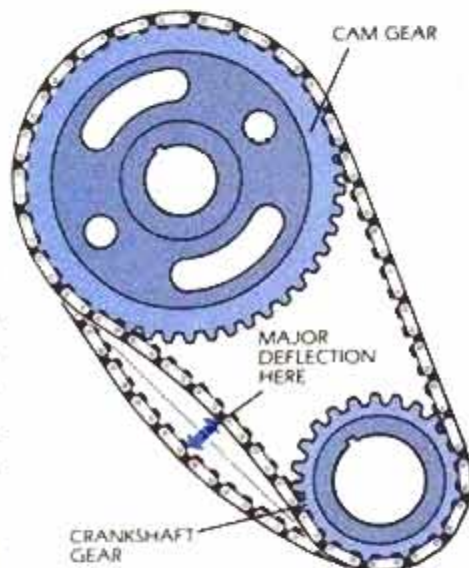
lem. On most engines, particularly V8s and V6s, a chain connecting the crankshaft and camshaft is responsible for driving the cam and maintaining it in proper relation to the crankshaft. As the chain ages and begins to stretch, the camshaft retards, causing a loss of low-speed response and torque. If your engine has relatively good compression, but lacks the punch it had when it was new, it may be that the timing chain has stretched. Once the chain stretches to the point where it can hop all the way off the teeth of the gears, the engine may "jump time." This condition is evidenced by an engine that dies and won't restart. It usually backfires and burps as you try to start it.

If you suspect that your engine has jumped time, rotate it to the ignition timing mark on the crank pulley. Make sure both valves for the No. 1 cylinder are closed. You can do this by placing your finger over the sparkplug hole while a helper rotates the engine toward the timing mark. You should feel and hear air compressing in the cylinder if the valves are closed. Stop at the timing mark and remove the distributor cap. Check to see that the rotor is pointing to the No. 1 cylinder sparkplug wire.

If you find that the rotor is pointing to No. 1, try to determine if the trigger wheel is aligned approximately with the distributor's magnetic pickup (or, on engines with contact points, that the points are just beginning to open). If so, the ignition is in time, so the camshaft

must also be approximately in time, and is probably not the source of the no-start problem.

If you suspect that your timing chain has stretched to the point where it is affecting engine performance, there are a couple of ways you can check it. The most reliable way is to remove the timing cover and check for chain deflection. Once the cover has been removed, turn the engine until the timing chain starts to turn the cam. The chain will then be tight on one side of the gears and slack on the other side. On the loose side, measure how much you can move the chain back and forth. If you can move it more than a half inch, timing chain wear is excessive; replace the chain and drive gears.



To check for timing chain play, remove the timing cover and turn the engine until chain is tight on one side and loose on the other. Check play on the loose side.

When a new cam is installed, the cam must be properly phased in respect to the crankshaft. On most cars, there are marks on both the crank gear and cam gear that must be aligned on the centerline of the cam and crank bores. Again, consult a shop manual for specific instructions for your vehicle.

Some camshafts are gear-driven, including many GM in-line four- and six-cylinder engines. To check for excessive wear on a gear-driven cam, the timing cover must be removed, and clearance between gear teeth checked with a feeler gauge. It should be at least 0.002-inch, and should not exceed 0.006-inch.

Excessive clearance on cam gears won't affect timing dramatically, but will produce noise and eventually result in total gear failure. **PM**

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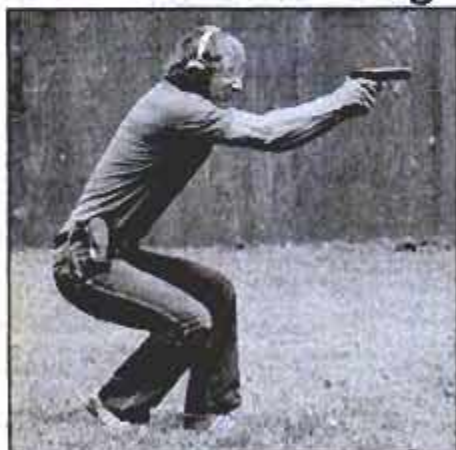
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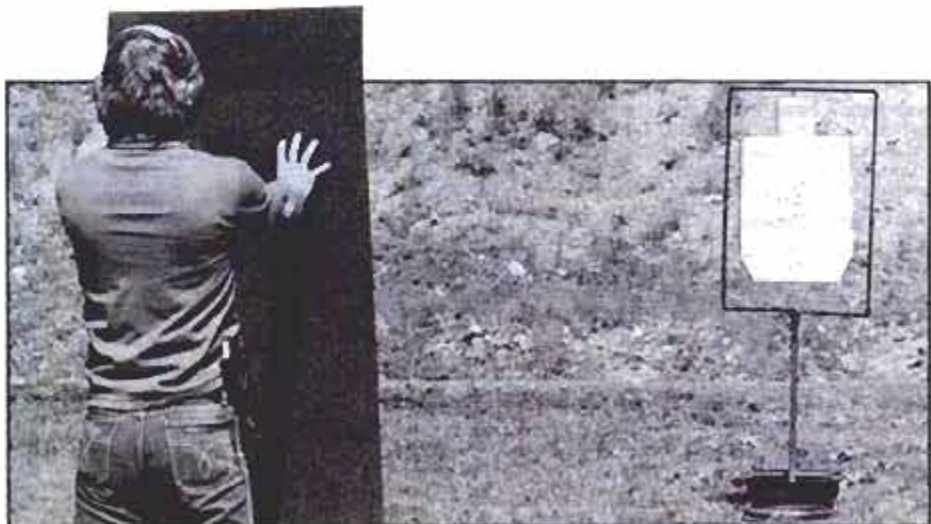
# ALL OUTDOORS



## Practical shooting



Some practical shooting courses may require that you walk and fire together.



Wyatt Earp never did it like this. PM's Outdoors Editor stands ready to draw and fire around barrier into target 25 feet away when whistle blows. Local gun clubs offer courses.

When I was a youngster, my brother gave me an old P38 he had picked up in Germany. It had a broken firing pin, but that didn't matter. I practiced fast-draw with it. If I had a dollar for every time I drew and dry-fired that thing, I'd be so wealthy that I wouldn't be a journalist now.

I sold the P38 for a pittance years ago. After that, I never thought much about the art of the fast-draw. Until today.

I was standing behind a plywood wall. On my hip was a Colt .45 automatic with a full clip in the handle. Unlike my old P38, this automatic didn't have a broken firing pin.

When a whistle blew, I was to yank the .45 out of its holster, knock the safety off with my thumb, peek around the wall ever so slightly and pump two shots into a cardboard target 25 feet away.

The whistle blew. I reached for the gun quickly, as I did years ago. In one fluid movement I brushed the safety off, looked around the wall and shot two holes in the target. Not bad, I thought.

"Whaddya doing? Taking a nap?" the instructor yelled behind me. "Pull the gun straight out. You're wasting time bringing the gun out to the side."

Kind of like basic training. Except that I wanted to be doing this. I was taking a six-hour course in practical shooting offered by a local gun club.

Practical shooting started a few years ago when people got bored shooting stationary targets. Now it's one of the most popular shooting sports in the country.

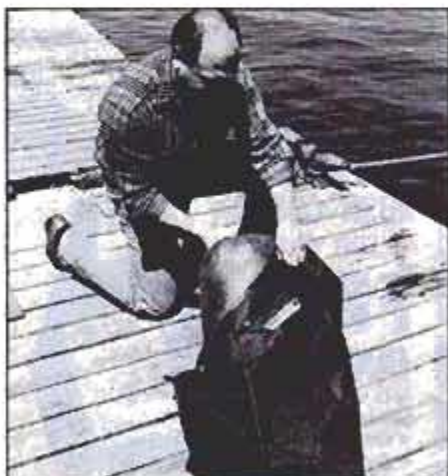
It combines elements of fast-draw, marksmanship and athletic ability. The good guys can empty a clip into multiple targets so fast and accurately you won't believe it.

If this sounds like fun to you, call your local gun club and see if they do practical shooting.

## Waterproof storage bag

There's nothing more miserable than pitching camp after a day on the water—only to find that all your dry clothes aren't dry anymore. Such misery is a thing of the past if you use Voyageur's storage bag.

Made of durable neoprene, this waterproof duffel measures 36 x 18 x 10 inches. It comes with tie-down grommets, carrying straps and a repair kit (in case it gets punctured). A couple of other nice features: It uses a special waterproof zipper, which makes opening and closing easy; and you can inflate it if you wish, so it will float. It retails for \$125. For more information, write: Voyageur's Ltd., Box 409, Gardner, Kan. 66030.



Unique zipper is used in this waterproof bag, which can also inflate and float.

## New RV waste treatment

Microsanitizer is a new waste treatment system for recreational vehicles that may replace the black-water holding tank now being used. This device uses microwave technology to kill bacteria and eliminate contamination, thus permitting continuous reuse of the flush water.

Testing of the unit is currently under way. If it proves successful, RV makers may be installing the device as original equipment in their larger type-A motorhomes by the end of this year. The Microsanitizer will also be available to RV consumers through selected dealers across the country.

The device is manufactured by Ecology One Inc., in Hialeah, Fla. **PM**



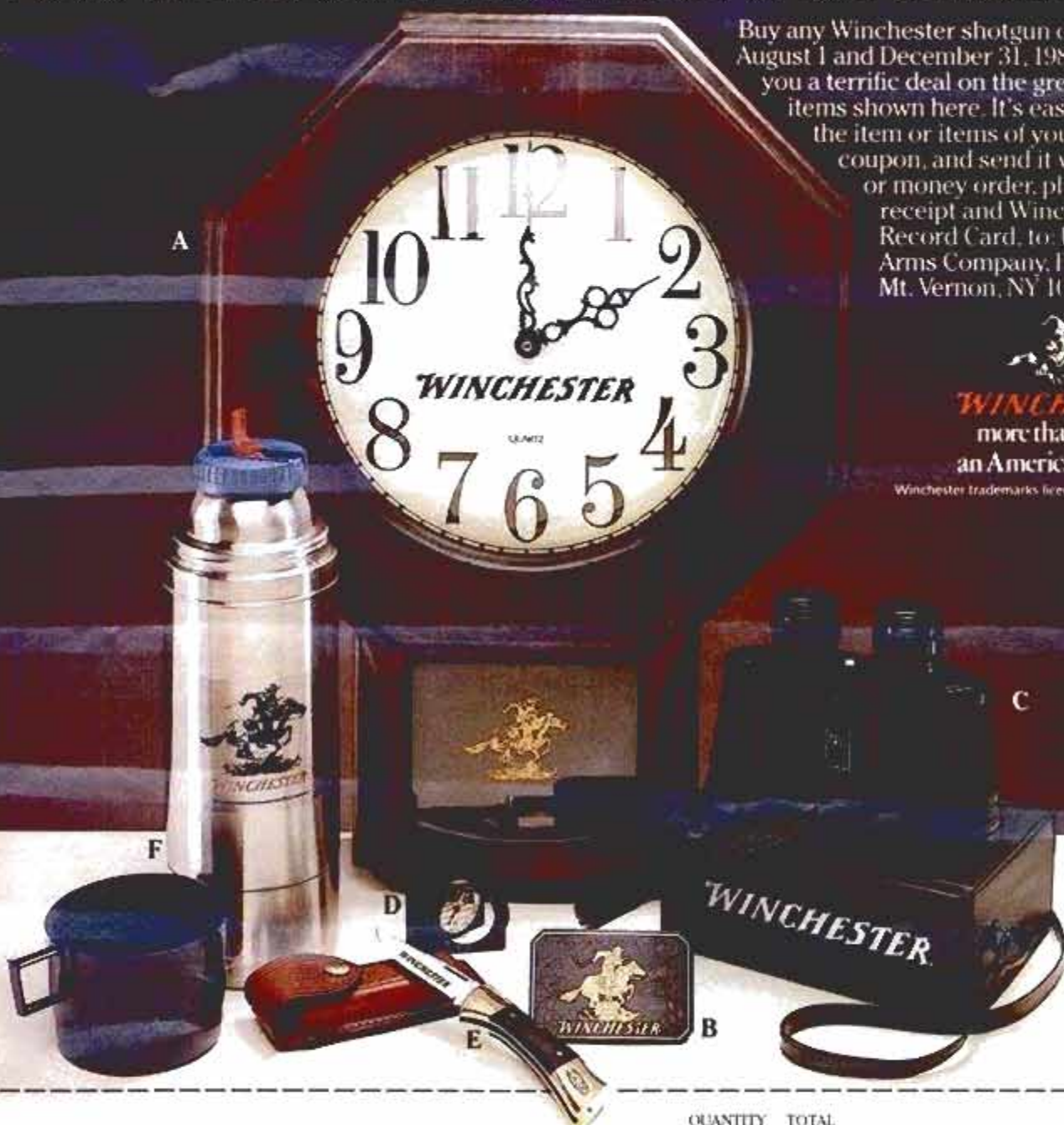
# BUY A WINCHESTER GUN AND WE'LL GIVE YOU A GREAT DEAL EXTRA.

Buy any Winchester shotgun or rifle between August 1 and December 31, 1983, and we'll give you a terrific deal on the great sportsman's items shown here. It's easy. Just indicate the item or items of your choice on the coupon, and send it with your check or money order, plus dated sales receipt and Winchester Purchase Record Card, to: U.S. Repeating Arms Company, P.O. Box 30-30, Mt. Vernon, NY 10551.



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- A. Winchester Schoolhouse Clock**, handcrafted of solid pine with antique walnut finish. Quartz movement. Pendulum glass screened with Horse and Rider® design.  
Retail value: \$135  
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Retail value: \$49.95  
Great Deal Price: **\$22.50 ppd.**
- D. Silva™ Huntsman™ Compass** pins to your shirt for no-hands use. Features 5° graduations, luminous dial points, map scale, and sun watch.  
Retail value: \$13.95  
Great Deal Price: **\$8 ppd.**
- E. Case™ 4¼" Lockblade Knife**, with Winchester "lightning" logo etched on blade. Laminated wood handles. Brass liners and bolsters. Leather sheath.  
Retail value: \$39.95  
Great Deal Price: **\$23.30 ppd.**
- F. Thermos™ All-Stainless Steel Vacuum Bottle**, with Winchester and Horse and Rider logos. 1-qt. capacity, unbreakable body and liner, new Flip 'n' Pour™ stopper.  
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Allow 6-8 weeks for delivery. Connecticut residents add 7½% sales tax. Canadian customers: All payments in U.S. \$, add \$5 for special handling. Offer valid through December 31, 1983, or while supplies last. Not valid where prohibited by law.

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# SCIENCE WORLDWIDE



## Torch song trilogy

Westinghouse has opened its new Plasma Center near Pittsburgh, where the company will use its revolutionary plasma torch to perform three major functions: process new metals, develop new chemicals and destroy toxic chemical waste.

The torch can generate temperatures up to 10,000° F. by passing pressurized gas through an electric arc in a gap between two copper electrodes. An industrial torch using fossil fuels and normal firing procedures produces temperatures up to only 3,600° F.

High-temperature processes have been used by NASA to modify metal coatings slightly to increase hardness or elasticity. Plasma ironmaking is one hoped-for result of the experiments going on at Westinghouse. The iron would rust at a far slower rate than anything currently available.



Westinghouse plasma torch produces temperatures up to 10,000° F., a leap forward.

## Well-rounded treatment

Now that acupuncture is practiced at many American hospitals, other forms of folk healing or nontraditional healing are finding their way into the mainstream of medicine. At St. Agnes Medical Center in Philadelphia, Dr. Sae-Il-Chun is treating patients who suffer from arthritis with sets of stainless-steel isospheres.

The spheres, each a ball within a ball, are made in China. Chun says arthritis patients who manipulate a set in the palms of their hands get long-term relief from the pain and stiffness associated with the disease. They get relief as far up their arms as the shoulder joints, he reports.



Isospheres are stainless-steel balls that are manipulated to relieve arthritis pain.

## DNA's new wrinkle

Deoxyribonucleic acid (DNA) is the basic chemical building block of life. Science has long known that DNA molecules are built up of chains of chemicals that form what looks like a spiral ladder. Now, Purdue University biological science Prof. Struther Arnott has discovered tiny creases along the ladder structure. The wrinkles showed up in computer-enhanced X-ray pictures of DNA structures.

The Purdue researcher thinks the wrinkles may act with other chemicals to turn on and off individual DNA molecules during reproduction or during the growth of a cell. Further investigation may give us answers to why cells stop growing and die.

## Bee an undertaker

Cornell University entomologist Kirk Visscher has observed a clearly specialized group of worker bees in experimental hives. He calls them "undertaker bees." These workers remove dead bees from the hive. He says the undertakers double as hive guards. The discovery is bound to spark searches for other specialists in the living quarters of highly socialized insects.

## Join the waves

The human brain produces waves of pure electricity as well as those of pure magnetism. MIT researcher David Cohen says his research team has now confirmed differences in the way the waves register on detectors.

The difference between the way a brain wave shows on an electroencephalogram and on a magnetoencephalogram is so slight that it took highly sensitive and specially rigged detectors to divide a brain wave into the two components. Cohen says that now, doctors may be able to take both kinds of readings on patients to help pinpoint the locations of brain disturbances, such as those associated with epilepsy.

## Glue balls are real

Physicists from Brookhaven National Labs and City College of New York have announced the discovery of so-called "glue balls," elementary particles believed responsible for holding together the nucleus of every atom. PM reported last year that scientists strongly believed in the existence of glue balls, also known as gluons (see *Here's The Atom As You've Never Seen It*, page 76, Dec. '82). The confirmation came this past summer in experiments viewing smashed atoms through Brookhaven's Multiparticle Spectrometer. The results should intensify the hunt for other, smaller atomic particles.

## Bound for the heavens

As promised last month, I'll share with you the duties a NASA committee has dreamed up for the first journalist launched into space. My name is on the list of candidates. The journalist will write a history of the mission, as well as do live broadcasts beamed to Earth radio and TV. He'll probably write a second history on the mission's science and technology aspects, separate from any narratives on life aboard the Space Shuttle. The trip could become the basis of a high school course on the Space Shuttle, a course created by the journalist. NASA officials are looking over the committee recommendations as well as the list of some 400 volunteers who'd like to go. **PM**

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

SOFT PACK 100s FILTER, MENTHOL: 2 mg. "tar", 0.2 mg. nicotine av. per cigarette, FTC Report MAR, '83.

Competitive tar levels reflect either the Mar '83 FTC Report or FTC method NOW. THE LOWEST OF ALL BRANDS.



**They're all after us.**



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**Today the Services  
can help you so  
you not only get better  
you really grow.**



**Prove you can make it.  
Prove it to all.  
Serving your country  
and walking tall.**



**You'll work hard –  
learn all that you can.  
Responsibility is  
part of the plan.**



**ARMY  
NAVY  
AIR FORCE  
MARINES**





**Challenge, adventure  
excitement too.  
A time to enjoy.  
See something new.**



**You've got it together  
they'll see in a glance.  
Thanks to the Services  
you got the chance  
in the Army, Navy,  
Air Force, Marines.**

Looking for an opportunity to develop and grow as a person? You'll find it in the Army, Navy, Air Force and Marines. And that's especially true if you're smart enough to graduate from high school.

You can earn responsibility in the Services. Learn to lead. Prove that you can make it. In fact, there are all kinds of opportunities for advancement.

The Armed Forces can bring out the best in you—actually help you grow better. For instance, there's even a program in which the government contributes money toward a college education.

Serving in the Armed Forces is an adventure and a challenge. There are new places to see. And new friends to make.

Pay is higher than ever—more than \$550 a month to start. And you earn 30 days of vacation each year. Plus, the Services take care of your food, uniforms, housing and medical needs.

But above all, you'll gain new confidence. Stand a little taller. Walk a little prouder. All while serving your country. And that's one of the finest things a person can do.

To find out more, see your local Armed Forces recruiter or write Armed Forces Opportunities, P.O. Box C 1776, Huntington Station, N.Y. 11746.

**IT'S A GREAT PLACE TO START**

# THE PM WORKBENCH



## Custom folding box

When I learned about these charming, old-time boxes, I felt PM's readers would want to know about them.

The boxes are faithful reproductions of the delivery crates of yesteryear. Manufacturers would ship their goods to retailers in collapsible, returnable boxes like the one shown. The fun part is that you can order the boxes with custom printing on the side. I ordered one for my first grandson (see photo) to use as a toybox. The boxes come in  $\frac{3}{4}$ - (\$18.53), 1- (\$21.46) and 1 $\frac{1}{2}$ -bushel (\$25.57) sizes. Printing and delivery charges are extra. For details, contact Hubbard Folding Box Co., Box N-O, Downing, Wis. 54734.—H.W.



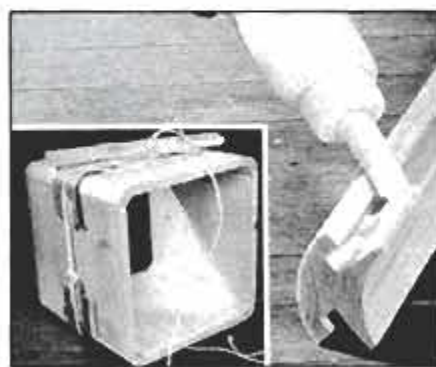
The replica of an old-fashioned shipping crate is shown personalized as a child's toybox. The crate collapses, as did the originals, for easy storage (right).

## Modular furniture in a kit

Here is a quick and attractive way to add decorative and useful furniture at reasonable cost. Hagerwood Inc. (1545 Marquette S.W., Grand Rapids, Mich. 49509) offers a variety of sanded pine, ready-to-assemble modules that can be used singly—as coffee or end table, for example—or in combination to achieve the popular cluster look.

The three units shown, ranging in price from \$11.95 to \$31.88, were assembled in less than an hour by two

of us in my shop. The parts required very little additional sanding. For the most part, we assembled them as they came. Since you'll need a pair of web or rope clamps for each module you put together, you can assemble more than one box at a time only if you have extra clamps on hand. (We used Black & Decker's newest rope clamps.) The three units shown were left clear and finished with two coats of satin finish varnish. For module styles and prices, write to the manufacturer.—H.W.



Manufacturer offers a variety of modules. Three are shown at left. At right above, glue is placed in preshaped corner mold. Glued and assembled unit is then clamped.

## Classy carrying case



Polyethylene carrying case features double-wall construction and a thick foam insert.



First, trace the lens profiles. Then, cut along the lines to produce a snug, custom fit.



All ToolMaster toolboxes are constructed of lightweight, corrosion-proof polyethylene.

I've finally found an economical, rigid protective carrying case for my photographic equipment. The TravelMaster polyethylene case comes in four sizes for carrying everything from calculators to personal computers. Prices range from \$59.95 to \$110.30. For details, contact Southern Case Inc., Box 28147, Raleigh, N.C. 27611.—J.T.

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.



# Your screwdriver just became obsolete.

Once you've used the Skil Cordless Screwdriver, you won't want to go back to your old screwdriver. The Skil Cordless Screwdriver weighs mere ounces and is so small it fits into your pocket. Yet its high torque motor has the power to drive up to 500 screws on a single charge.

The Skil Cordless Screwdriver recharges in 3 hours or less and even has a special built-in feature to help prevent stripping of screws. And since it's cordless, it's perfect for everything from everyday fixups in or out of the house, to serious do-it-yourself projects.

With everything it can do, you'd think the Skil Cordless Screwdriver would be expensive, but it's not. Not at all. And its surprisingly low price makes it a great gift.

So forget about all the stripped screws, tired arms and blisters that went with your ordinary screwdriver. The Skil Cordless Screwdriver just made them obsolete.

**SKIL**. We build tools  
that last and last and last.

**SKIL** CORDLESS  
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2000 For Field

HIGH PERFORMANCE INDUSTRIAL TORQUE RECHARGES IN 3 HOURS OR LESS

DRIVES OR REMOVES UP TO 900 SCREWS PER CHARGE

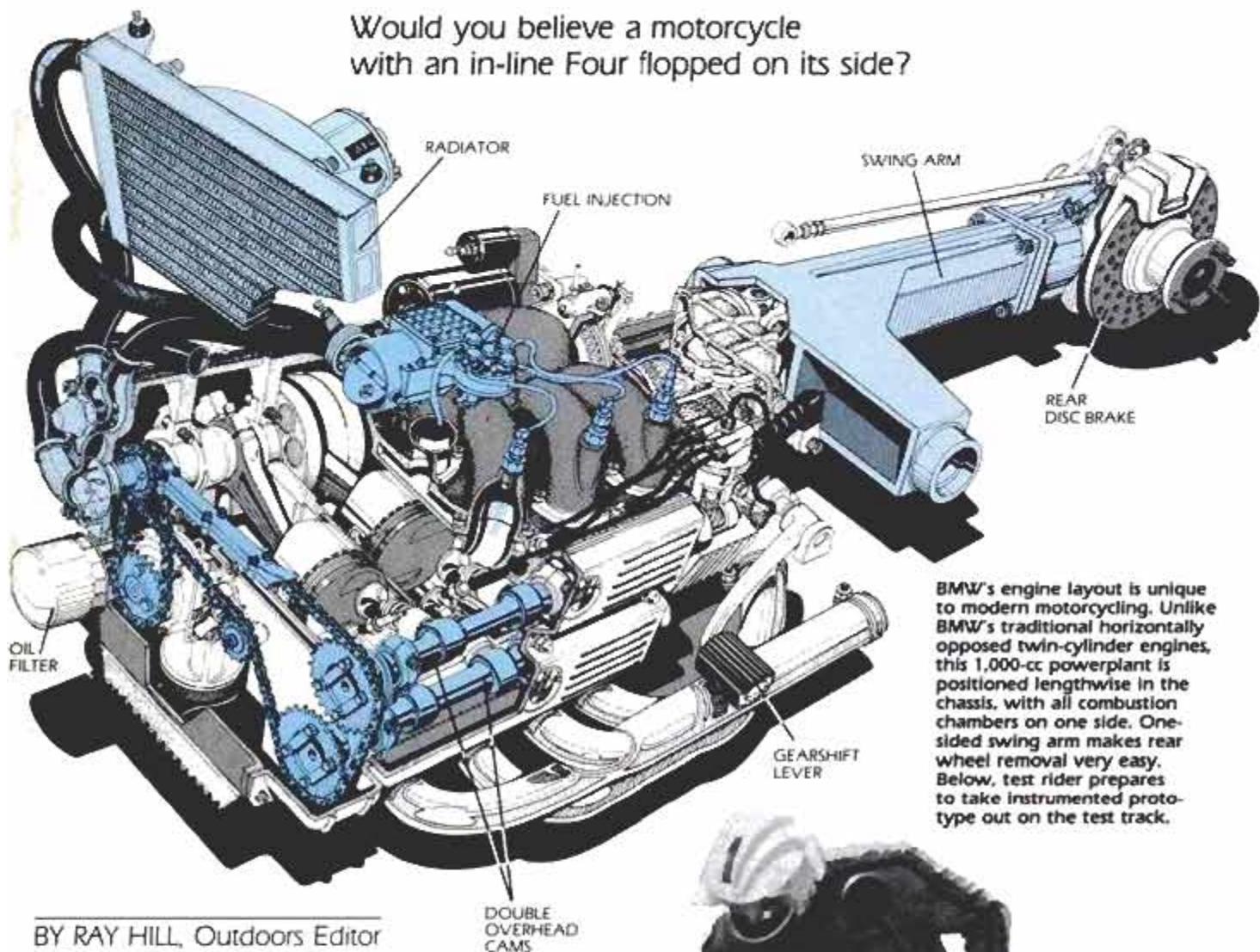
  
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# NEW BMW1000

## A DEPARTURE FROM TRADITION

Would you believe a motorcycle with an in-line Four flopped on its side?



BMW's engine layout is unique to modern motorcycling. Unlike BMW's traditional horizontally opposed twin-cylinder engines, this 1,000-cc powerplant is positioned lengthwise in the chassis, with all combustion chambers on one side. One-sided swing arm makes rear wheel removal very easy. Below, test rider prepares to take instrumented prototype out on the test track.

BY RAY HILL, *Outdoors Editor*

**T**he flat, opposed-twin design of BMW motorcycle engines is considered antiquated by many. Japanese makers, on the other hand, offer a staggering variety of state-of-the-art engine designs: V-Twins, V-Fours, in-line Fours, Singles and much more.

In an effort to become more competitive in the sales arena, BMW just introduced an all-new motorcycle, which will come to the United States in the fall of 1984. Its 1,000-cc powerplant is an in-line Four positioned horizontally in the motorcycle. The cylinder head is on the left side of the motorcycle and the crankshaft is on the right. The water-cooled engine drives the rear wheel via a driveshaft.

The BMW1000 weighs about 550 pounds and accelerates from 0 to 60 mph in about 4 seconds. This compares

*(Please turn to page 52)*





# Ford Escort Diesel: Better mileage than this leading import.



We didn't believe it at first, either.

But EPA testing figures established it. Our new Escort Diesel is rated approximately four miles per gallon higher than a Honda 750.

Just take a look at our numbers:

**46** EPA EST. MPG.

And because this diesel is an Escort,

**68** EST. HWY.

there's a lot more to talk about than great economy.

Like the fact that Escort's the best-selling car in the world.\*\*

Or that it comes with more total passenger room and more total cargo room than a Honda Accord.†

More standard features than a Toyota Tercel.††

There's even a fully-independent suspension system for a smoother ride than a Nissan Sentra.

All of which means Ford Escort not only gives you a big advantage over that motorcycle pictured above.

It also beats more than its share of cars.

## THE BEST-BUILT AMERICAN CARS.

When we say "Quality is Job 1," we are talking about more than a commitment. We are talking about results. An independent survey concluded Ford makes the best-built American cars. The survey measured owner-reported problems during the first three months of ownership of 1983 cars designed and built in the U.S.

And that commitment continues in 1984.

\* For comparison, Honda 750 mileage is obtained from EPA emissions testing and is *not* an official rating. Your mileage may vary depending on speed, trip length, weather. Actual highway mileage lower. Escort Diesel mileage applicable to sedans with FS engine and without power steering and A/C. Not available in California.

\*\* Sales estimates based on worldwide production figures.

† Based on EPA Interior Volume Index.

†† Escort GL (shown) compared to Toyota Tercel 3-door deluxe liftback.

Get it together - Buckle up.

Have You Driven A Ford... Lately?



favorably with Japanese superbikes which dominate the U.S. market. Its top speed, which is about 130 mph, also stacks up well.

Most unusual is that the engine is positioned lengthwise in the chassis. All other motorcycle manufacturers currently mount their in-line Four engines transversely in the chassis.

Another unique feature is the method of attaching the rear wheel. Most motorcycles have a swing arm which fits on either side of the rear wheel. An axle runs through the wheel and is attached at both sides of the swing arm. Removing the rear wheel isn't easy, especially on a large-displacement motorcycle. With the new BMW, this hassle is eliminated. It uses a one-sided

swing arm. Wheel removal is simply a matter of removing three fasteners and pulling off the wheel. Very slick.

BMW is also working on a smaller-displacement version with one less cylinder. It displaces 750 cc. Company spokesmen say that the 750 probably won't reach American shores until sometime in 1986.

Whether this new design will give BMW a leg up in the American superbike market remains to be seen. Much depends on how well the production models compare with the Japanese machines in terms of cost, handling, comfort and acceleration.

One thing is for sure, though. It's a very interesting motorcycle. I can't wait to try one. **FM**

## BMW: The Gentleman's Motorcycle



drives the rear wheel—only the displacement differs. There are nine bikes in the line.

The two 650-cc machines mentioned above are \$3,600 and \$3,990, respectively. Two of the 800-cc models, the R80G/S and R80ST, are \$4,190, while the R80RT, with its fairing, double-disc front brake and other touring touches, is \$5,490. The 1,000-cc bikes are BMW's heavyweights, but in terms of pounds (440 to 480) they are not heavy for touring motorcycles. The R100 models, called the R100RS and the R100RT, are priced from \$5,000 to \$7,000, depending on how they're set

up. The grand tourer, the R100RT, gets the whole works, including load levelers, special cockpit and saddle bags. The windshield is adjustable so that riders of different heights can place the top where they want it.

So, if you like your motorcycles done the traditional way, you've got an ample choice of BMWs. Even when the United States gets the red-hot, in-line Four for the top of its line, the horizontally opposed foot-warmers will still be around.—B.H.

**BMW's models start with the R65, perfect bike for a good whirl, not wheelies.**

If you really like to crank it on, you'll find that a BMW just doesn't give you enough blast per buck. Bikers addicted to G-forces buy Japanese machines that scream up to speed a lot faster and are more affordable.

What BMW gives you for your money, though, is a beautifully engineered and impeccably crafted motorcycle. Recently, we took out an R65, the baby of the line at 650 cc and the cheapest at \$3,600. On our test ride, we found that—even though, it's not a rocket—it does exactly what a motorcycle is supposed to do: leave all four-wheel vehicles sitting at the light. And, for our medium-framed 155 pounds, it's more than adequate as a touring bike—no need for 1,000 cc of Bimmer. Adding a passenger did nothing to lessen our riding pleasure. However, the passenger would be more comfortable if the R65 had the same built-in grab handles as on the R65LS sports bike.

All BMWs mount the same quiet and smooth, two-cylinder, four-stroke horizontally opposed engine that shaft-



Traditional, horizontally opposed R65 engine gets an easy idle adjustment.



## The Perfect Gift

Unmatched in Performance

Highly Desirable

Experts Choice

Exclusive Source

Convenient Shopping

No-Risk 30 Day Trial



### THE RADAR DEFENSE KIT

ESCORT comes complete with a molded carrying case, detachable power cord, visor clip and hook and loop mounting, spare fuse and alert bulb, and a comprehensive owner's handbook.



# Overwhelm Your Favorite Driver

A good gift is more than a surprise; the perfect gift hits the mark. If there's a driver on your list, you can give ESCORT with absolute confidence. Here's why.

## First Class Performance

When radar is out there, ESCORT's superheterodyne circuitry will find it. Over hills, around curves, hidden in the bushes, anywhere. But don't take our word for it. In its most recent comparison test, *Car and Driver* rated ESCORT number one, calling it "...clearly the leader in value, customer service and performance..."

## Coveted Equipment

For several years after its introduction, demand was so great that customers waited up to six months for delivery. We finally had to build a new factory to keep ahead of the demand.

Users quickly came to depend on ESCORT's unique radar report—the way its variable-pulse audio warning, analog meter and amber alert lamp work together to give a precise indication of radar type and range.

the brightness of the alert light to suit. These are just a few of the many details that make ESCORT unique.

But all this sophistication doesn't mean that ESCORT is hard to use. Just install ESCORT on dash or visor, and plug it into the lighter. We even include an adapter for European lighter sockets. And ESCORT's low-profile shape, finished in non-glare black, looks right at home in any car.



Power-On LED and Sensor

Signal Strength Meter

Highway/City Switch

## Apart From The Crowd

We've always felt that users of precision electronics are entitled to deal with experts. That's why we only sell ESCORT direct from our factory. There are no middlemen. When it comes to customer satisfaction, we take full responsibility.

Our system of direct sales offers special benefits to the gift giver. You needn't worry about inadvertently buying a discontinued model still in a store's stock. Your gift will never be seen marked down in the discount chains. Moreover, giving an ESCORT shows you were concerned enough about quality to track down the only source. And there's another advantage.

## Easy Access

ESCORT lets you do your Christmas shopping by phone and avoid the retail hassle. We're only a toll-free call and a parcel delivery away. And ESCORT is guaranteed to please. Holidays or any time, take the first thirty days as a trial. If you're not absolutely satisfied, return it and we'll promptly refund your purchase and mailing costs. We also back ESCORT with a full one year

limited warranty. *Car and Driver* called us the "class act" in radar detection. So order now. ESCORT is the perfect driver's gift.

## Do It Today

It's easy to order an ESCORT, by mail or by phone.

**By Phone:** Call us toll free. A member of our sales staff will be glad to answer any questions and take your order. (Please have your Visa or MasterCard at hand when you call).

**CALL TOLL FREE... 800-543-1608**  
**IN OHIO CALL... 800-582-2696**

**By Mail:** We'll need to know your name and street address, daytime phone number, and how many ESCORTs you want. Please enclose a check, money order, or the card number and expiration date from your Visa or MasterCard.



**ESCORT (Includes Everything)... \$245.00**  
Ohio residents add \$13.48 sales tax.

## Speedy Delivery

If you order with a bank check, money order, credit card, or wire transfer, your order is processed for shipment immediately. Personal or company checks require an additional 18 days.

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RADAR WARNING RECEIVER

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FIXES FOR

# 4 Common Plumbing Problems

BY RICHARD DAY

Here are do-it-yourself remedies for the leaks and clogs you'll get in your pipes sooner or later.



The first attempt to unclog a drain is made with a plunger. Always plunge with 2 in. of water in the fixture bowl. As you lower the plunger into the water, tip it to release trapped air. Hold the plunger tight against the drain and pump up and down vigorously 10 times. Then, pull up sharply, as shown, to dislodge the clog.

Other than a dripping faucet, the four most common home plumbing problems are clogged drains, running toilets, leaking pipes and frozen pipes. Here are do-it-yourself solutions for these headaches. (For a complete faucet repair guide, see *How To Stop Any Faucet From Leaking*, page 149, Apr. '83.)

## Sluggish and clogged drains

The first step in clearing a stopped-up drain is to locate the blockage. If only one fixture is affected, then chances are that the trap (the curved pipe installed under a fixture) or the waste line leading from the trap is clogged. However, if more than one fixture is affected, you can assume that the clog is farther down the drainage system. When all the fixtures in the house are affected, the main house drain or sewer is suspect.

A rubber force cup, or plunger, is the first tool to reach for when a clog occurs. For the plunger to be most effective, be certain that the pipe is full of water. This way the water becomes an incompressible medium for transferring plunger pressure to the blockage.

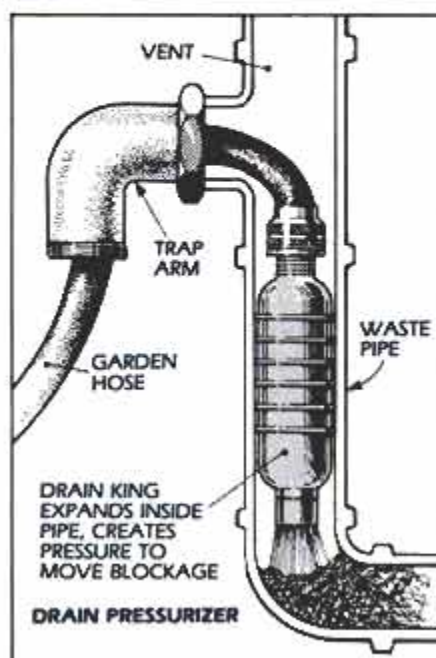
In addition to the plunger, several

*(Please turn to page 56)*

## UNCLOGGING DRAINS



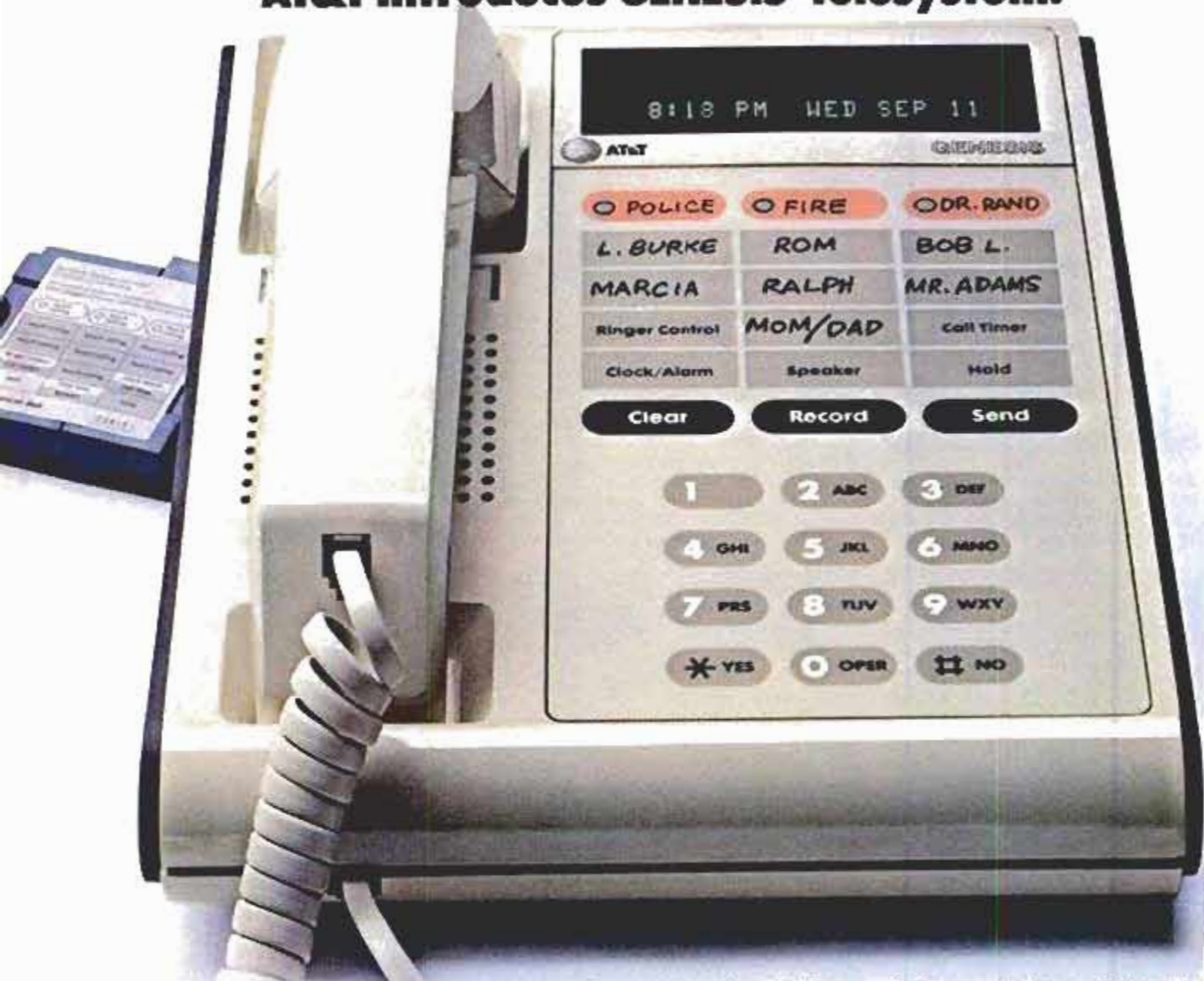
Pouring commercial drain cleaner into a clogged fixture seldom works. Once drain is clogged, it's usually too late for this method. Instead, use drain cleaners routinely in free-running fixtures to help prevent clogs.



A hand-cranked, self-storing drain auger is used to unclog a sink waste pipe. Feed out about 10 in. of cable. Then crank the handle, causing the cable to rotate, as you push the auger into the drain and through the blockage. To remove the auger, you should pull back gently while still cranking the handle in a clockwise direction.

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## PLUMBING PROBLEMS

(Continued from page 54)

pressurizing devices are available which also use water pressure to blow out clogs. These tools are highly effective on clogs located near the fixture. The drain pressurizer shown in the drawing on page 54 is the Drain King made by G.T. Water Products Inc., 19438 Business Center Dr., Northridge, Calif. 91324. To use it, thread the Drain King onto a garden hose and insert it into the drain pipe. When water pressure is turned on, the Drain King's rubber sides expand and press tight against the pipe walls. Pulsating blasts of water break up the clog.

The drain auger, or snake, can free



Undog fixture traps by inserting a straightened wire hanger into the drain-plug opening. If there is no drain plug, undo the slip couplings and remove the entire trap.



When a plunger fails to unclog a toilet bowl, try using a toilet auger. Feed the auger into the bowl in a vertical position while cranking the handle. When the obstruction is felt, hook it and pull it back out. Avoid forcing a solid object such as a child's toy or hair brush farther into trap.



Blockages that can't be reached through fixture traps and waste pipes are best attacked through cleanout openings. Remove the cleanout cap and cut through the clog with a drain auger. Run the auger through again to assure clear passage. Then flush out the pipe, using a garden hose.

all but the hardest-to-reach clogs. Augers come with a variety of cable diameters. A 1/4-in.-dia. auger is recommended for fixing household plumbing problems since a larger diameter cable is difficult to work through fixture traps. Many drain augers have a separate head, or tool. The basic tool for household use is the flexible bulb auger.

A toilet auger is specifically designed for unclogging toilet bowls. It has a bent tubular shaft to help start the auger up the trap passage. The toilet auger reaches through the toilet bowl trap passage, but not much farther. If the blockage is located beyond the reach of the toilet auger, then work a longer drain auger into the bowl. You



When the clog is located beyond trap, work an auger directly into the waste pipe to move blockage. Reassemble trap with silicone sealant or plumber's putty on slip couplings to prevent leaking. Skip this step if trap is made of ABS plastic, which is adversely affected by such compounds.

may need to reach into the bowl to guide the auger.

Clogs located beyond the waste pipe of any fixture are best attacked from either the cleanout openings in the drainage system or from the vent stack protruding from the roof. These drains are often 3- or 4-in.-dia. pipes and serve more than one fixture.

Every properly installed plumbing system includes a cleanout at the upper end of every horizontal run of pipe, and at all turns or bends. In a concrete slab house, look for cleanouts at or near floor level behind fixtures and low on exterior walls near bathrooms and kitchens. The cleanouts may be visible on the surface or behind removable panels. In

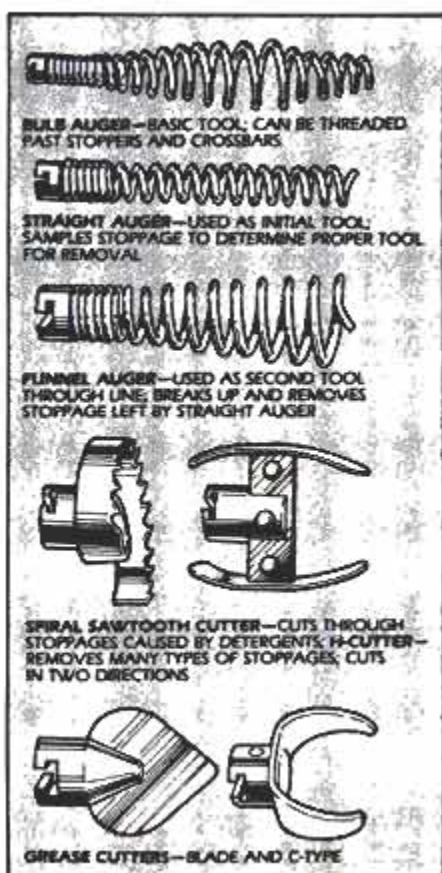
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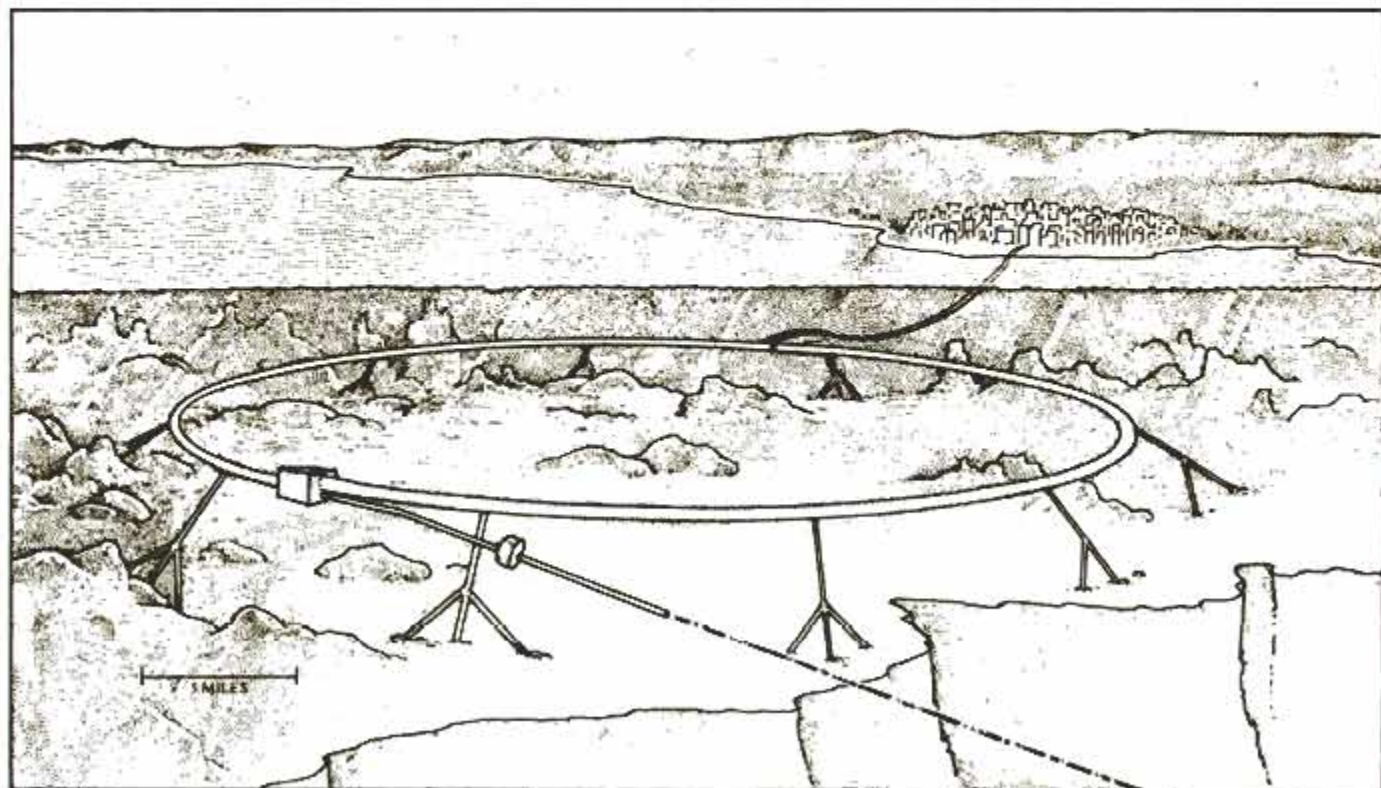
The most direct route for augering a bathtub drain is through the overflow opening. First, remove the overflow cover, lever and rod. Then work about 8 ft. of cable into the opening and through waste line. Here, a Rigid K-37 variable-speed power auger makes easy work of drain cleaning.



Rent an electric drain-cleaning machine to unclog far-reaching obstructions in the main house drain. Wear metal-faced gloves to feed the rotating cable down the roof vent stack. *Caution:* For houses with steep roofs, hire a professional drain cleaner.



Physicists apply atomic theory to mineral exploration with an accelerator called Geotron.



Superfast protons circling in Geotron's ring detour into a "snout," where they strike metal. The resulting neutrinos race through the Earth, revealing mineral deposits to distant detectors. The ocean location allows the snout to be pivoted in any direction.

## NEUTRINOS PIERCE EARTH FOR OIL

Imagine a pipe three feet thick and 100 miles long, formed into a doughnut 32 miles across. It floats 30 feet beneath the turbulent surface of the ocean, anchored to an undersea coral reef. A beam of high-energy protons whips through the pipe at nearly the speed of light. The doughnut is a machine called Geotron and is the largest, most powerful particle accelerator in the world. It isn't looking for charmed quarks, however, or for magnetic monopoles—the standard quarry of particle physicists. It is prospecting for oil.

"I have to admit, it's farfetched," says Robert Wilson, founding director of Fermilab near Chicago and one of Geotron's designers. "To a degree, the proposal is tongue-in-cheek. But it's still a distinct possibility that Geotron can someday be built." The estimated price tag would be several billions of dollars, and although Wilson and his colleagues began designing the machine during the 1979 oil shortage, no company has yet volunteered to fund it.

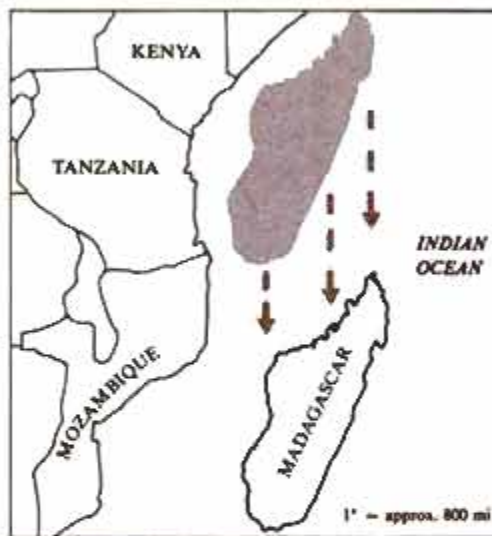
Currently, geologists look for oil-bearing rock with sound waves, generated at the surface by explosives or by mechanical "thumpers" mounted on trucks. The sound, reflected off mineral layers, profiles their structure. But by the time the waves reach the surface, the precise location of reflecting layers can be unclear.

Geotron would generate sound by bombarding the Earth with neutrinos. These massless (or nearly so) particles ordinarily pass right through the Earth without stopping. They would do the same with a chunk of lead trillions of miles thick. Given sufficient energy, though—the kind produced by Geotron—a beam of neutrinos could be made that would interact with matter, producing underground sound detectable from the surface.

Geotron's neutrinos are a by-product of the whirling proton swarm. The beam is diverted on one of its near-light-speed laps and routed into an attached straight pipe (called the snout) that is angled a few degrees down from the horizontal. Partway down the pipe, the protons smash into a dense metal target, producing a shower of unstable particles called mesons. As these race down the rest of the tube, they decay into neutrinos that shoot off through the Earth. Hundreds of miles away, their passage is heard by sensors and recorded.

If built, Geotron will have some uses besides oil exploration. It could also locate high-density metals, including uranium. Neutrinos hitting metal deposits would produce muons, a kind of heavy electron, which could be detected. Unfortunately, the muons would not tell observers whether they came from gold or lead.

Geotron may also be used for a more purely scientific purpose. The snout could be pivoted to point straight down, shooting neutrinos through to the other side of the Earth. In passing, they would interact with the molten metal core, providing scientists with the first accurate picture of our planet's heart.



## DRIFTING ISLE LEAVES TRACKS

A Texas-size island located in the Indian Ocean recently found its place in a global jigsaw puzzle.

Millions of years ago, it's thought, several continents were joined to form a large landmass called Gondwanaland. The mass broke up and the parts went their separate ways. How these pieces originally fit together has been a mystery.

Some scientists now believe that one of the pieces, the island of Madagascar, off the coast of Mozambique, was once attached to Africa near where Kenya is today. The evidence? A magnetic code inscribed in the seafloor.

When landmasses separate, there is an upwelling of molten rock from the

The continents may have once been joined together in large landmasses (left). After these broke up, a fragment now known as Madagascar could have drifted south from its original position near Kenya to its current home off the coast of Mozambique (right).

Earth's interior that eventually solidifies, laying down fresh rock in the newly created void in the seafloor. Magnetic particles in the new rock line up with Earth's magnetic field, just as iron filings orient themselves to the pull of a nearby magnet. But scientists know that Earth's magnetic field has changed many times. For example, 800,000 years ago a compass needle would have pointed to the magnetic south pole instead of north. If the field changes while new rock is being formed, the magnetic reversals are recorded on the seafloor.

"It's like there is a gigantic tape recorder operating, with the seafloor being the tape and the Earth's magnetic field the recording head," says Millard Coffin, of Columbia University's Lamont-Do-

herly Geological Observatory.

By tracing the path of the reversals between Africa and Madagascar, a team of geologists, including Coffin, was able to figure that the island drifted 1,000 miles south over millions of years to its present location. It's also been argued that Madagascar moved northeast from the African coast. Another theory is that everything shifted around Madagascar and it did not move at all.

**SOME TERMITES** are virtually walking weapons, with bodies so geared for battle that they can neither feed themselves nor reproduce.

## MAN EVOLVING LESS THAN APE

Humans are evolving slower than the African apes, at least as far as some traits are concerned.

"There is a very widespread idea that virtually every human trait is more highly evolved than the corresponding trait in gorillas and chimps," says evolutionary biologist Alan Templeton. "But on the level of DNA, humans are the more primitive type."

Since the 1960s, molecular biologists have been promoting the idea that DNA and the proteins it codes for may hold clues to our evolutionary past. The history of evolution, they say, is inscribed in these molecules.

The concept—part of what is known as the molecular-clock hypothesis—is based

on the assumption that the longer the time span since two animals shared an ancestor, the greater the difference between their biological molecules. The theory also holds that for any given protein or DNA segment, the rate of molecular evolution—the number of mutations it has accumulated over time—is the same for all lineages—man, ape or otherwise.

Templeton, at Washington University in St. Louis, believes that the latter part of this hypothesis is wrong. The molecular clock ticks, he says, but not at the same rate for all animals.

He arrived at this conclusion by first using statistics to figure out, from a number of competing alternatives, the most probable family tree, or phylogeny, for the primates. Phylogenetic trees depict the order of, and the relative time between, species divergence. Templeton found that the most likely tree had the human line branching off from both goril-

las and chimps before they split off from each other. Next, he counted the number of mutations occurring in certain DNA fragments that are common to all three forms. On average, the DNA in the human line had two to three times fewer mutations than the DNA in either the gorilla or chimp branches.

The slow rate of evolution in humans is reflected in many physical traits, says Templeton. Besides being more primitive on the molecular level, our body plan—short arms and long legs—is closer to the ancestral primate form than either the chimp's or the gorilla's. These modern apes, he claims, with their long arms and short legs, are a radical departure from the prototype; the rate of change of their molecules and physique has far outpaced recent human evolution.

There's one obvious exception: In the DNA that controls brain development, we're way out in front.



## FUNNY FOODS

Tired of the same old franks, burgers and fruit drinks? Take heart. Your next meal could be a bunny hot dog washed down with a swig of cottonseed juice.

Notes Agricultural Research Service information officer Bruce Schwartz, "We need to look at all kinds of foods as a bank for the future. We can't assume that all of the staple foods will be available at one time, particularly when the population grows."

"Fruit drinks are mostly water and sugar with a little bit of flavor, minerals and vitamin C," says the USDA's John Cherry. "Throw in some protein and you've got a protein drink." This could come from cottonseed, he says, which is plentiful in the South and in developing nations. "It's much like soybean but without the beany flavor and off-color." Research has shown that okra seeds could also be used.

Beef tallow, says USDA chemical engi-

neer Michael Kozempel, is also underutilized. Tallow is a by-product of meat-packing; cocoa butter is a costly ingredient in chocolate products. Kozempel and his colleagues have found a way to extract quasi cocoa-butter from tallow.

And can you handle rabbits in your hot dogs? According to Richard Whiting, a USDA food scientist, rabbit meat makes great franks. It's nutritious, low in fat and lower in sodium and cholesterol than beef and pork. How do bunny dogs taste? "I'd bet that if we just mixed the meat in and didn't tell anyone, most people wouldn't know the difference."

## TOBACCO PIE

Tobacco may turn up in lemon meringue pie, mayonnaise and cattle feed.

According to plant pathologist Shuh Ji Sheen at the University of Kentucky, edible proteins can be extracted from young tobacco. The plants' immaturity ensures that they will be virtually free of nicotine, which is poisonous if eaten.

Sheen obtains the proteins by crushing the leaves and extracting a green juice. When centrifuged, filtered and dried, the liquid yields edible but odorless and tasteless white protein powder. A green protein that also results could be used for animal fodder.

Although tobacco's image won't speed its arrival on the dinner table, Sheen says the protein could be used in a variety of foods. It can be whipped into a cream that stays fluffy, even when frozen. When beaten and baked, it resembles meringue. If mixed with oil and flavorings, it mimics mayonnaise.

Tobacco protein could also boost the nutritional value of soft drinks or be used as a milk substitute for people unable to digest the real thing. ■

**THE SMALLEST SHARK**, a rare species found in the Pacific, averages only five inches in length.

## WHITE SHARKS LURED BY SEAL BABY BOOM

An elephant seal pup weighing over 500 pounds splashes in the cold California surf. Suddenly there is a rush of foam and fury: A great white shark the size of a pickup truck slams into the young sea mammal and, trailing a red cloud, carries

it into the milky green depths.

Ashore, the incident is spotted by biologists and added to a growing list. Since 1970, scientists from the Point Reyes Bird Observatory, just north of San Francisco, have noted a dramatic increase in white shark sightings at the Farallon Islands, 20 miles out to sea. Why? For the first time in 100 years, this species, *Carcharodon carcharias*, has an abundance of its favorite food: seals.

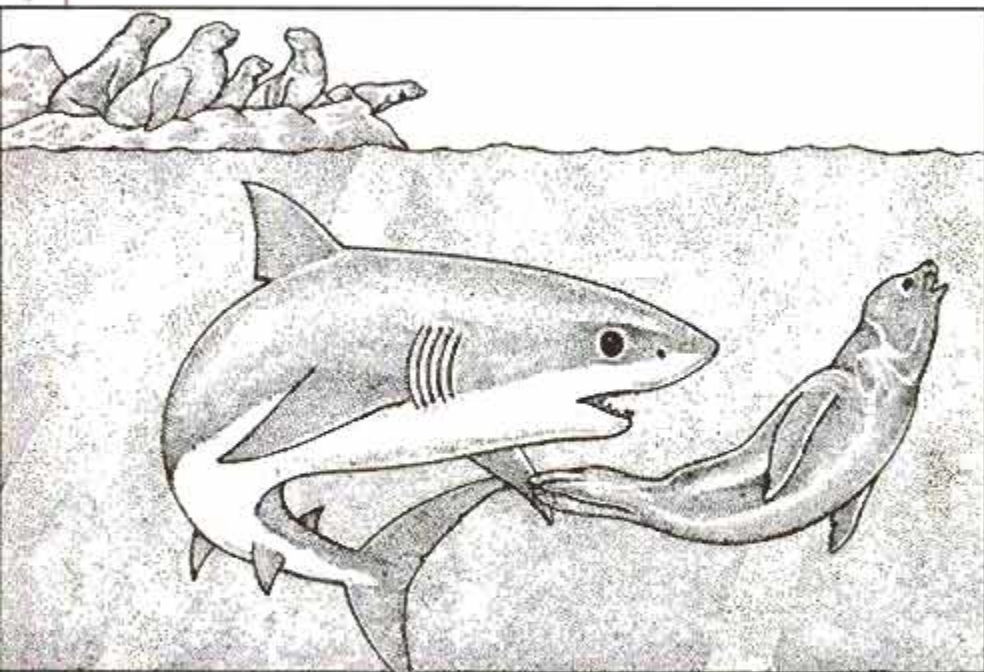
California's seal population is exploding. Thanks to conservation efforts, the

northern elephant seal, for example, has come back from a mere 20 individuals in 1890 to 30,000 today. And the sharks have followed. "In the early seventies, we'd see one or two white sharks a year," says David Ainley, head of research at Point Reyes. "Last year, there were seventeen sightings in the Farallons."

Ainley emphasizes that this poses no immediate danger to humans: "The only people who are at risk are those stupid enough to jump in the water near a seal colony." He claims the white sharks are actually very rare and cites as proof a recent incident and its effect: "Last year, a bunch of yo-yos killed four white sharks." Subsequent sightings plummeted, indicating that although sightings have increased, the number of sharks may not have jumped at all.

But John McCosker, director of San Francisco's Steinhart Aquarium, disagrees. The numbers are increasing, he says, and we've only just seen the beginning. "Nobody knows how long it takes a white shark to mature. They are on the rise now, and soon they'll start pumping out the young." Juveniles eat fish for several years and don't start taking seals until they are 10 or 15 feet long. McCosker speculates that there will be a lag of a few years before the number of adult great whites really starts to climb.

He says it's only natural. As the seal population recovers from centuries of hunting, the sharks will also multiply. "We're looking at a return to normalcy," McCosker concludes. "Once the natural balance has been reached, then we've got good reason to be worried." ■



The great white shark is perhaps the most single-mindedly deadly creature on Earth. Up to 30 feet long and 3 tons, it will attack anything from seals to scuba divers.

## FLOWER'S HUE—BAD AIR CLUE

An ongoing experiment with spiderwort plants has shown that air pollution may be more hazardous to your health than unlawfully high levels of radiation.

It's been known for a long time that this relative of wandering Jew, a common houseplant, mutates in the presence of excessive radiation levels. Now, scientists from Brookhaven National Laboratory are transporting dozens of fresh, healthy spiderwort cuttings with developing flower buds to industrial areas suspected of having high levels of carcinogenic air pollution. The trailer containing the cuttings is parked downwind, and ambient air is drawn into a growth chamber day and night for 10 days, simulating chronic exposure. A second chamber contains cuttings that are exposed to clean, filtered air.

Brookhaven uses a hybrid—"clone 4430"—that normally has blue hair cells on its stamens, or pollen-producing organs. But chromosome mutations, which can be triggered by carcinogens, allow a recessive pink gene to express itself some 7 to 15 days after exposure. Spiderworts can also mutate spontaneously—from wide temperature fluctuations, for example, or even for no apparent reason.

After a trip, the cuttings are returned to Brookhaven. Each morning, as new flowers open, their stamens are removed

and the mutant, pink hair cells counted. But to arrive at the correct number of these cells that were pollution-induced, the researchers must subtract the number of mutations in the clean, control cuttings from those in the experimental cuttings.

Pollution-induced mutations occurred at 12 of the 19 sites visited between 1976 and 1982. Generally the mutation numbers exceeded those caused by 0.5 rems of radiation, which is the legal annual limit, except for such high-radiation workplaces as nuclear power plants. The worst site was Elizabeth, New Jersey, where air pollution was comparable to 5 rems of radiation, the maximum annual dose allowed for employees in high-radiation areas. Charleston, Birmingham, Houston and Baton Rouge ranked next.

If pollution causes mutations in spiderworts, are people who breathe the same air likely to suffer chromosome damage? "By no means are we saying that plants and humans respond to the same stresses," says Lloyd Schairer, director of the project. "This does suggest, though, that there are mutagens in the air."

Schairer hopes the experiment will help pinpoint chemicals that cause mutations. "Just because the air looks smoky doesn't mean it's polluted," he says. "It's more economical for a factory to remove specific chemicals than to clean all of its smoke-stack emissions."

## IN BRIEF

**The best way to get rid of weeds may be to stimulate their growth.**

Of the 50 million-odd seeds per acre—10,000 per square yard—found in some soils, less than 10 percent germinate each year. Those that lie dormant can remain viable for decades, creating a perpetual problem for farmers. Nearly all are resistant to available herbicides.

While sterilizing the soil is one way to deactivate seeds, the procedure is costly and can harm beneficial organisms. Now, U.S. Department of Agriculture scientists believe that stimulating seed germination by chemically interrupting dormancy is the answer.

Any of the stimulants used—ethylene appears so far to be the most effective—will need to be applied several times a year to catch as many seeds as possible on the verge of sprouting. The resulting seedlings can then be tackled with potent weed killers.

**Thirsty hikers can now drink straight from mountain streams** without worrying about contamination—thanks to a special kind of straw.

The Pocket Purifier is a plastic drinking straw equipped with a series of mineral and chemical filters that strain harmful microbes from the water. Chemical pollutants and salt, however, are left untouched.

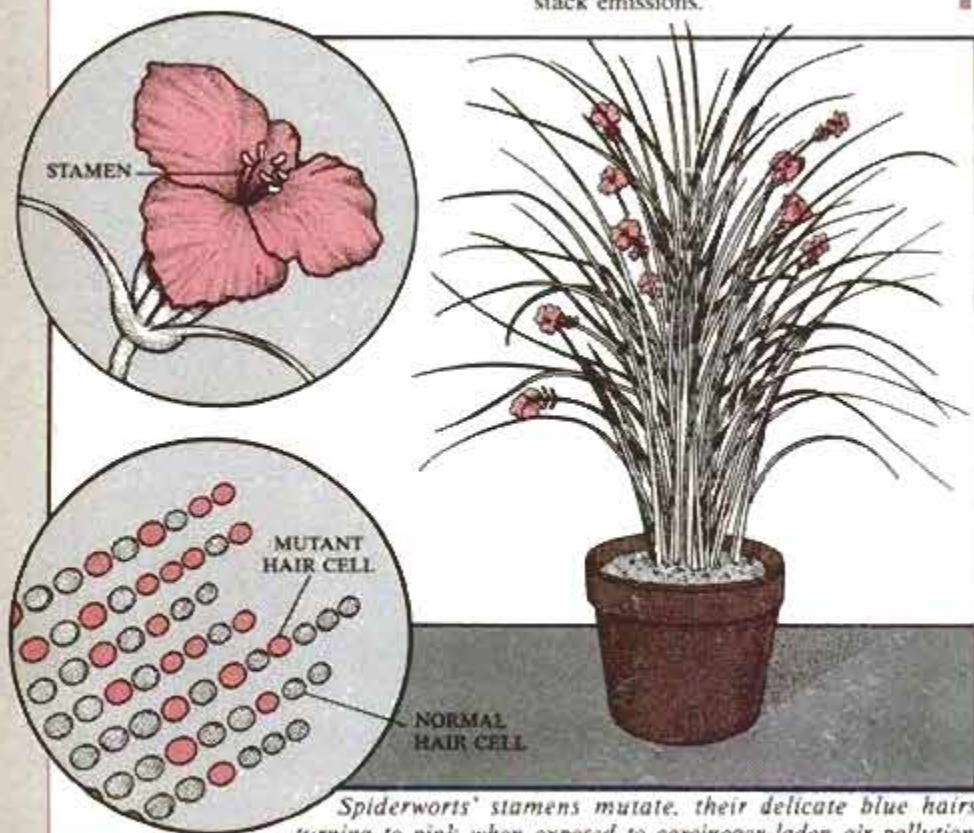
According to the manufacturer, Stuff Enterprises, Inc., of Union City, California, the Pocket Purifier can turn raw sewage, stagnant pond water and water from lakes and streams into entirely germ-free drinking water. The device has been approved by the Environmental Protection Agency.

Each Pocket Purifier is good for about 100 gallons of water, but as a safety measure, its filters become clogged long before that limit is reached.

**There's gold in them thar trees!**

By analyzing burned samples of Douglas fir wood from Idaho's Payette National Forest, U.S. Geological Survey scientists were able to detect promising traces of gold, silver and tin. Samples of beargrass ash yielded high concentrations of molybdenum. The minerals enter the plants' root systems in water that has passed through the deep-lying deposits.

The site has never been mined. Even so, the researchers say there probably won't be another gold rush there, because any lodes that might be hit are likely to be low-grade.



*Spiderworts' stamens mutate, their delicate blue hairs turning to pink when exposed to carcinogen-laden air pollution.*

# FIDDLING AROUND WITH SOUND

**A fiddling biochemist believes he's found the lost secret of the legendary violin-makers of Italy. By keeping minuscule wood pores open, he makes what he thinks are fine instruments. Professional musicians say he's onto something.**



For centuries, violin-makers have tried in vain to reproduce the exquisite tone that gives some violins and cellos built by Stradivari and Guarneri their million-dollar price tag. Now, a Texas A&M biochemist and part-time fiddler thinks he has the answer.

It's all in the wood, according to Joseph Nagyvary. Living trees have microscopic pores that allow nutrients to flow through; these pores close up when wood is dried, and they can be seen under an electron microscope on a modern violin. But on the old masters' instruments the pores are open.

"Closed pores make the violin vibrate too much," says Nagyvary. "This produces unwanted extra sounds that muddy up the tone." Open pores, on the other hand, make the violin less elastic, thus allowing it to make a pure, sweet sound. "It's like a rubber ball," he notes. "If you drill it full of holes, it won't bounce as high."

Evidently, it was careful treatment of wood with secret formulas that gave the Italian luthiers their advantage. Rumor has it that one step in the process was to soak the wood in beer, then bury it in sand. When he tested a chip from a Guarneri cello, Nagyvary didn't find any beer, but he did find a number of foreign substances, including gold. "Guarneri was a great practical chemist," he says, "not just a wood-carver. Many people have made beautiful boxes that sounded terrible."

The reason no one found the open pores before may be that no musician was willing to sacrifice his instrument to the electron microscope. Nagyvary had to search 10 years before finding his sliver, a pedigreed piece of cello, belonging to Paul Katz of the Cleveland Quartet, that was shaved off when the instrument was trimmed in the 1800s. "Now," he says, "I need to find a piece from a Stradivari."

Based on what he learned, Nagyvary developed a water-plus-chemical bath (a secret formula of his own that he is trying to patent), in which he soaks wood for six months. When dry, the wood is shipped to China, the only place where he has found a professional instrument maker willing to use it. The finished instruments come back to Nagyvary, who applies a special varnish—made

from shrimp shells—that he also invented. Now he is looking for endorsements from well-known musicians.

Katz was among the first to try one. "I'm very excited about Nagyvary's cello," he says. "The sound is quite amazing for a new instrument—not yet in the same class as a Stradivari, but with great potential."

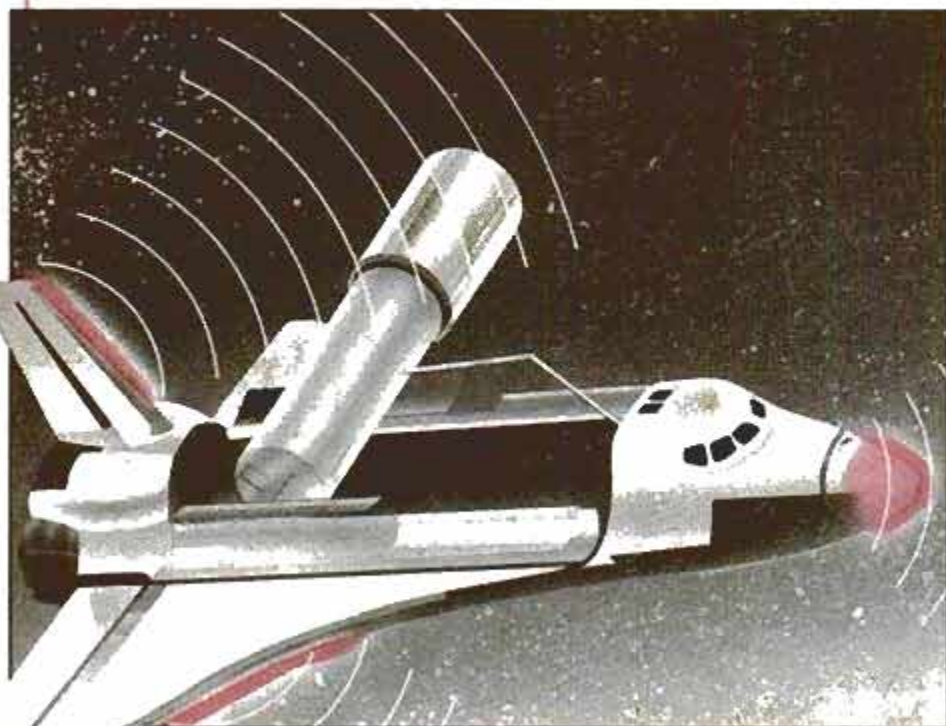
The wood is also being used by some students at the Violin-Making School of America in Salt Lake City. Peter Prier, the director, likes to experiment with new techniques. He is cautious, though. "To say this is what Stradivari used is premature," he says. "There are eighty-nine separate factors that go into a violin's sound. To change just one thing can't make all the difference. We also have to wait fifty or a hundred years to see if the wood holds up."

But for now, those who can't pay a few hundred thousand dollars for a Strad might try a Nagyvary. At a price estimated at "about what you'd pay for a cheap new car," it could be worth the risk.



An electron micrograph reveals closed pores in modern violin wood (top). A new treatment can prevent them from shutting.

## BAFFLING GLOW FROM SHUTTLE



A faint, mysterious glow that emanates from the orbiting space shuttle could place delicate optical experiments in jeopardy. Its cause is being investigated by NASA.

The space shuttle takes off like a rocket and lands like a plane. It also shines like a glow-in-the-dark Frisbee, and this has scientists worried.

The visible-light and infrared glow, though too dim for human eyes to see, is bright enough to interfere with sensitive optical experiments that the shuttle will occasionally carry. Worse yet, glowing has also been seen on orbiting satellites. There is a chance this could cause problems for the Space Telescope, scheduled for a 1986 launch.

"The Space Telescope could be rendered less sensitive than telescopes on Earth," says Stephen Mende, the scientist in charge of investigating the glow. "That would make the mission a total waste."

Two shuttle-borne attempts to identify the cause of the glow have been undertaken since its accidental discovery on a *Columbia* flight in April 1982. Results were less than conclusive. "Basically," says Mende, "we've confirmed that the glow is hard to analyze."

There are several theories to account for the phenomenon, including the idea that the shuttle, passing through the thin (but still present) air over 100 miles up, causes oxygen atoms to combine into molecules, then split again to release energy. Mende, though, favors another explanation: Molecules on the shuttle's surface—water vapor, or perhaps the Scotchgard coating that protects the shut-

tle's thermal tiles—are knocked off by atmospheric friction and glow as they vaporize. "But no one has any real, factual knowledge about any of this yet," says Mende. "We need better information."

That information may come from analysis of data from a glow-detecting experiment sent up on the August shuttle. So far, all that is known is that the glow is brightest on surfaces perpendicular to the direction of motion. A forward-moving shuttle, for example, will glow most on the tip of its nose. The glow also seems stronger at lower altitudes. Unfortunately, even though the Space Telescope will orbit much higher than the shuttles do, its extreme sensitivity to light could still make it vulnerable.

For that reason, the experiment included tests of how optical equipment can be oriented to minimize the effects of the luminosity. And data on various materials, including the paint planned for use on the Space Telescope, are being analyzed for susceptibility to the glow—whatever it turns out to be. ■

**IF WE COULD ONLY harness rainfall! The power of the drops striking a one-acre area in a heavy, inch-an-hour rain equals that of a 100-horsepower engine.**

## CANCER CURE OR WEAPON?

Scientists have a new, efficient way to poison human tissues. Fortunately, their purpose is benign. Bacterial, fungal and plant toxins, some so powerful that an ounce could kill 3 million people, will soon be used in an attempt to treat cancer. The dramatic new therapy has been described by normally cautious researchers as a potential "magic bullet" against malignancies.

The use of poison against cancer is not new. But where conventional chemotherapy relies on poisons that attack cancer and body at the same time, the new technique uses antibodies to carry a few toxin molecules directly to the tumor site.

First, cells are removed from lung, breast, prostate, colon or other cancers. These are introduced into the bloodstream of animals, which react by producing antibodies that recognize and seek out the cancer in question. These antibodies are then chemically coupled to a particular toxin.

When the loaded antibodies are injected into a patient, they rush directly to the tumor, each cell carrying a molecular "hit man."

"The time is very close when the technique will be clinically tested in humans," says a researcher at a California genetic-engineering firm involved in the cloning of such toxins. The fact that antibodies largely bypass healthy tissues in animals suggests that the same thing will happen with humans.

One aspect of this anticancer research has some scientists worried, though: The same genetic-engineering methods that produce large amounts of toxins for medical purposes can produce them for military purposes. James Larrick, a genetics researcher, wrote to the British journal *Nature* warning of such use.

In fact, the Department of Defense (DOD) does fund research into genetic engineering. But according to Captain Sherry Stetson-Mannix, a DOD spokeswoman, the research involves only defense. "We have to be able to recognize and counteract the effects of biological toxins if they're ever used as weapons against us," she says. She says that, because the Biological Weapons Convention of 1972 prohibits the production and stockpiling of such toxins, "We don't do it."

The industry source doesn't think toxins would make good weapons anyway. "Sure, toxins are toxic," he notes, "but how do you deliver them? You can put poison on a bullet, but why bother? A bullet's pretty deadly already." ■

## EXPLODING SKIN KEEPS TANKS SAFE

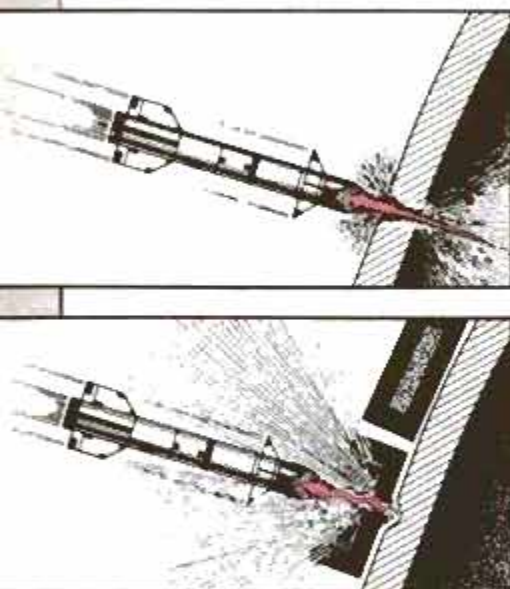
When Israeli tanks rolled into Lebanon last year, they carried containers of high explosive bolted to their turrets and hulls. It wasn't a suicide mission, however. The volatile armor was intended for self-defense.

Called "active armor," the new system takes advantage of the special shaped charges used in antitank missiles. These projectiles have hollow tips constructed so that gases exploding from within focus like a cutting torch to burn through the tank's thick metal skin.

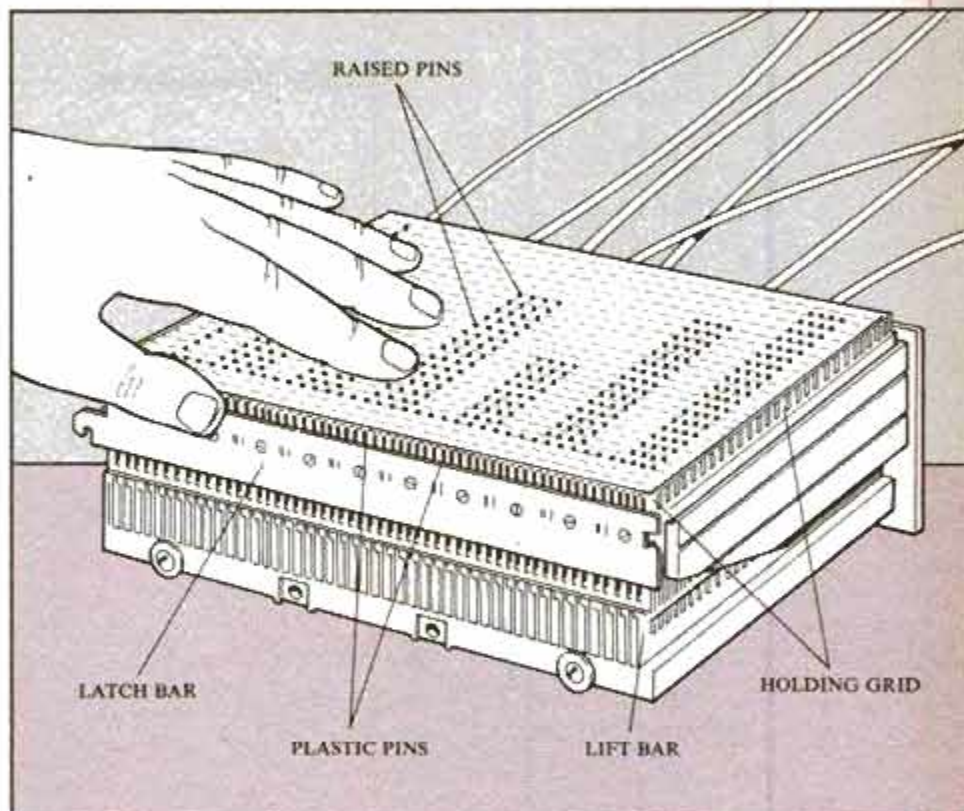
That doesn't happen with active armor. The explosive is so sensitive that it goes off in a billionth of a second when the tank is hit, preventing the missile's gases from focusing at all. The explosion is directed outward, and the tank remains unharmed.

Active armor can also defend against missiles shot from other tanks. These are usually streamlined shells of very dense metal that travel more than 3,600 miles per hour. At such high speeds, the shells get extremely hot. So when they hit the target tank, the additional energy created by the exploding armor vaporizes the hot metal instantly.

Apparently the system works: Israel lost 60 tanks to Syria's 600. But active armor is still crude in design. The next step is to incorporate it directly into the tank's skin.



A jet of burning gas erupts from the tip of an armor-piercing shell, boring into a tank's metal skin (above). "Active armor" (below) instantly deflects the explosion.



A new, computer-driven grid of plastic pins, manipulated by interlocking latch and lift bars, gives blind people ready—and cheap—access to printed and graphic material.

## BLIND "SEE" TACTILE SCREEN

Braille books are expensive and bulky, so many forms of printed matter for the blind are in limited supply. Graphic materials in particular are often unavailable. But soon, a new computer terminal will enable the blind to have inexpensive, ready access to both.

Existing computer terminals for the blind either produce voice sounds or display a single line of braille, the code of raised dots used by the blind for reading; none are capable of graphics. The new terminal, developed at the American Foundation for the Blind, can handle graphs and maps, as well as conventional letters and braille. Using a grid of up to 16,000 plastic "pins," it will be able to display as much as a page of braille on its foot-square "screen."

To form a desired symbol or pattern, the appropriate pins are raised slightly above their holding grid by hundreds of actuators. Computer controlled, these devices drive horizontal rows of latch bars and vertical rows of lift bars to address each pin in the matrix. When a single latch bar is pulled back, all the pins in that row can be raised or lowered by the lift bars. The latch bar is then pushed in, locking the raised pins in position, and the system moves on to the next row. To read the display, the user need only run

his fingertips along the pins.

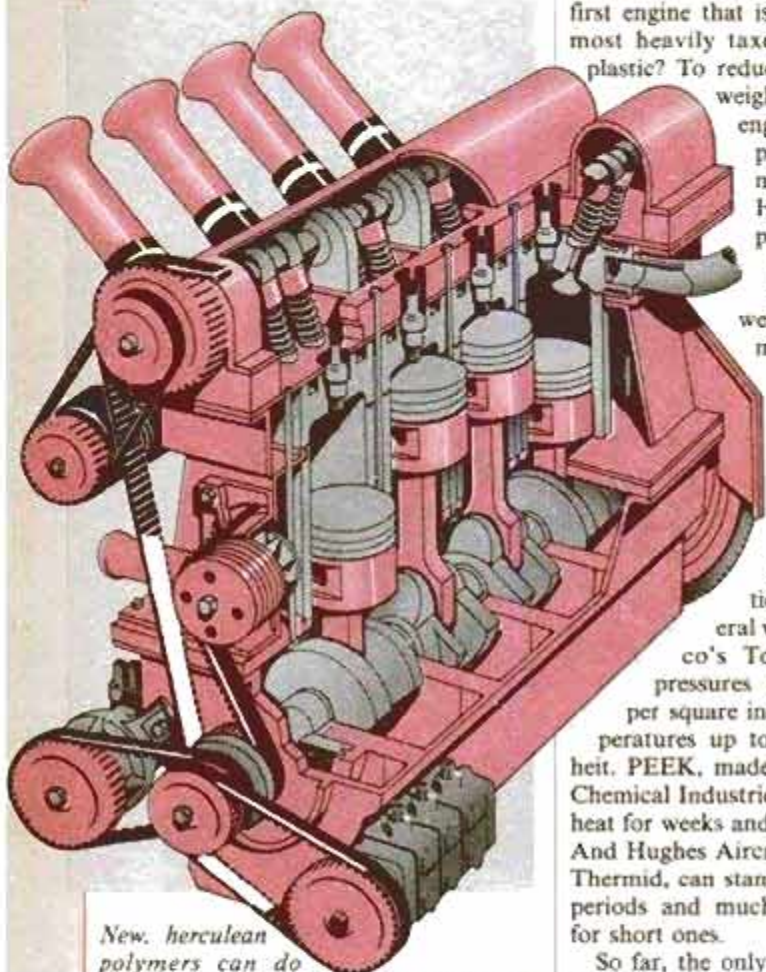
According to inventor Douglas Maure, the display has many applications for the blind. Researchers and students, for example, will be able to perceive graphs and charts. Airline listings and maps can be made far more accessible to travelers. The terminals are readily tied in to most home computers, so any book, magazine or encyclopedia can be stored cheaply on cassettes or floppy disks. Says Maure, "The braille book, instead of costing sixty dollars, will cost one." And be pounds lighter as well.

The price? Systems with a single-line readout can run as high as \$12,000. The new terminal is expected to cost only a fraction of that.

Once the system is perfected, Maure expects that users will be able to "turn the page" in two to four seconds. While that may not be fast enough for a game of Pac-Man, it's far quicker than the reading capacity of most blind people.

**BENEATH THE SURFACE** of the searing Sahara, things are remarkably wet: 150,000 cubic miles of water lie under the desert sands.

## PLASTIC ENGINE TO POWER RACER



*New, herculean polymers can do the jobs metals do. This engine, being built for a racing car, is mostly plastic (red). As much as 200 pounds lighter than an all-metal engine, it's also more fuel-efficient.*

"Plastic" used to mean flimsy, brittle or cheap. But times are changing. Today, plastics that sell for 100 times the price of machine steel are replacing metal in car engines.

Engineers at Polimotor Research, Inc., of Fairlawn, New Jersey, are building the first engine that is plastic in all but the most heavily taxed components. Why plastic? To reduce weight. "The more weight you take out of the engine, the less strain you put on other components," says Matty Holtzberg, the firm's president. This, in turn, means that other parts can be made lighter as well, reducing strain even more. The plastic engine, which will appear in a European racing car next year, is about 50 percent lighter than an all-metal model.

Holtzberg won't say which superplastics he's using, but several would fit the bill. Amoco's Torlon can withstand pressures up to 30,000 pounds per square inch and long-term temperatures up to 500 degrees Fahrenheit. PEEK, made by Britain's Imperial Chemical Industries, can bear 600-degree heat for weeks and 430 degrees for years. And Hughes Aircraft claims its product, Thermid, can stand 600 degrees for long periods and much higher temperatures for short ones.

So far, the only barrier to widespread use of these materials is their cost. PEEK, for example, commands \$28 a pound. At a time when structural steel can be had for 25 cents a pound, superplastics can be

economically justified only for special purposes, even though an equal weight of plastic goes further. Why are they so costly? "They aren't made in the quantities that would allow them to be less expensive," Holtzberg says. "They could be cheaper, but the volume isn't there."

Even if the price of building a plastic engine comes down, Holtzberg thinks it will be some time before the public will see a family car that has one. Moreover, the internal combustion engine will probably always contain some metal. Polimotor's model has a metal crankshaft and camshaft as well as combustion chamber. "Some of the areas where the heat is extreme just don't warrant a plastic part," Holtzberg says.

For now, automobile manufacturers are trying out less exotic plastics in car bodies. General Motors' new Fiero is built by bolting plastic panels onto a metal chassis. The body of Honda's Ballade Sports CR-X is 40 percent polymer alloy. The plastic bodies not only increase fuel efficiency; they are less prone to dents and corrosion than metal ones.

**SKYDIVERS jumping headfirst can plummet 185 miles per hour—only 2 miles per hour slower than some meteors strike the Earth.**

—Submitted by Ernie Gallatin  
Anaheim, CA

**THE PULL of gravity is greatest at the Earth's surface. The closer to the middle of the planet you go, the lighter you become. If you could somehow reach the very center, you would be weightless.**

## DIOXIN DINNER FOR MAN-MADE MICROBES?

Bacteria found in lake sediment and sewage sludge may one day be used to render dioxin, PCBs and other deadly pollutants harmless.

A class of chemicals called halogenated aromatics includes these and many other toxic agents that have poisoned dozens of waste-disposal sites around the country. These compounds are important in the production of various industrial chemicals and are formed during such processes as the bleaching of wood pulp. But they enter the environment in large quantities,

resist degradation and accumulate in sediments and living tissues.

Michigan State University researchers have found that anaerobic bacteria—which grow only in the absence of oxygen—break down certain halogenated aromatics by removing chlorine, bromine or iodine from their molecular structure. "It makes the compounds less toxic and more susceptible to additional degradation by the same organism or others," says James Tiedje, a professor of microbiology. Enzymes produced by the bacteria do the work, he says, but the precise biochemical reaction is still unknown.

Waste-treatment plants depend on naturally occurring anaerobes to break down sewage, but until now, bacterial action against toxic chemicals has not been widely studied. "Anaerobes are difficult

to work with," explains Tiedje, "because they're oxygen-sensitive and don't grow very fast."

Tiedje hopes to determine whether anaerobic bacteria are effective against dioxin and PCBs. His team will also have to develop efficient ways to use the bacteria. Chemical plants, for example, might have reactor tanks in which the bacteria detoxify a waste stream of hazardous chemicals. And at waste dumps, they might be added to contaminated sediment or mud.

If the scientists are able to pinpoint the genes responsible for the bacteria's action, Tiedje says, they might use genetic engineering to make new, high-performance organisms that are also easier to work with. But that, he concedes, is still years away.

# Lazy Millionaire Wants To Share The Wealth

You think times are tough and you've got problems?

Well, I remember when a bank turned me down for a \$200 loan. Now I lend money to the bank — Certificates of Deposit at \$100,000 a crack.

I remember the day a car dealer got a little nervous because I was a couple of months behind in my payments — and repossessed my car. Now I own a Rolls Royce. I paid for it in full — with cash.

I remember the day my wife phoned me, crying, because the landlord had shown up at the house, demanding his rent — and we didn't have the money to pay it.

Now we own five homes. Two are on the oceanfront in California (I use one as my office). One is a lakefront "cabin" in Washington (that's where we spend the whole summer — loafing, fishing, swimming, and sailing). One is a condominium on a sunny beach in Mexico. And one is snuggled right on the best beach of the best island in Hawaii — Maui.

Right now I could sell all this property, pay off the mortgages, and — without touching any of my other investments — walk away with over \$750,000 in cash. But I don't want to sell, because I don't think of my homes as "investments." I've got other real estate — and stocks, bonds, and cash in the bank — for that.

I remember when I lost my job. Because I was head over heels in debt, my lawyer told me the only thing I could do was declare bankruptcy. He was wrong. I paid off every dime.

Now, I have a million dollar line of credit; but I still don't have a job. Instead, I get up every weekday morning and decide whether I want to go to work or not. Sometimes I do — for 5 or 6 hours. But about half the time, I decide to read, go for a walk, sail my boat, swim, or ride my bike.

I know what it's like to be broke. And I know what it's like to have everything you want. And I know that you — like me — can decide which one it's going to be. It's really as easy as that. That's why I call it "The Lazy Man's Way to Riches."

So I'm going to ask you to send me something I don't need: money. Ten dollars to be exact. Why? Because I want you to pay attention. And I figure that if you've got \$10 invested, you'll look over what I send you and decide whether to send it back... or keep it. And I don't want you to keep it unless you agree that it's worth at least a hundred times what you invested.

Is the material "worth" \$10? No — if you think of it as paper and ink. But that's not what I'm selling.

## PROOF!

Don't take my word for it. These are excerpts from articles in newspapers and magazines:

### Time:

He only works half the year in his stunning office on California's Sunset Beach, and even when he's there he puts in short hours... In other words, Joe Karbo... is the prototype for... "The Lazy Man's Way to Riches."

### Money:

Joe does more than dwell on personal problems; he solves them.

Which is a nice change: Karbo almost went bankrupt back in '62.

### Boston Herald-American:

The book has drawn hundreds of letters from persons who have profited by it.

### Los Angeles Herald-Examiner:

"Going broke was the best thing that ever happened to me," explains Joe Karbo who went from one business trouble to a million-dollar business fortune.

### Forbes:

After bouncing around show biz, advertising, and real estate, he made his fortune... \$250,000.

### Money Making Opportunities:

Maybe Joe Karbo has the secret. Don't you think you owe it to yourself to find out what it is all about?... I just finished it — and I'm off on a vacation myself. Get the idea?

### Long Beach Independent:

He's programmed the path to riches for the lazy man.

### The Kansas City Star:

He prints statements like "Most people are too busy earning a living to make any money." He should have added that too many people these days are too busy earning a living to do any living.

What I am selling is information. More information than I give when I'm paid \$1000 as a guest speaker. More information than I give in a one-hour consultation for \$300.

But you're really not risking anything. Because first, I don't want you to send me any money — at least none that I can use. Instead, as a token of your sincerity, send in your check or money order and *postdate* it for six weeks from today. You see, it's not really money because it's not negotiable — besides, I won't even touch it for six weeks anyway.

In this way you'll have plenty of time to receive my material, look it over, try it out and *prove* to yourself that everything I am telling you is true.

I know what you're thinking: "He got rich telling people how to get rich." The truth is — and this is very important — the year before I shared "The Lazy Man's Way to Riches," my net income was \$216,646. And what I'll send you tells just how I made that kind of money... working "part time"... a few hours a day... about 8 months out of the year.

It doesn't require "education." I'm a high school graduate.

It doesn't require "capital." Remember I was up to my neck in debt when I started.

It doesn't require "luck." I've had more than my share. But I'm not promising you that you'll make as much money as I have. And you may do better. I personally know one man who used these principles, worked hard, and made 11 million dollars in 8 years. But money isn't everything.

It doesn't require "talent." Just enough brains to know what to look for. And I'll tell you that.

It doesn't require "youth." One woman I worked with is over 70. She's travelled the world over, making all the money she needs, doing only what I taught her.

It doesn't require "experience." A widow in Chicago has been averaging \$25,000 a year for the past 5 years, using my methods.

What does it require? Belief. Enough to take a chance. Enough to absorb what I'll send you. Enough to put the principles into *action*. If you do just that — nothing more, nothing less — the results will be hard to believe. Remember — I guarantee it.

You don't have to give up your job. But you may soon be making so much money that you'll be able to. Once again — I guarantee it.

I know you're skeptical. Well, here are some comments from other people. (Initials have been used to protect the writer's privacy. The originals are in my files.) I'm sure that, like you, these people didn't believe me either when they clipped the coupon. Guess they figured that, since I wasn't going to deposit their checks for six weeks, they had nothing to lose.

They were right.

And here's what they gained:

### 'Made \$50,000 just fooling around'

"In February you sent me (for ten bucks) your Lazy Man's Way to Riches. Since then I have made approximately 50 grand (\$50,000) just fooling around on the basis of your advice. You see, I really am lazy — otherwise I could have made 50 million! Thank you!"  
R. McK., Atlanta, GA

### '\$24,000 in 45 days'

"...received \$24,000.00 in the mail the last 45 days.  
"Thanks again."  
E.G.N., Matewan, WV

### From \$50 to \$565 per week

"...when I sent for your (Lazy Man's Way to Riches), I was delivering the L.A. Times for \$50 per week... Now... I earn an average of \$565 per week, have \$7,000 in the bank and a condominium that's worth \$85,000..."  
J.N., Culver City, CA

### 'There's no stopping me'

"Since I've got your (Lazy Man's Way to Riches) in July, I've started 4 companies... there's no stopping me and I'm so high I need chains to keep me on the ground."  
M.T., Portland, OR

### \$260,000 in eleven months

"Two years ago, I mailed you ten dollars in sheer desperation for a better life... One year ago, just out

of the blue sky, a man called and offered me a partnership... I grossed over \$260,000 cash business in eleven months. You are a God sent miracle to me."

B.F., Pascagoula, MS

### \$7,000 in five days

"Last Monday I used what I learned on page 83 to make \$7,000. It took me all week to do it, but that's not bad for five days' work."  
M.D., Topeka, KS

What I'm saying is probably contrary to what you've heard from your friends, your family, your teachers, and maybe everyone else you know.

I can only ask you one question.

How many of them are millionaires?

So it's up to you.

Six weeks from today, you can be nothing more than a little older — or you can be on your way to getting rich. You decide.

The wisest man I ever knew told me something I never forgot: "Most people are too busy earning a living to make any money."

Don't take as long as I did to find out he was right.

I'll prove it to you, if you'll send in the coupon now. I'm not asking you to "believe" me. Just try it. If I'm wrong, all you've lost is a couple of minutes and a postage stamp. But what if I'm right?

Some have called it a Miracle. Some have called it Magic. You'll call it "The Secret of the Ages."

As for me, I thank God that before he died Millionaire Joe Karbo left, for all to share, the secret of "The Lazy Man's Way to Riches." The above story, which is in his own words, is his gift to you.

Because of the nature of this special offering, we can guarantee delivery *only* to the readers of this publication who respond within the next 10 days.

After that date, orders will be filled on a "first come, first served" basis as long as supplies last.

To order, write your name and address on the coupon and send it with your \$10 today.

Remember, the *only* way to guarantee prompt delivery is to respond *today*.

If you have any questions, you may call us at (714) 898-4357 during normal business hours. Make your check or money order payable to Financial Publishers.

© Joe Karbo - 1979, 17105 South Pacific, Sunset Beach, CA 90742

### Sworn Statement:

"On the basis of my professional relationship as his accountant, I certify that Mr. Karbo's net worth is more than one million dollars."

Stuart A. Cogan

### Bank Reference:

Bank of Westminster  
8251 Westminster Avenue  
Westminster, CA 92683

### Financial Publishers

17105 South Pacific, Dept. 551-A  
Sunset Beach, California 90742

You may be full of beans, but what have I got to lose? Send me The Lazy Man's Way To Riches. Enclosed is my check or money order *postdated* six weeks from today!

If I return your material — for any reason — within that time, return my uncashed check or money order to me. On that basis, here's my ten dollars.

Name \_\_\_\_\_

(Please Print Clearly)

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

SORRY — NO COD'S

(All foreign orders please add two dollars)

# Don't Be Caught Out in the Cold this Winter



Treat yourself to a new pair of Weinbrenner insulated boots, and increase your enjoyment of the outside world this fall and winter. Our tradition of Northwoods Craftsmanship in outdoor footwear does more than just keep your feet warm. It also provides total comfort, durability and dependability... from top to bottom, inside and out.

When you're looking for quality and value in boots and shoes, look for the name Weinbrenner... The Craftsmen of the Northwoods.

## FREE...

A thick, warm pair of custom made thermal outdoor socks with the purchase of a new pair of Weinbrenner boots or shoes during the months of October and November 1983 at these participating dealers. Hurry, supply is limited

### See these Weinbrenner Dealers:

#### CONNECTICUT

Berlin Micky Fun Store  
Bridgport Jimmy's Army & Navy  
Bristol Irving's Army Navy  
Danbury New England Uniform Co.  
East Hartford Industrial Uniform  
Fairfield Fairfield Trading Post  
Hartford Sam's Army & Navy Store  
Kensington Mason Sales  
Madison Running Start  
Milford New England Safety Shoe  
New Britain Vogue Shoes  
Norwalk B & G Sales Co.  
Norwalk Ed's Army & Navy Inc.  
Norwich Gordon Shoe Outlet  
Stamford B & G Sales Co.  
 Torrington Railroad Square Salvage  
 Torrington Soucy - Choquette Inc.  
 Watertown Rays Army & Navy  
 West Hartford W.G. Simmont Co.  
 Wilton Wilton Bootery Inc.

#### DELAWARE

Dewey Abbotts Shoes

#### FLORIDA

Apopka The Shoe Tree  
Clearwater Carters Army Navy Surplus  
Dade City Hardy's Department Store  
Fort Lauderdale Outdoor Life  
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 Holly Hill Rocky's Holly Hill Shoes  
 Homestead Orlando's Shoe Shop  
 Jacksonville Green Acres Sporting Goods  
 Lake City Capital's Shoe Store  
 Labeland B.C. Cabral Inc.  
 Miami Roberts Western Wear  
 Miami Topick Tapes Inc.  
 Mizelle Army Navy Surplus Store  
 Ocala Pasture Sporting Goods  
 Ocala Sport City Inc.  
 Okeechobee The Fair Store  
 Orange Park Western World Inc.  
 Orlando Denmark Sporting Goods  
 Orlando Southeastern Archery  
 Ormond Beach Max's Gun Shop Inc.  
 Pompano Beach Billy Bots Inc.  
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Albany Jackson & Sons Inc.  
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 Alhambra Fussell's Western Wear  
 Alma Adams Beach  
 Americus Planter's Hardware  
 Augusta King's Inc.  
 Augusta Widener Arms  
 Bailey Fowlerton's  
 Cedartown Double Discount Stores  
 Chatsworth American Pawn & Sporting  
 Goods Inc.  
 Clayton The Squire Shop  
 Clayton Reeves Hardware  
 Cordele Rooters Inc.  
 Dalton Dalton Bootery  
 Eastman Eastman Shoe Shop  
 Fitzgerald Fitzgerald Shoe Hospital  
 Glennville Lutz's Dept. Store  
 Hazledust Donajue Western Wear  
 Jesso Mr. Brian's Parts  
 Pearson Roberts Milling Co.  
 Sardis Charles Hardware  
 Savannah Chapman's Sporting Goods  
 Savannah Fish Hunter Ltd. Inc.  
 Smart Smart General Merchandise  
 Statesboro Newton Sporting Goods  
 Tycamore One Stop Denham  
 Thomasville Knapp Hardware Co.  
 Thomasville The Shoe & Harness Shop  
 Vidalia Army Navy Store  
 Warner Robins Marie's Shoe Shop  
 Waynesboro Waynesboro Sporting Goods

#### MAINE

Brewer Epstein's Inc.  
 Camden Hapox & Cappel  
 Dexter Ray's Footwear & Clo.  
 Milinocket Epstein's Inc.  
 Presque Isle Epstein's Inc.  
 Skowhegan Griffin's Cash N. Carry  
 Wilton Heart of Maine Casuals  
 Winthrop Wilson's Dollar Store

#### MASSACHUSETTS

Brockton Marion's Shoes Inc.  
 Chicopee Bakers Inc.  
 Chicopee Paris Shoes  
 Chicopee Terry's Uniform  
 Framingham West Clothing Center  
 Framingham Raphael Army & Navy  
 Hattishe Marion's Shoes Inc.  
 Holyoke Oscar Ball & Son Shoe St.  
 Middleboro Stries Shoe Store  
 New Bedford Lincoln Shoe  
 New Bedford Rowant Shoe Store  
 New Bedford Terry's Sport Shop  
 Palmer Nick's Sport Shop  
 Weymouth L. B. Evans Retail Store  
 Ludlow L. B. Evans Retail Store  
 Marlborough Marion's Shoes Inc.

#### NEW HAMPSHIRE

Dover Lothrop - Farnham Co.  
 Keene Irving's Clothing Store  
 Nashua Morry's Men's Wear

#### NEW JERSEY

Bloomfield Carb Uniforms  
 Clinton Charles's Bootery  
 Cresskill Giovanni's Shoes  
 Lakehurst Red the Tailor  
 Newark Katz's  
 Paterson All Cross Uniform Co.  
 Somerset John's Inc.  
 Summitville The Bootery  
 Somerville Somerville Enterprises Inc.  
 Wallerville Blazer's Inc.  
 Woodbury Pasky's Army-Navy

#### NEW YORK

Binghamton Dick's Clothing & Sporting Inc.  
 Certe Place Economy Uniform  
 East Williamson East Williamson Merc. Co.  
 Endicott Alexander - Harvey Clothing  
 Grafton Main Street Discount Store  
 Hockley Goldman Brothers  
 Pt. Jefferson Sneaker Shack Inc.  
 Port Washington Bay Bootery  
 Preble Hank's Gun Shop  
 Westbury Early Uniform Co.  
 Westcott Wolcott Bargain Center

#### NORTH CAROLINA

Asheville Smetette Uniform Sales  
 Charlotte The Hub Uniform Co. Inc.  
 Garner Williams Farm Supply  
 Greensboro Showlety's Inc.  
 Greensboro Stevens Uniform Sales  
 Newland Sherman's Ladies & Men's Store  
 Raleigh Hub Uniform Co.  
 Raleigh Smith Shoe Service  
 Raleigh Smetette Uniform Sales  
 Robbinsville Smetette's Dept. Store  
 Robersonville Griffin Shoes  
 Silver City Farmers Alliance Store Inc.  
 Vase Half-Way Supply Inc.  
 Wilmington Country Clobber Inc.

#### RHODE ISLAND

Newport George G. Proulx Co.  
 Wakefield Base Camp Inc.  
 Wakefield Wakefield Arms & Sports Center  
 Woonsocket Social Department Store

#### SOUTH CAROLINA

Easley Robert's Bargain Store  
 Greenville Shoes Unlimited Inc.  
 Walterboro The Western Shop  
 Wm. Gill's Store

#### TENNESSEE

Jasper Valley Shoe Store  
 Kingston Shorty's Shoe Barn  
 La Follete Myers Discount Mart  
 Memphis Sportsman's Supermarket Inc.  
 Mount Juliet The Boot Barn Inc.  
 Mount Airy City Shoe Store  
 Winchester Judge's Gun Shop Inc.

#### VERMONT

Brattleboro Sams Dept. Store Inc.  
 Colchester Cig Factory Shoe Store  
 Essex Junction Knight's Sport Center  
 Essex Junction Timberline Sports  
 Milton Milton General Store  
 New Haven Junction Sports Inc.  
 Springfield Patsy's Economy Store  
 Springfield Wild Goose Trading Post

#### VIRGINIA

Dryer Crozet Shoe Service  
 Norfolk Smetette Uniform Sales  
 Richmond Hub Uniform Co.  
 Virginia Beach Mervis Uniform

#### WEST VIRGINIA

Hinton Don's Sport Shop  
 Wheeling Bonhardt Co. Inc.

MADE IN U.S.A. SINCE 1892

# WEINBRENNER

MERRILL, WISCONSIN 54452



## PLUMBING PROBLEMS

(Continued from page 56)

a crawlspace or basement house, look for cleanouts under the first floor, either inside or outside the foundation wall. Long sewer lines also have cleanouts at or below ground level.

To clean far-reaching blockages in sewers and main house drains, you'll need a larger, more powerful tool than a drain auger. You'll have to rent an electric drain-cleaning machine. Flexible steel cables come in separate 50-ft. lengths that couple together to form longer runs. Be certain to get enough cable to reach from the roof vent stack or cleanout location to the street sewer or septic tank.

Drain-cleaning machines, like drain augers, can use a variety of cutting tools. Start with a straight auger tool attached to the cable end. The straight auger bites into the clog and retrieves a small sample for identification. Now you can select the appropriate tool (see the drawing on page 56) for removing that type of clog.

**Caution:** Care must be taken when using sharp tools in plastic pipes. Working the tool in one spot for too long could cut through the pipe. Keep the cutting tool moving as it rotates. If the tool won't turn a sharp bend, switch to a smaller, more flexible bulb tool.

### Running toilet tank

When you flush a toilet, the handle lifts a rubber flush ball so that water can enter the bowl. As water leaves the tank, a hollow float drops with the water level, which in turn opens an inlet valve connected to the water supply line. The flush ball then falls back into position and seals the tank. At the same time, water enters the tank and the float ascends until it closes the float valve and stops the flow of water.

If either the flush valve or float valve fails to seat properly, water will run continuously into the bowl and through the drainage system. Running water can be stopped by adjusting or replacing the valves and their parts.

The ball that closes the flush valve is made of rubber and can corrode or become misaligned to create a constant trickle. If there's any sign of corrosion, replace the flush ball. Adjust a misaligned ball by straightening the lift wires. If a chain is used, try shortening or lengthening it.

When the tank fills and water continues to flow, check the float and float valve for faulty operation. Lift the float by hand. If the trickle of water ceases, bend the float arm downward slightly. This applies more pressure on the valve as the water raises the float. If this fails, unscrew the inlet valve assembly and pull the valve out of its seat. Check the

valve seat for any debris or corrosion. Finally, clean all surfaces and replace all corroded parts.

### Repairing leaks in pipes

Most leaks occur at the joints, where sections of pipe are joined with fittings. But, leaks can also appear along the pipe itself. Here are fixes for both.

A leaking threaded metal pipe joint is often fixed by simply tightening the threads using a pipe wrench. If the joint still leaks, unscrew the pipe from the fitting, apply pipe dope or teflon tape to the male threads and rejoin the pipe to the fitting. To repair a leaking sweat-soldered copper pipe joint, it's best to disassemble the fitting and resolder the joint. Be certain to clean the mating sur-

faces with fine sandpaper or emery cloth before resoldering.

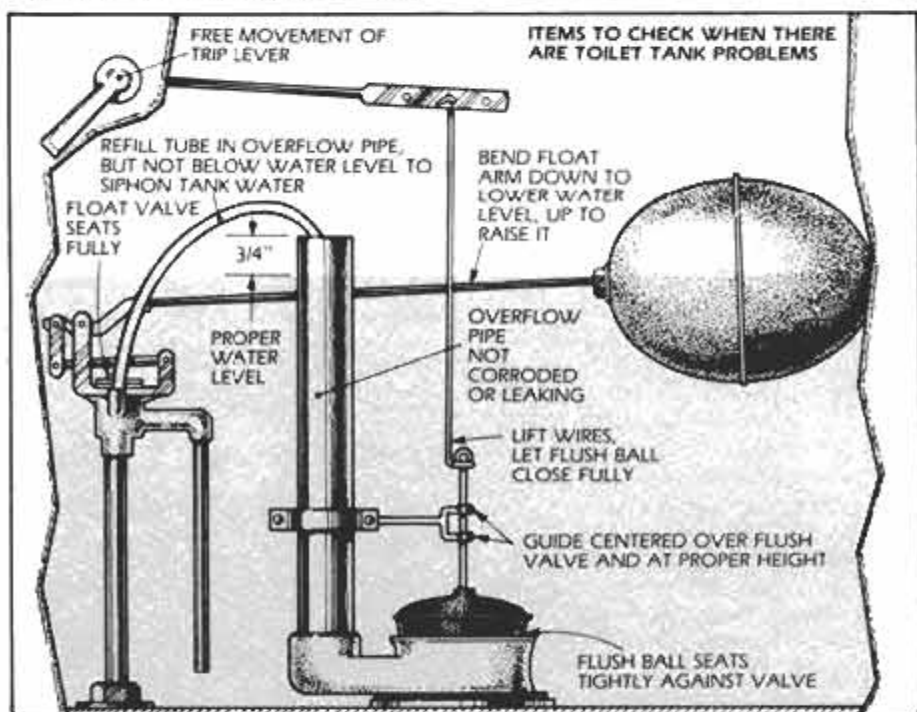
To stop a leaking solvent-welded plastic pipe joint, first cut out the defected fitting using a hacksaw. Then, use two couplings to solvent-weld a new fitting into the system.

The method for fixing a leak in the middle of a pipe is the same for all types of pipes. First, cut out the damaged section and then replace it. After cutting out a leaking section of metal threaded pipe, unscrew and discard the remaining pipe sections. Then, thread in two new pipe sections. Now join the two sections with a union fitting.

To repair copper or plastic pipe, join a single pipe length into the system

(Please turn to page 60)

## TOILET TROUBLES



Here's an easy test to determine if a toilet tank is leaking into the bowl. Add a few drops of food coloring to tank as it refills after a flush. Several minutes later, check bowl water for discoloration. See drawing above for possible sources of trouble.



Toilet tank replacement parts are available for quick repairs. A fill valve (left) and flush valve flapper (right) are more reliable than original hardware. Fill valve should be an antisiphon type to prevent cross-connection between toilet and house water.

## PLUMBING PROBLEMS

(Continued from page 59)

using couplings at each end. Then solder or solvent-weld the couplings to the existing pipes. Note that with this procedure there must be enough space to push the pipes aside slightly to slip in the new pipe and couplings.

### Thawing frozen pipes

Preventing freeze-ups is far easier than trying to thaw the pipes afterward. But, if freezing does occur, there are methods for defrosting the ice without damaging the pipes. **Caution:** Frozen pipes split open easily, so work on them carefully. Never use an open flame to defrost pipes; the intense heat could cause a steam explosion.

The quickest way to thaw frozen pipes is to wrap them with hot water-soaked rags. Then, as the rags cool, pour on more hot water.

An electric heat lamp or hair blow dryer can also thaw frozen plumbing. But don't allow the heat source to remain in one place for too long. **Caution:** When using electric heating devices, keep the power cord off of the wet floor. Work while standing on dry wood boards; never stand on a wet surface while using electric tools.

Regardless of the defrosting method used, always start from the faucet and work back toward the house water service to prevent any pressure buildup. Be certain to open all faucets in the line to drain melting ice.

The best way to prevent frozen pipes is to wrap them with electric heating tape. Once plugged in, the tape maintains a temperature just above freezing. Some heating tapes come with a thermostat that operates the tape automatically when the temperature drops near freezing. The thermostat is not only convenient, but also saves energy. For additional protection, cover the tape with fiberglass or pipe insulation to help retain the tape's heat. Don't cover the thermostat with insulation. But insulation alone isn't enough protection to keep pipes from freezing.

If a house is unheated for long periods during below-freezing weather, the plumbing system must be drained to prevent freezing. First, turn off the water at the house main shutoff valve. Then flush the toilets and open all faucets to drain the water supply system. Now drain the hot-water heater and shut off its fuel supply. The small amount of water remaining in the fixture traps are protected from freezing with automotive antifreeze. Pour one cup of antifreeze into sink traps and a half-gallon into toilet traps. Finally, shut off and drain the house service entrance to prevent the water meter and nearby pipes from freezing. **PM**

## REPAIRING LEAKING PIPES



This quick, temporary repair for leaky pipes will last until a permanent fix can be made. First, turn off water and open a faucet to release pressure. Clean around leak by scraping with a knife or screwdriver. Then apply epoxy glue liberally to leak.



A compression clamp consists of two curved metal plates hinged on one side and lined with a neoprene pad. Place clamp around the damaged pipe and tighten clamping bolts located opposite hinge. Clamp works best on small holes and short splits.



This homemade clamp stops small leaks using a thick rubber pad and a hose clamp. Wrap the rubber (a piece of inner tube or split rubber hose) around damaged pipe and tighten clamp directly over leak.



Cut out a leaky pipe section and replace it with plastic pipe. Use CPVC tube designed for hot and cold water. Install transition unions to cutoff pipe ends. Then solvent-weld new plastic pipe between them. Genogrip adapter shown simply hand tightens to copper tubing without soldering.

## THAWING FROZEN PIPES



The quickest way to thaw frozen pipes is with hot water-soaked cloths. Start defrosting at faucet end of pipe run. Pour hot water onto pipe as cloths cool.



Use an electric heat lamp to thaw pipes. Start from an open faucet or unfrozen section of pipe to avoid pressure buildup. Keep lamp and wire away from water.



The best way to keep pipes from freezing is to wrap them with electric heating tape. Each linear foot of pipe gets two complete wraps. Don't let tape overlap itself.



When a house is left unheated for long periods, the plumbing system must be drained to prevent freezing. An effective way to be certain that all water leaves the pipes, especially in the low spots, is to blow compressed air into an open hose bibb.

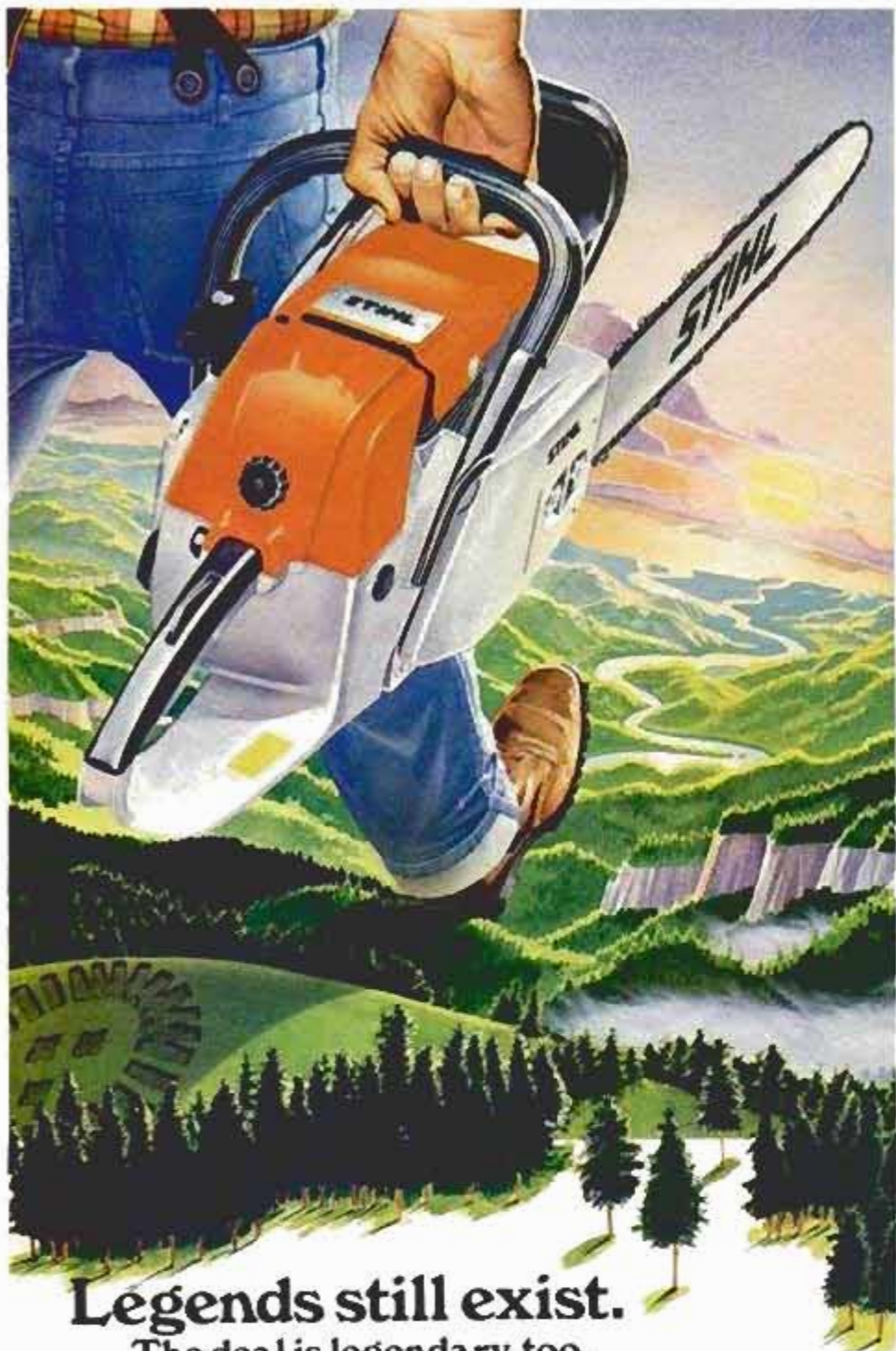
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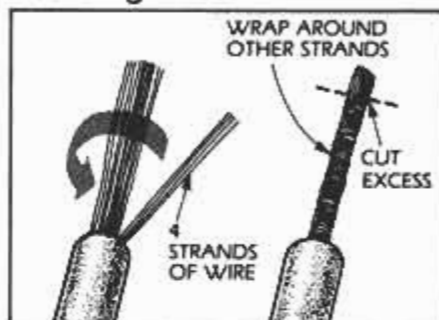
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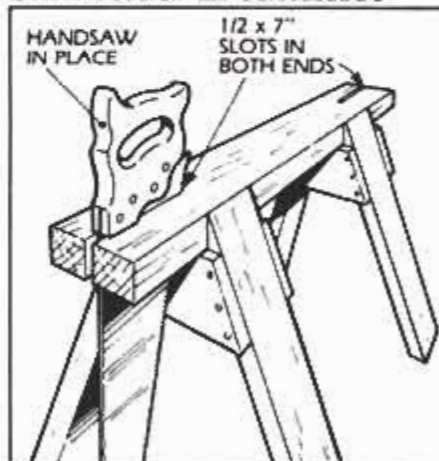
# HINTS FROM READERS

## Securing wires



Often in electrical repairs it is necessary to secure multi-strand lamp cord under a terminal screw. The fine strands have a tendency to move out of position as the screw is turned down. To keep the cord in place, separate four of the strands and wind them around the others in an open coil. Then snip the secured wire strands to the needed length, pinch them around the terminal and tighten it.—*E.T. Gunderson*

## Saw holder in sawhorse



For a long time, I had trouble protecting my handsaws when transporting them indoors and out for use with sawhorses. When I hung the saw by a nail from the sawhorse leg, the saw often would fall off, usually dulling the teeth. When laid on the ground, the saw would be stepped on, or kicked out of the way. I solved the problem by cutting a saw slot in each end of the sawhorse crosspiece. Now, when I am through with a saw, I drop it in a slot where it remains until I need it.

—*Howard E. Moody*



## PM LONG-TERM CAR TESTS

**NEW YORKER**  
Living-Room Luxury In A Compact

**CIMARRON**  
Survived Our Thrashing Admirably

**AUDI 5000S**  
An Aerodynamic Mercedes-Beater

**CAMARO Z28**  
Update On Our Trips To The Dealer



Domestic and foreign approaches to luxury: Chrysler New Yorker (left) and Audi 5000S, both fwd, provide more than basic transportation.

Now that the average price paid for a new car is over \$10,000, it seems reasonable to look at what you can get if you stretch your budget a bit and pay a sticker that's in the teens. We've added two luxury cars to our fleet—one domestic and one import—and we've been racking up the miles.

Meanwhile, three other cars we've told you about—the Cimarron, Camaro and Eagle (see *PM Long-Term Car Tests*, page 170, June '83)—have been returned to Cadillac, Chevy and AMC.

### Chrysler New Yorker

The New Yorker price starts at just over \$11,000, but can easily top out at \$15,000 or more. Ours has just about everything—including an appeal that's astounding. One Lincoln Continental owner was taken with the car's good looks, but thought it too small. He changed his mind as soon as he sat in the driver's seat. Once on the road, rolling along smoothly and quietly, we had to answer his question "Six or Eight?" with the correct reply: "Four." Indeed, we've found the 2.6-liter, Mitsubishi-made powerplant a most willing performer in this luxury compact.

Other drivers, more at home in

imported cars, also respond favorably to the '83 New Yorker. Yes, even with its column-mounted, automatic transmission shift lever and living room seats. Chrysler has really put together a nice one: not too downsized or puny to alienate the domestic luxury car buyer, and not so insolent a chariot that it would drive more buyers into import car showrooms.

We've put over 2,500 miles on the white, fwd New Yorker so far and have had not so much as a stumble or glitch. Handling and ride comfort are a beautiful compromise between a too-taut sports sedan and a too-soft luxury car. We've been averaging 20 mpg (EPA

city figure is 22), but you can understand how we yield to the temptation to drive somebody else's car in a way we would never drive our own. That being the case, we think 20 mpg is pretty good. We do promise to make at least one economy run (however short!) to be able to report a steady, 55-mph highway mileage figure. Maybe we'll let the excellent cruise control do the driving for us.—B.H.

### Audi 5000S

It's summer in New York as we write this, but there's one great escape from the heat and humidity: the 5000S. The



After 5,000 miles, but in as good condition as we got it, we drove Cimarron back to Detroit.

terrific, quiet, climate control system in this streamlined Space Shuttle has passed the test, and we like the digital punch-in for interior temperature. The interior of the '84 5000S, as nice as it is, isn't nice enough. It's got lots of good features (as reported in *Driving The Audi 5000S*, page 138, Aug. '83), but we find it too... Volkswagenish. Maybe a piece of burl walnut in the dash would do the trick—a touch to remind you that you've just gone almost \$20,000 for your latest new car.

The flush window glass, which is part of the superb aerodynamics, keeps the ride quiet, whatever speed you go. And at whatever speed, the 5000S handles more like a two-seater sports car than a four-door sedan. We've been throwing it around for over 2,000 miles



**Chevy Camaro went back to providing first-class performance after fixes were made. Faulty cigaret lighter was main problem.**

and averaging 21 mpg. That's with the five-cylinder engine working with Audi's automatic transmission. Driving the 5000S, you really appreciate a large fuel tank. It's nice not to worry about fuel for 350 miles or so before refilling (about 17 gal. average). This is in contrast to our refills with the New Yorker: about 10 gal. every 200 miles—a nuisance.

Considering handling, performance, comfort and workmanship, Audi's flagship is one of the finest cars we've ever driven. Cars with three-pointed stars on the hood don't offer any more driving pleasure. As for status, of course, the Mercedes star still has it over Audi's four rings. That's the costly difference.—*B.H.*

## Cadillac Cimarron

We put over 5,000 miles on the '83 Cimarron before PM's Science Editor drove it back to Detroit to return it to Cadillac. The 7,500-mile maintenance came due during the time we had the car and we had it done at Potamkin in New York City; the chipped chin spoiler was replaced at the same time. Total charge: \$196.09. Of this, \$110.35 was labor, mostly for painting a new spoiler to match car color (\$40) and installing it (\$40). The panel itself was \$32.82 and the paint \$14.35. (There's a business opportunity here—a nationwide chain

*(Please turn to page 68)*

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## FIRSTHAND REPORT



Head-turning bodywork by Ital Design's Giorgetto Giugiaro clothes tested components from Isuzu's I-Mark sedans. It's no sports car, but it's plenty sexy and a turbo is on the way.

# Driving The Isuzu Impulse

I rode to the MGM Grand on Las Vegas Blvd. with two Isuzu dealers. We shared the cab. On the way from the airport, the three of us talked about the Impulse. None of us had seen the car yet, and the dealers were really anxious to find out the SRP—the Impulse's suggested retail price.

One dealer thought the car might sticker out around \$16,000. He hoped he was wrong, because that price would put the Impulse toe-to-toe against the Toyota Celica Supra and Datsun 280ZX—two tough competitors.

The other dealer said he'd heard that the Impulse wouldn't cost more than about \$14,000. This would give it a good chance against the Mitsubishi Starion, but might cause it to run into flak from a loaded Chevy Camaro Z28, the Pontiac Firebird, 5.0-liter Mustang GTS and, especially, the Mazda RX-7.

A few hours later, as the three of us sat inside the MGM's main ballroom along with 200 other Isuzu dealers, the company's general manager, Jack Reilly—after an extravagant unveiling of the Impulse—revealed the news: The Impulse, he told a hushed

Our road test reveals  
Oriental practicality  
in an Italian suit.

BY MICHAEL LAMM  
West Coast Editor

audience, would carry an SRP of \$9,995.

The dealers leaped up, stomped their feet, clapped their hands, whooped, hollered, hugged each other, jumped up and down, yelled, cheered and, generally, couldn't believe it.

I never thought I'd hear a crowd go wild for a \$10,000 price tag. But there wasn't a person in that room, dealer or

reporter, who didn't feel that the Impulse has to be one of the automotive bargains of the year—maybe the automotive bargain of the year. With that price plus its mile-long list of standard equipment, the Impulse doesn't just look good, but is undeniably one of the best values of the season.

### From the driver's seat

This is not a sports car—at least not by my definition. Its handling is okay, but the Impulse is nose-heavy, with a weight distribution of 58/42, meaning it tends to understeer. Understeering, or plowing, showed up in the slalom on dry pavement. To the average driver, that means if you misjudge a corner, or try to corner too fast on a wet roadway, you could slide off the road front first.

For slalom, Isuzu officials pumped up the tires to around 60 p.s.i., which is usual procedure. The hard tires made for a fairly choppy ride on the freeway.

The Impulse's ride has to be better with normal 32 p.s.i. in the tires. Even allowing for the slight choppiness, though, the Impulse was very quiet and pleasant in normal driving.



Front-to-rear beltline groove hides the hatch and hood openings.



It's not an especially fast car, but it's also not sluggish. There's a turbo on the way, and that should help the Impulse's acceleration a lot. Our 0-to-60-mph runs averaged around 15 seconds, which is a lot slower than a Mazda RX-7 or V8 Camaro, but about the same as a Camaro or Firebird with the standard four-cylinder engine.

The manual five-speed shifts well except into REVERSE, which has a tricky little pushdown detent. The ratios leave too wide a gap between THIRD and FOURTH, so that around town, between 35 and 40 mph, THIRD gets too buzzy and FOURTH lugs the engine.

Out on the highway, though, overdrive FIFTH, at 0.79:1, feels good—not too high for passing, yet high enough for decent fuel economy. The EPA says 24/36 city/highway for the manual or 24/32 for the automatic, which is optionally available.

The Impulse interior has all sorts of thoughtful, friendly little touches that help make the car fun and interesting to drive. All four seats adjust, from the driver's five-adjustment bucket to the rear seats' four-position backrest angle. You can change the driver's lumbar support and also move the seatback through 40°, either with an indefinitely adjustable rowel or with a two-position lever.

The most striking element inside the



Fuel-injected, overhead cam, 90-hp engine delivers good, but not great, performance.

car, though, is the fingertip controls at each side of the instrument cluster. They make all the Impulse's switches as easy to reach and use as a normal turn-signal lever. These satellite pods adjust so you can set them within any finger's reach. Your hands never have to leave the steering wheel. And each individual switch takes only a feather's touch: It's that sensitive. The pods include cruise control, headlights and dimmer switch, rheostat, air-conditioner and heater controls, wipers front and rear, and vents. Once you get used to where everything is, you never have to search for individual switches: It's like touch-typing.

You may have heard that the Impulse was styled in Italy by the current [\(Please turn to page 147\)](#)

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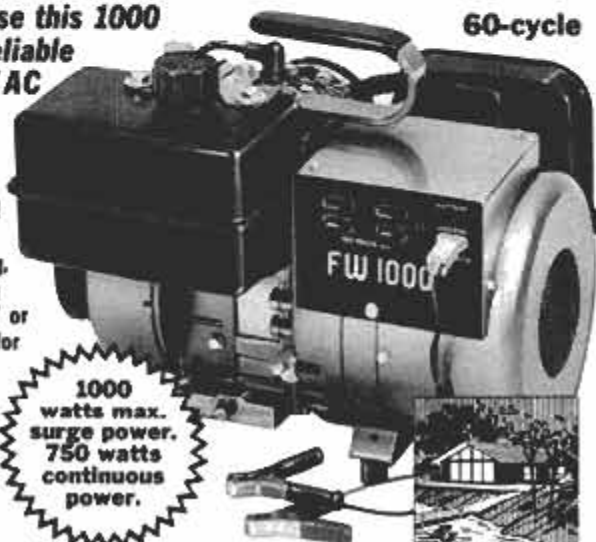
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### LONG-TERM CAR TESTS

(Continued from page 65)

specializing in the replacement of broken aerodynamic devices would do well, we think.)

We were happy with our overall mileage, which was just over 24 mpg, and the lack of anything to really complain about. Come to think of it, that's exactly how life with a Cadillac is supposed to be.—B.H.

### Chevrolet Camaro

When last we left our Camaro test car, it was being taken away by the Chevy guy to find out why it kept going dead. After replacing the battery and checking the rest of the electrical system, the car was pronounced okay and returned to us. Indeed, the car continued to run perfectly, delivering all the acceleration and handling any sane person could hope to ask for. In fact, several of us came to the conclusion that the Z28 Camaro handles better than even the new Corvette.

Unfortunately, all our bliss was shattered once again when we got into the car one day to find that the radio, horn, electric windows, electric mirrors, electric seat, electric door locks and cigaret lighter had all blown. Obviously, they were all wired into one fuse.

Once again, the Chevy man took the car away. After a tremendous amount of diagnostic work, they found the trouble. The cigaret lighter (made by an outside supplier and purchased by Chevrolet) did not fit properly into its receptacle. It sometimes made electrical contact and drained the battery. Other times, it simply shorted out the entire circuit. It was replaced, and we haven't had any problem since.

While Chevy repaired the electrical glitches, we also asked them to check the automatic transmission, which we felt was acting erratically. After inspection, Chevy decided to change the transmission also.

Since these repairs were made, the Camaro Z28 has become a real pleasure to drive. No, that's not quite accurate. The car has *always* been a pleasure to drive. The car's performance and handling are top class all the way. However, the pleasure of *operating* this test car was dimmed somewhat by the annoying electrical problems and a balky automatic transmission. It looks like the transmission problem was an isolated case, since the replacement works fine.

Meanwhile, we've just enjoyed the Z28's incredible cornering power, sock-you-in-the-back acceleration and 16-20 mpg on a last drive: Chevrolet made us give it back.—J.O.

### AMC Eagle

Now that "our" Eagle wagon has gone back to its rightful owner, we appreciate all the more the option of having 4wd in a family car.

We did tend to take it for granted, knowing it would be on tap whenever needed. And the fuel penalty was slight: On comparable, summertime highway trips, we measured 20.83 mpg in 4wd versus 21.88 mpg in 2wd. Overall—winter, summer, cold starts and all—we averaged 17.52 mpg over 4,985 trouble-free miles mostly in 2wd. And, we're definitely sold on the station wagon as the best choice of body style for a family car.—J.A.L.

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This remarkable product not only stops squeaks like magic — not only loosens jammed parts — but helps restore free and easy operation to virtually all moving mechanisms around the home. Spray some into the channel of your sliding door, and see how smoothly it opens and closes. Use it on hinges, windows, locks, lawn mowers — and much more.

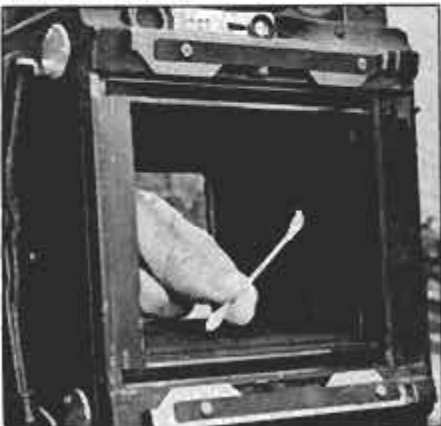
And what a powerful rust fighter! To prove it, we left two identical garden shears outside for 18 days. One was unprotected. The other was sprayed with 3-In-One Plus. You can see the dramatic results for yourself! New 3-In-One Plus. The lubricant and rust fighter no homeowner should be without.

## A new addition to the 3-In-One family.

\*Results could vary according to weather conditions.

# PM PHOTO HINTS

## Come clean!



Blowing dust from folds in a bellows camera may only cause it to settle in a different area. A dampened cotton swab is an ideal tool.—*Bob Brightman*

## A good rule(r)



Prevent paper and photo prints from shifting when you make a full-length cut on a paper cutter by holding paper with a ruler.—*Louis Hochman*

## Artful dodging



A length of coat hanger stuck into an alligator clip makes a great print dodger. Cut masks from any thin, opaque cardboard.—*Robert Hertzberg*

## Build your own air compressor from PM's plans



Once you have an air compressor in your home shop, you'll wonder how you ever got along without it. You can spray paint with it. You can inflate swimming gear, toys, auto and garden tractor tires. More important, you can sandblast parts and rivets in metal seams. You can blow-clean fine mechanisms and, with PM's unit you can vacuum pump your car's airconditioning system prior to adding Freon—something you can't do with most ordinary air compressors. Finally, this unit features a filter/water trap—which is an optional extra on most commercial air compressors.

## PM AIR COMPRESSOR

You can do all these things with this versatile 1-hp compressor and, happily, you can build it for less than \$200. **PM**

**Compressor evacuates car's airconditioning system prior to adding new refrigerant (far left). At left, routine inflation of tires saves trip to gas station.**

### HOW TO ORDER PLANS

Send check or money order for \$5.95 to Air Compressor, Popular Mechanics Plans Library, Box 1014, Radio City Station, New York, N.Y. 10101. Allow two to three weeks for delivery; for first-class mail send 75 cents extra.

Popular Mechanics is a publication of Hearst Magazines, a division of the Hearst Corporation.

# PM SOFTWARE MONITOR



## A revolutionary new 'idea processor'

A personal computer is a tool, but the software it is running defines what job that tool can be used for. Word processing, databasing and spreadsheets are all well-known uses for this most versatile of tools. Now there is something new, an "idea processor," which we think may become as popular as any of the other uses of the versatile computer.

The program is *Think Tank* (from Living Videotext Inc. in Palo Alto, Calif.) and it is available for the Apple II, probably the IBM PC by the time you read this, and for many other machines soon. We think that, for many people, it

will prove a reason in itself to own a personal computer. So, if you forget a command key, you have a handy, on-screen reference at all times.

By arranging information in this layered manner, it becomes easy to see the relationship between information that is at the same level. For instance, peeling the layers to a certain level in the demonstration results in a listing of the *Bounty's* crew. The layers beneath each crew member are hidden until the outline is further expanded.

When you are designing an outline, processing your own ideas, you will find that *Think Tank* helps you to direct the flow of your creativity toward a set goal. By getting your ideas down quickly onto the video screen, they become objects to manipulate, cross-connect, redefine and examine.

Because the layered format can be so easily and quickly reworked, you can follow each thread of your own thinking process to its conclusion. *Think Tank* helps you avoid dead ends by allowing you the capability of investigating every byway.

Once you have designed your idea to an extent that satisfies you, it can be printed out in various formats. The program will even generate a table of contents page to a long outline and automatically preface each headline or paragraph with a number showing its relationship to other entries.

The only problem we had with *Think Tank* is that it saves its files in the Pascal operating system. While it is not



A *Think Tank* screen starts off almost as a blank (above), as only the outline's most important titles are displayed.



Here we choose to look into the heading of "Personnel Records" and discover the first level of info on the *H.M.S. Bounty's* crew.



Checking deeper into William Bligh's data reveals he was *Bounty's* captain. Any type of outline may be structured like this.

usually necessary to access these files, there are times when you might want to interface *Think Tank* to another program—and that second program might not be written in Pascal. We understand that Living Videotext will have available, by the time this review is published, a number of accessory programs that will solve this problem by allowing the Pascal files to be translated to other systems and languages.

While this is a complex program, the manual that comes with it gives a clear and even readable presentation of how to access all this power. Its 200-plus pages might serve as a guide to how manuals should be written. That the manual was designed using *Think Tank* is its own advertisement for the program.

### Peeling the layers

Few programs are truly unique or fantastically useful. *Think Tank* is both.—N.S.

# JEEP INTRODUCES LEANER AND MEANER 4-WHEEL DRIVE CHEROKEE.



From the engineering experts at Jeep, this is the newest advance in Jeep 4-wheel drive technology.

*The all-new Cherokee is leaner...* to give you the highest gas mileage ever in a Jeep. Mileage that beats Bronco II and S-10 Blazer. (Blazer 4x4 comparison - 1983 EPA EST. MPG and EST. HWY figures.)

*And Cherokee is meaner...* You get more ground clearance than S-10 Blazer and Bronco II. And more horsepower per pound than S-10 Blazer, too. This is Jeep ruggedness, Jeep power, Jeep agility.

Cherokee is built in a different

way than its competitors. Jeep's Uni-Frame Construction is a welding of the frame to the body shell to create one solid rugged unit.

And our Quadra-Link Front Suspension combines a solid front axle with four locating arms and coil springs to give you a remarkable combination of ruggedness off road and smoothness on road.

There's more inside, too. Like shift on-the-fly between 2 and 4-wheel drive. And seating for 5, not 4 like the competition. You get

more cargo room. Plus, only Jeep gives you a choice of 2-door and 4-door availability.

The all-new leaner, meaner Cherokee is at your Jeep dealer's now. Helping to make up what is the world's largest selection in 4-wheel drive.

## CHEROKEE

33<sup>84 EST.</sup> HWY / 24<sup>84 EPA\*</sup> EST. MPG

## S-10 BLAZER 4X4

31<sup>83 EST.</sup> HWY / 22<sup>83 EPA\*</sup> EST. MPG

## BRONCO II

30<sup>84 EST.</sup> HWY / 20<sup>84 EPA\*</sup> EST. MPG

Jeep is a registered trademark of Jeep Corporation.

\*Use figures for comparison. Your mileage may vary with speed, weather, trip length. Actual highway and CA figures lower. '84 figures for S-10 Blazer 4x4 not available at printing.

	ALL-NEW CHEROKEE	S-10 BLAZER 4X4	BRONCO II
Wheelbase Length (in.)	101.4	100.5	94.0
Ground Clearance (in.)	7.7	6.9	6.5
2-Dr and 4-Dr Availability	YES	NO	NO
Cargo Room (ft <sup>3</sup> )	71.2	62.7	64.9
Seating Capacity	5	4	4
Uni-Frame Construction	YES	NO	NO
Quadra-Link Front Suspension	YES	NO	NO
Payload (pounds)	1150	1000	736
Select-Trac 2WD/4WD Available	YES	NO	NO
Rear Window Wiper/Washer	YES	NO	NO

# Jeep



WHEN IT COMES TO 4-WHEEL DRIVE...ONE WORD SAYS IT ALL.





Come to where the flavor is.  
Come to Marlboro Country.



Marlboro Red or Longhorn 100's—  
you get a lot to like.

17 mg "tar," 1.1 mg nicotine av.  
per cigarette, FTC Report Mar '83

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

© Philip Morris Inc. 1983

# Tomorrow's Shifty Dog Fighters

Popular  
Mechanics

Futuristic shapes—right out of a 'Star Wars' script—promise wild new ways to fly.

Fighters of the future: New Swedish JAS-39 jets are the first of a revolutionary breed of agile combat aircraft having fully controllable canards. The mini wings, sprouting like ears behind the nose, tilt up and down to permit trick maneuvers never before possible.

BY SHELDON M. GALLAGER  
Special Features Editor

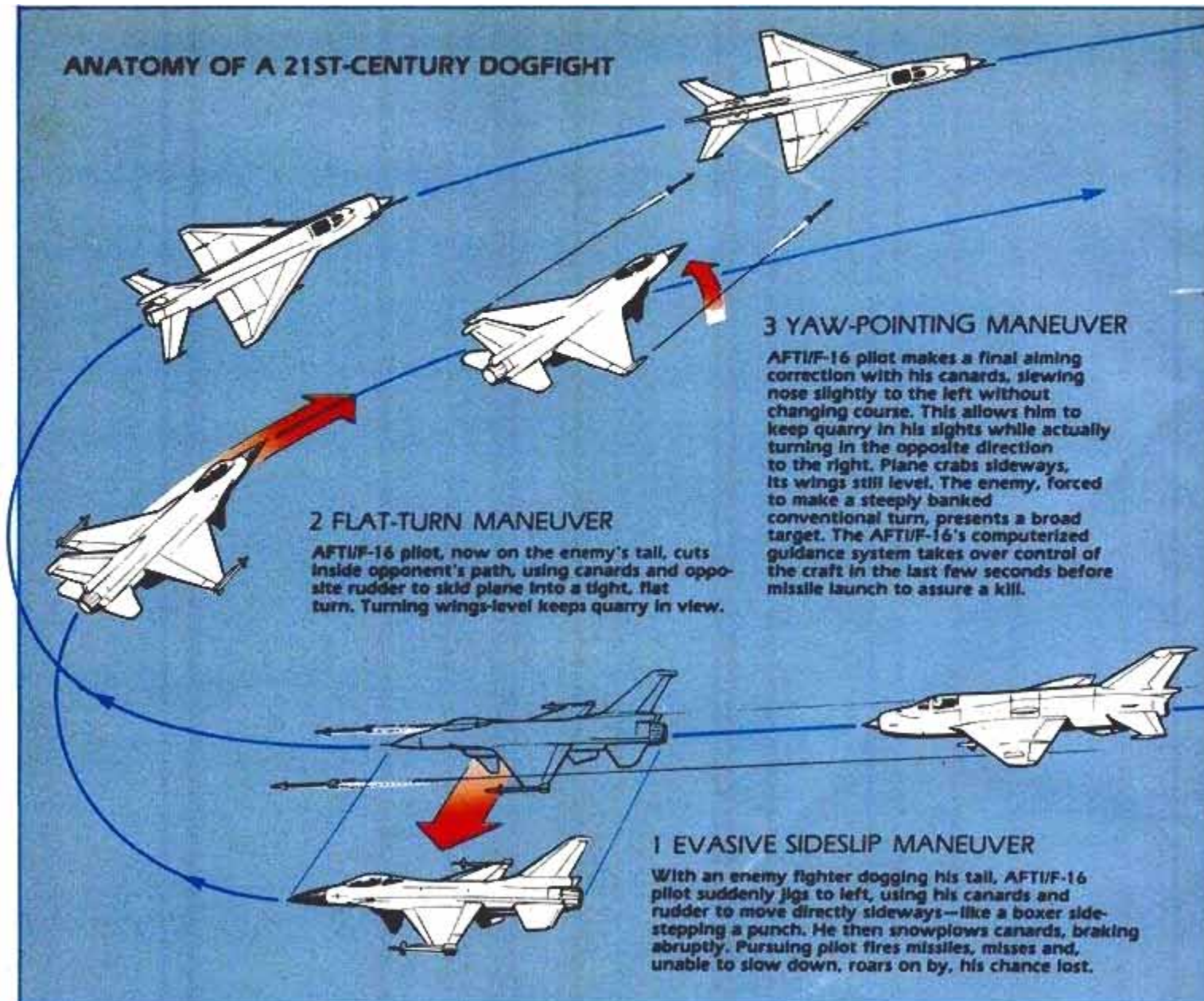
**Y**ou're a fighter pilot with an enemy hot on your tail. You twist and turn, but can't shake him off. Suddenly, you feint to the right, then dart to the left, sliding your plane directly sideways like a boxer sidestepping a punch. You hit your speed brakes and almost stand still. Your pursuer, caught off guard

and unable to slow down, zooms on past, his guns firing into empty air.

You slide back in behind him, now on his tail. As he rolls into a steep bank to get away, you cut inside him, skidding your nose around in an impossible flat turn that keeps your wings level and your quarry in view. Your radar-guided, computer-controlled gunsight locks onto the target and your plane almost flies itself. Within seconds, your computer will make the kill.

This is not a fantasy sequence for some futuristic space movie. It could happen today. By the 1990s, such aerial antics will be standard combat tactics for next-generation dogfighters now on the drawing boards of every major military aircraft maker in the world. The technology, in fact, is here now in such experimental demonstrators as the AFTI/F-16, a highly modified General Dynamics F-16 interceptor that's easily the most exotic flying machine in the

## ANATOMY OF A 21ST-CENTURY DOGFIGHT



### 3 YAW-POINTING MANEUVER

AFTI/F-16 pilot makes a final aiming correction with his canards, slewing nose slightly to the left without changing course. This allows him to keep quarry in his sights while actually turning in the opposite direction to the right. Plane crabs sideways, its wings still level. The enemy, forced to make a steeply banked conventional turn, presents a broad target. The AFTI/F-16's computerized guidance system takes over control of the craft in the last few seconds before missile launch to assure a kill.

### 2 FLAT-TURN MANEUVER

AFTI/F-16 pilot, now on the enemy's tail, cuts inside opponent's path, using canards and opposite rudder to skid plane into a tight, flat turn. Turning wings-level keeps quarry in view.

### 1 EVASIVE SIDESLIP MANEUVER

With an enemy fighter dogging his tail, AFTI/F-16 pilot suddenly jigs to left, using his canards and rudder to move directly sideways—like a boxer sidestepping a punch. He then snowplows canards, braking abruptly. Pursuing pilot fires missiles, misses and, unable to slow down, roars on by, his chance lost.

air today. The AFTI designation stands for Advanced Fighter Technology Integration, a joint Air Force/Navy/NASA program designed to see just how far out a fighter can get.

If its name is a bit unwieldy, the AFTI/F-16 itself certainly is not. Fitted with new downward-pointing canards—twin underbelly fins that steer like rudders—it can bounce around the sky like a Mexican jumping bean, performing aerial gymnastics unheard of in a conventional fighter. Imagine a plane that can move straight up or down like an elevator, scoot sideways like a crab, or point its nose in one direction while traveling in another.

And this is just the beginning. To turn a conventional fighter, its pilot must roll into a bank using ailerons, feed in rudder to bring the tail around, haul back on the stick to pull the nose around, then roll back out wings-level again and try to re-establish contact with his prey. All this takes time, concentration and often some guesswork



### SUPER MIRAGE 4000

The first French fighter to have canards, Super Mirage will pave the way for even more awesome ACX expected in the 1990s.

### JAPANESE CCV

With both vertical belly canard and horizontal canards, the CCV (Control-Configured Vehicle) can perform unorthodox maneuvers.

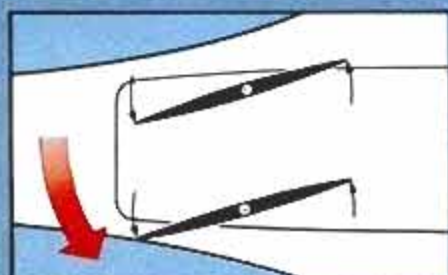




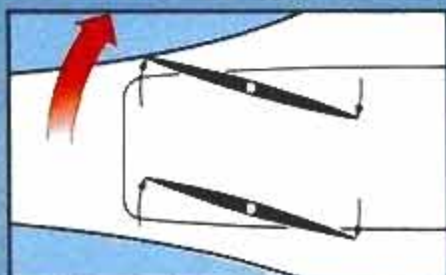
## EXPERIMENTAL AFTI/F-16

World's most exotic fighter: Experimental AFTI/F-16 (above), a joint Air Force/Navy/NASA research craft, has unusual downward-pointing fins under its belly scoop. Called canards, these near-vertical vanes pivot like twin rudders to steer the nose to the right or left independently of the tail, permitting uncanny controllability. Some of the trick maneuvers they make possible are depicted in the dogfight sequence shown on the facing page.

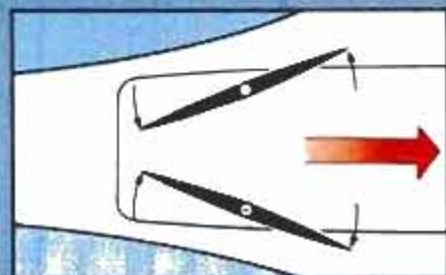
## HOW CANARDS STEER THE AFTI/F-16 (TOP VIEWS)



CANARDS LEFT, NOSE LEFT



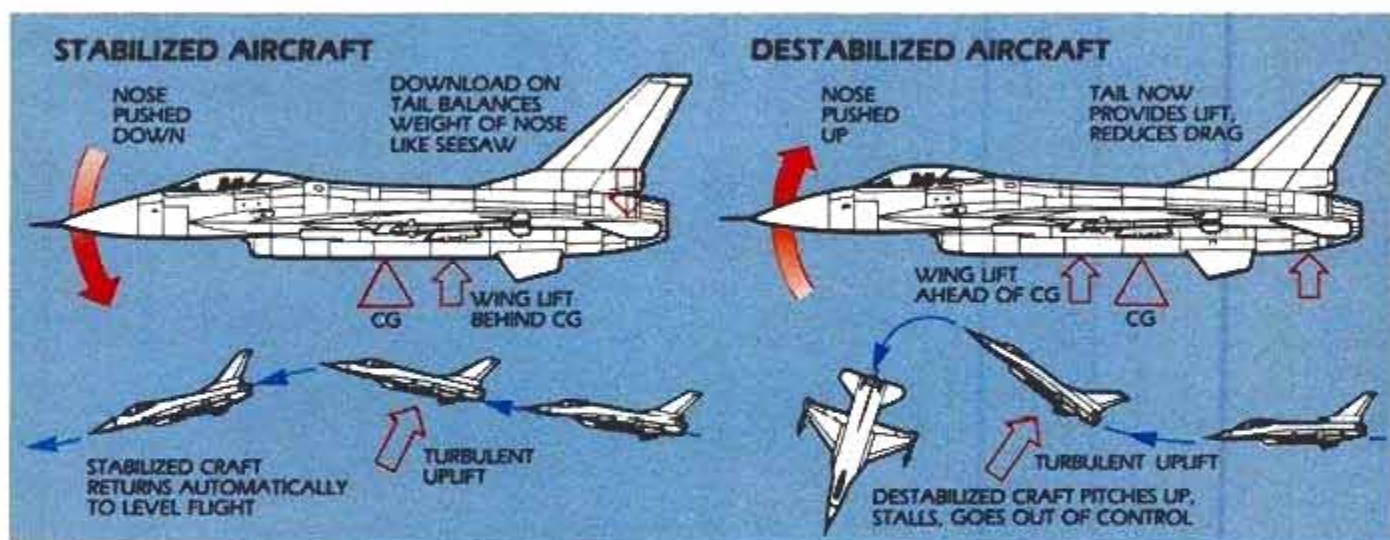
CANARDS RIGHT, NOSE RIGHT



CANARDS SNOWPLOWED FOR FAST BRAKING

How canards turn the nose of the AFTI/F-16 is shown in the drawings above. The fins can also be "snowplowed"—deployed so they both point inward—to induce deliberate drag, providing rapid

deceleration during a dogfight to deceive an enemy attacker. Such highly agile aircraft are known as Control-Configured Vehicles (CCV) because they're designed for maximum control response.



The principles of destabilized flight, a dramatic new characteristic of advanced combat designs, are shown above. Center of gravity (CG) acts like the fulcrum in a seesaw. In naturally stable craft, the wing lift behind the CG keeps the nose pushed down. After a disturbance, the plane returns automatically to level flight. The disadvantage is that a download is constantly placed on the tail to balance weight

of the nose, causing drag. In new deliberately destabilized fighters, wing lift ahead of the CG forces the nose up, eliminating download on the tail. This reduces the drag, increases lift and greatly improves combat maneuverability. But uplift on the nose would quickly cause the aircraft to pitch up, stall and crash without the artificial stability that is now possible through computerized control surfaces.

FRENCH ACX

Superfighters of the 1990s, shown here in artists' concepts, are (clockwise from the top): France's ACX, an advanced version of the famous Mirage; the British-German-Italian ACA; and MBB's TKF-90. All three combine fully movable canards with a delta-wing configuration that eliminates conventional tailplanes. Multipurpose control surfaces in the wing's trailing edge, such as elevons or flaperons, perform the functions of ailerons, elevators and flaps all in one—a modern trend.

BRITISH ACA

GERMAN TKF-90

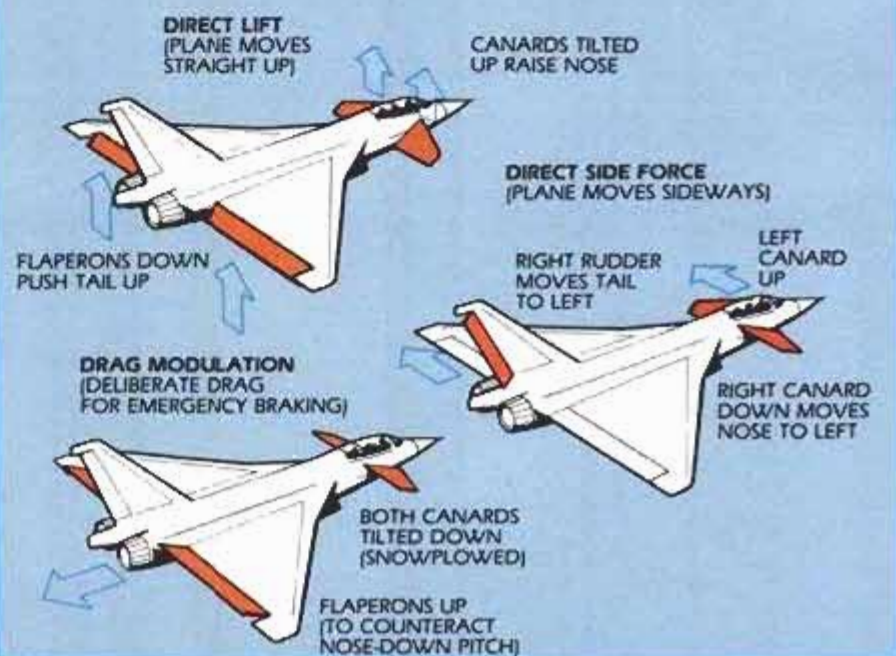
because the enemy may be temporarily lost from view during the turn.

In the AFTI/F-16, the pilot merely uses his canards plus opposite rudder to skid the plane into a flat, wings-level turn, a maneuver that takes much less time and keeps the enemy in full view. It also permits a much tighter turning radius—the hallmark of a superior interceptor. A fighter that can turn inside an opponent's path will usually emerge the victor.

The ability to point the nose up, down or sideways independent of flight path—called pitch pointing and yaw pointing—enables a pilot to keep his gunsight trained on an elusive quarry without taking the time to climb, dive or turn in the conventional manner. Moving the entire plane up, down or sideways—called vertical or lateral translation—allows a pilot to dodge away from a pursuing attacker or pull up sharply at the end of a bombing run to evade ground fire.

Such fancy aerial footwork is the result of several new technologies that represent a radical departure from traditional aircraft design. Since the beginnings of aviation, airplanes have been made to be inherently stable. Wing lift is located behind the center of gravity (CG) so that upward forces encountered in turbulence or during a maneuver tend to push the nose back

### HOW CANARDS CAN MAKE A PLANE DO CRAZY THINGS



It's all in those funny ears on the nose: Drawings above show how all moving canards, functioning like the diving planes on submarines, permit heretofore impossible maneuvers. Tilting the canards up and flaperons down (top) exerts lift on the nose and tail simultaneously, moving entire plane straight up without the craft entering a slow climb—useful, for instance, for gaining altitude fast at end of

a bombing run. Using the canards differentially—one tilted up and the other down—forces the nose sideways (center). At the same time, applying reverse rudder pushes the tail in the same direction. Together, they allow the plane to slide sideways without turning. With both canards tilted down like a snowplow (bottom), sudden drag slows plane abruptly to fool a pursuer.

## GRUMMAN'S 'WRONG-WAY WING': RIGHT FOR THE FUTURE?

Grumman's futuristic forward-swept-wing X-29A, shown here as model, is due to fly next year. Drawings show how airstream flows outward on conventional aft-swept wing, but inward on forward-swept design, leaving wingtips in clear air. Advantages: higher lift, lower drag, lack of wingtip stall and improved maneuverability.

### CONVENTIONAL AFT-SWEPT WINGS



AIRFLOW MOVES OUTWARD,  
HASTENING WINGTIP STALL

### NEW FORWARD- SWEPT WINGS



AIRFLOW  
MOVES  
INWARD,  
DELAYING  
WINGTIP  
STALL

down. The plane, after a disturbance, returns automatically to straight and level flight, even if you take your hands off the controls.

This makes for an airplane that's safe, docile and easy to fly, but also one that tends to resist sudden changes in attitude. A further disadvantage is that a download is constantly imposed on the tail to counterbalance the weight of the nose and keep it from pitching downward. The tail thus generates drag, but no useful lift.

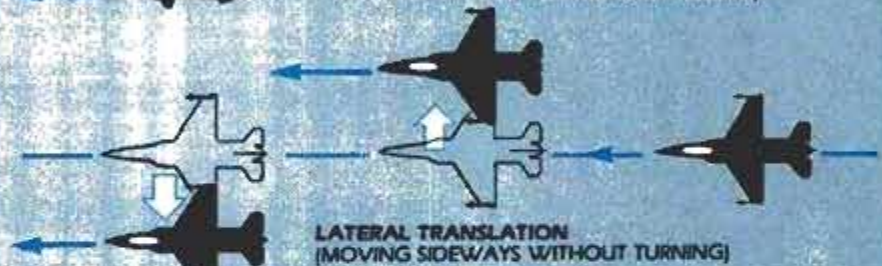
If you give up natural stability, surprising things happen—some good, some bad. By moving wing lift ahead of the CG, the nose is constantly forced upward so that downloading on the tail is no longer needed to keep the plane in trim. The tail now becomes a lifting surface, helping the wings to support the plane. The wings can then be made smaller and lighter, saving weight, reducing drag and improving overall responsiveness.

In addition, a plane with no tendency to remain in stable flight is suddenly free to execute maneuvers much more quickly and violently than a conventional aircraft.

Sounds simple. Why not make all airplanes this way? The problem is that an unstable aircraft is virtually unflyable—so skittish that no human pilot

*(Please turn to page 125)*

### NEW DECOUPLED MODES OF FLIGHT



In conventional aircraft, control surfaces are operated together to produce coordinated maneuvers. In future fighters, controls will be

"decoupled"—operated independently of each other—permitting strange new maneuvers (above) with equally strange names.

# Daring High-Wire Ride To Freedom

With bow and arrow, they shot a wire over the Berlin Wall for a death-defying freedom ride.

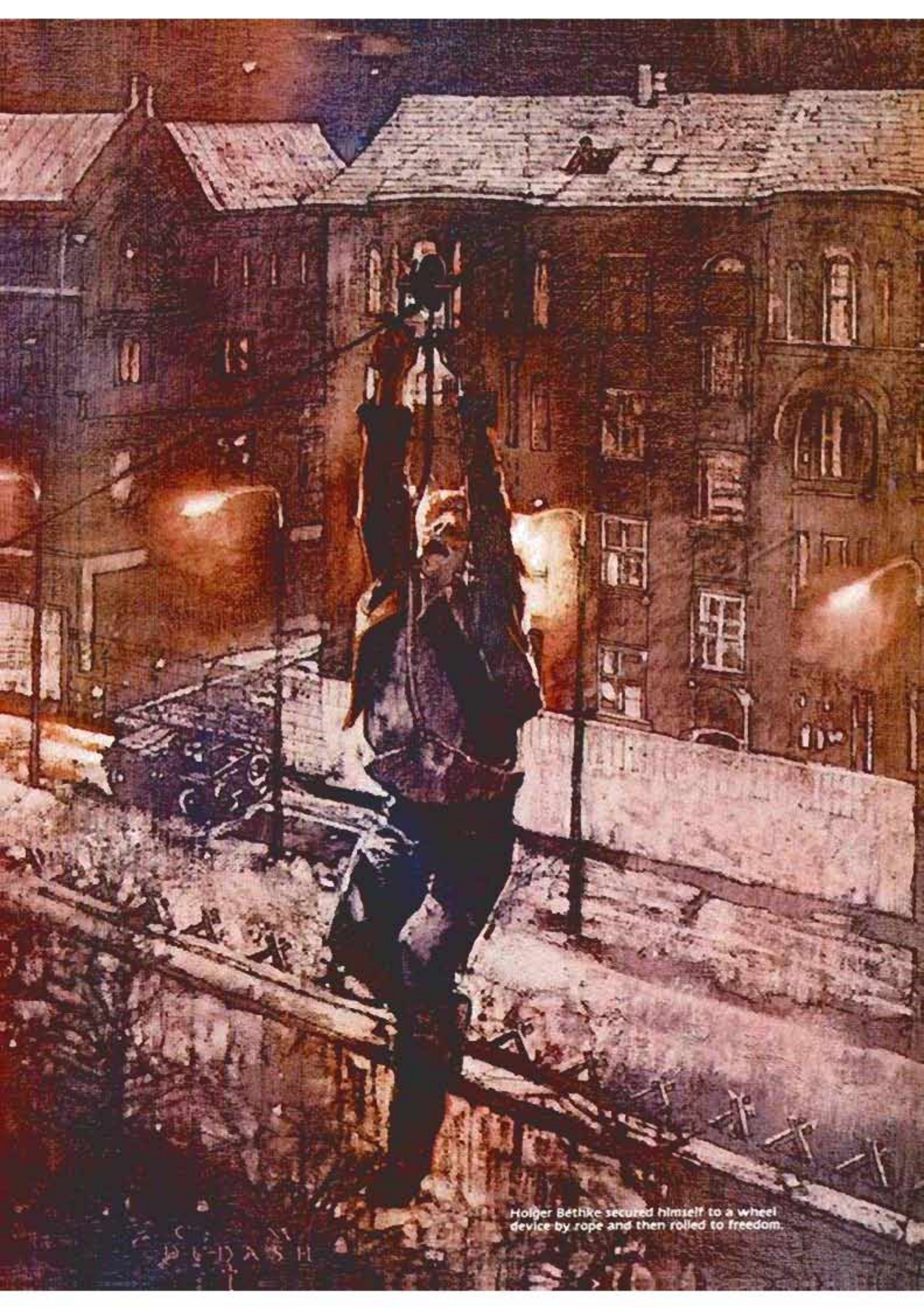
BY JOHN DORNBERG; *Illustrated by Michael Dudash*

It was 4:30 a.m., well before the first gray light of dawn on Thursday, March 31, when tenants in the apartment house at No. 68-A Bouchestrasse in West Berlin's borough of Neukölln were startled from their sleep by loud singing and raucous shouting.

Yells of "We made it! We made it!" came from the clothes-drying area in the attic of the four-story building. "I thought there were burglars or drunks up there, or both," said a housewife who lives on the top floor.

But the early-morning noisemakers—Michael Becker, 23, and his friend Holger Bethke, 24—were neither. They were arrivals from that distant, cold foreign planet just over the Berlin Wall: East Berlin.

Their mode of travel: two little wooden rollers with which they coasted 165 feet on a quarter-inch steel cable strung taut from the attic of a slightly higher, five-story apartment house in the East. Their journey—nearly 70 feet above the street and the grim Wall with its dark watchtowers—took each of them a mere 10 seconds. But it had required many months of planning and preparation as well as secret and



Holger Bèthke secured himself to a wheel device by rope and then rolled to freedom.

C  
DASH



After two failures, Holger Bethke managed to shoot an arrow over the roof on the western side of the Wall. A thin fishing line attached to the arrow was anchored to the back of a car. Next, a thick, high-seas fishing line was played out along the first line. To the end

of this, a steel rope was attached. After sending the steel rope across the border and fastening it to a chimney, first Bethke and then Michael Becker placed their wheels on the line, grabbed hold of the handles and rolled to freedom.

dangerous coordination with an accomplice, a relative, in West Berlin.

Since the Wall was built nearly 22 years ago by the Communists to keep their own people from fleeing West, East Germans have tunneled, swum and snorkeled under it, jumped and ballooned over it (see *The Freedom Balloon*, page 100, Feb. '80). Yet, in the annals of great escapes, the high-wire act is in a class by itself.

Only two young men with the gumption, grit, mechanical skills and daring of Holger Bethke, an electrician, and Michael Becker, a plumber and heating-pipe fitter, could have done it. It was not the first escape attempt for Becker, who left his wife behind in East Berlin and hopes that she will be allowed to join him in the West within a year as part of the "family unification" program between the two Germans.

"I tried it in July 1979 while on a trip to Hungary," he told PM. "I was just going to walk through the woods and across the fields to Austria. I made it across several barriers and was already on the border strip with only one 10-foot fence left to go when a Hungarian guard spotted and captured me," he explained. The upshot was extradition to East Germany and trial for "attempting to flee the Republic." He was sentenced to 20 months in prison.

With the 1979 conviction on his record, Becker was rejected for most jobs as a "political and security risk." Ultimately he found employment with one of the few privately managed but "socialistically pledged" service and crafts cooperatives that keep everything in East Germany running.

He soon chanced upon a smuggled West German magazine with an article about famous and daring escapes

across the Berlin Wall. One of these was the story of a family which in 1965 used a steel cable, pulleys and harnesses to slide from the roof of a government office building right at the dividing line to freedom.

More than six months before finding his partner and actively searching for an escape route Becker ordered the basic rollers he'd use to travel the high wire to freedom. Cut and lathe-turned from solid blocks of beechwood, they measured 6 inches in diameter and about 1 inch thick. Becker had them made for \$8.25 apiece at the carpentry shop which is part of the cooperative where he worked.

"When the guys there asked me why I needed the rollers," he explained, "I told them they were intended as wheels for a little decorative cart in my father's garden and that I wanted the grooves so I could put small tires on them."

Finding a suitable partner, Holger Bethke, took longer. They traveled in similar social circles. "One day I just put it to him straight. I told him I had a plan with an 80 percent chance of working. . . . His eyes lit up and he said: 'Count me in, I'm with you.' That was last November."

The choice couldn't have been better, for Bethke had a relative in West Germany whose participation in the caper proved vital—a young man who remains anonymous, but who had escaped from East Germany only a few years before.

Having alerted Bethke's relative to the scheme by letters with fake return addresses, cryptic telephone calls and using other relatives as intermediaries, Becker and Bethke set out in earnest to put the plan into operation.



Michael Becker stands on the western side of the Berlin Wall near site of his escape.

First, they rented a car and toured the length of the 28-mile-long Wall to scout for a site. None seemed as good as the corner where Schmollerstrasse in East Berlin intersects with Bouche-strasse in West Berlin. It is a niche where the Wall zigs and zags, dividing streets so that houses on one side are in the West while those on the other are in the East.

Becker and Bethke selected as their "launch pad" a corner house 165 feet across from house front to house front. The building on the Communist side was a floor higher than the facing row of apartment houses in West Berlin. "We inspected the inside of the house. Dressed in coveralls as repairmen, we went up to the attic—which Holger opened with a skeleton key—made sketches, checked to see that the chimney was big and solid and that the little

skylight windows to the roof were big enough for us. It was all perfect.

"But most important," Becker added, "there were virtually no cops or border guards in the area. We came back repeatedly, during the day and night. Though there is a watchtower, with a clear view of the East Berlin side of the block, where all the trees have been felled and steel barricades put in, we never saw a walking patrol or vehicle."

One reason for the absence of border guards, as Becker and Bethke now realize, is that wherever buildings are left standing that close to the Wall, the tenants usually are trustworthy police and state security service officers with their families. "Had we known that," Becker admitted, "we might have thought twice about it. But maybe that was also part of our luck—operating right in the lion's jaw, as they say."

### Circus training

Becker obtained the 297 feet of quarter-inch steel cable from a friend working at a state-owned crane-making factory. To test the rope and their rollers, Becker and Bethke went to a public park near the edge of the city, attached one end to a tree about 23 feet above the ground, wrapped it around another tree at a height of 16½ feet and then secured it on their rented car. For two weeks they practiced in broad daylight.

"Oh, sure, people came by and watched," Becker laughed. "We told them we were in training for a circus." In the training sessions the rollers proved less safe than expected. They were loose and moved from side to side. "We decided to have the grooves deepened, and to place a ball-bearing system in the center that would hold the axle tight," said Becker.

There was another major pre-escape hang-up: Neither Becker nor Bethke had used a bow and arrow before, not even as kids. So off they went again for practice and training—this time on a meadow almost adjacent to Soviet Army headquarters. Soon the two were sure that they could shoot the arrows straight and far enough to reach the courtyard behind Bouchestrasse, where Bethke's relative would be waiting.

"We tried to think of every little thing," said Becker. "To reduce noise in the attic of the building, we took wool inlays from rubber boots, padding them with foam, to wear over our shoes. I wound the steel rope on a big electrical cable spool whose edges I covered with several layers of masking tape so there'd be no sound of metal grating on metal as we unreeled the cable. Holger fixed up an empty champagne bottle, on which he wound the fishing line."

Shortly before 2:00 p.m. on March 30, the two set out in a rental car for the Schmollerstrasse apartment house.



Seen from the western side of the Berlin Wall, Bouchestrasse is also cut off by fence. A guard tower (far right) looms at end of street. Escape was made from house with the tile roof.

Dressed as electricians, with wires and cables hanging around their necks, they began lugging their escape gear up five flights of stairs to the attic: the bow and arrows disguised in wrapping paper, the spool with the steel rope, which weighed close to 85 pounds, the fishing lines, a pile of blankets, sandwiches, pop bottles and Bethke's electrician's tool kit, an important prop. The attic was to be their hiding place for more than 13 hours—until "launch time" at 3:00 a.m., March 31.

At 3:00 a.m. they switched on their walkie-talkie. A familiar voice, from West Berlin, crackled over it. "Ich bin hier—I'm here. Are you ready?" They certainly were.

Carefully they spread the blankets over the wooden floor as additional soundproofing. Stealthily, Becker went to one of the little skylight windows,

opened it silently, leaned out over the sloping roof under him and studied the desolate, brightly illuminated strip of no-man's land adjacent to the Wall, five floors below. The only guard in sight was in the tall watchtower at the end of the block and, to Becker's astonishment, he seemed to be asleep.

While Becker communicated with the accomplice on the walkie-talkie and held the champagne bottle with the fishing line, Bethke secured the line to an arrow. Taking the bow, Bethke leaned out the window, drew back the string, arched it at a 45° angle and shot. A strong wind had come up and the arrow fell short, landing in a tree on the West Berlin side. The two were petrified. Had it been heard? They waited in frightened silence, but the guard in the tower was oblivious. The second arrow

*(Please turn to page 119)*

# NEW SNOWMOBILES: We Fly The '84s

Our resident test pilot lights up the afterburners on the new high-tech fun machines.

BY RAY HILL, *Outdoors Editor*



PM's outdoors editor is airborne with the Polaris Indy 600. Its liquid-cooled, three-cylinder engine can put out gobs of power, enough to propel the Indy to a blistering 100 mph. A liquid-cooled, hydraulic disc brake makes for quick, dependable stops. Independent front suspension produces superior handling when blasting over hard, bumpy snow.



**S**nowmobiles ain't what they used to be. Twenty years ago, a typical snowmobile was powered by a 340-cc, four-stroke engine, went a whopping 15 mph wide-open and handled with the nimbleness of a Greyhound bus. It had the styling of a shipping crate. And it chewed up drive belts like they were TV dinners.

Not so today. I had a chance to test-ride the 1984 models recently. They are sleek, nimble and fast. They're stone-ax reliable, and there's a machine for every type of riding. You say performance is your bag? All four manufacturers have

machines that are capable of speeds well past the 80-mph mark.

Ski-Doo's 9700 Blizzard will do 100 mph right out of the box, no tinkering required. In addition to gut-wrenching acceleration and eye-blurring top speed, the 9700 is also a nimble handler. A power slide is only a throttle squeeze away.

The top-of-the-line performance entry from Polaris is the Indy 600. Its liquid-cooled, 600-cc, three-cylinder engine has oil injection, so you don't have to worry about mixing gas and oil. Top speed for the

Indy is also around 100 mph. But even more important is the way this sled handles—superbly. It has independent front suspension, which you really appreciate when traveling over bumpy trails at speed. Of the four 1984 high-performance machines I rode, the Indy's front end worked the best in the rough stuff.

Yamaha's high-performance bullet is the well-proven V-Max. The oil-injection system has been recalibrated to cut oil consumption nearly in half. Its 535-cc, liquid-cooled, twin-cylinder powerplant pumps out healthy amounts of horsepower



Getting Ski-Doo's 9700 up on one ski is easy. Handling is so nimble and responsive that it invites antics such as these at every opportunity.



John Deere Sprintfire's 339-cc, liquid-cooled engine rests in a chassis that's nearly all aluminum. It is designed to be economical, yet luxurious.



A 521-cc Rotax rotary valve engine rests under the hood of Ski-Doo's 9700 Blizzard. New tuned and calibrated exhaust pipes with an improved swirl-chamber muffler keep the noise low and the power high. This little baby can do 100 mph, no problem.

## SNOWMOBILES:


and torque. I like its Telescopic Strut Suspension up front. It gives nearly twice the travel of leaf springs—which means better handling and a comfortable ride.

John Deere's high-performance Liquifire is loaded with high-tech innovations. Exotic materials include Ultra-Form 80 steel in the front pan/front frame member assembly, and front skis. Lighter and more malleable than conventional steel, Ultra-Form 80 can be bent into special shapes without cracking, resulting in high-strength, lightweight components.


New models for '84 include Ski-Doo's SS25, a commemorative sled celebrating Ski-Doo's 25 years of building snowmobiles. A member of the 80-mph-plus fraternity, the SS25 has a 460-cc, liquid-cooled, oil-injected engine. The twin-cylinder engine transmits its power to the ground via a new clutch with which the owner can adjust its engagement speed (a handy feature when riding in widely varying snow conditions). A special bumper, which gives a one-piece appearance to the cab, is designed to absorb reasonable impacts and return to original shape.

Yamaha's new entry is the Phazer. A 485-cc, twin-cylinder, fan-cooled engine provides power. As with all Yamaha snowmobiles, the engine is oil-injected. In the handling department, the Phazer has an innovative antisway bar, which reduces lean in corners and sharpens steering response.


There was a time, not all that long ago, when snowmobiles were ugly curiosities—slow, ungainly and not overly dependable. That period is gone. The 1984 lineup of sleds is shining proof of that. Whether your needs are performance, family trail riding, or a combination of both, there's a snowmobile for you. **PM**



Ski-Doo SS25 is Bombardier's 25th anniversary sled. Dual ducts in cab flank a recessed quartz-halogen headlamp. Integral polyurethane bumper absorbs mild impacts.



Yamaha's new entry for '84 is the Phazer. Fairing turns with the handlebars, and since the headlight is in the fairing, the light always points to where the rider wants to go.



Polaris's Indy Trail, one of the nicest family-type trail sleds around, has independent front suspension for better handling. A 440-cc, air-cooled engine powers it.

## FIRSTHAND REPORT



New Z-car styling (top) retains many of the old Datsun's styling cues and adds contemporary features such as semillided headlights. Dial-and-pointer instruments (right) are standard, while the LCD graphics (left) are part of an option package.

# Driving Nissan's New 300ZX

Nissan's new Z-car blasts into the future on V6 turbocharged power.

BY MICHAEL LAMM  
West Coast Editor

I don't usually drive 134 mph, but on Nissan's Tochigi test track in Japan, that's what I did. It's a safe place to speed. And even at 134, Nissan's new 300ZX turbo feels smooth and rock-steady. The Z's aerodynamic body slices the air with a Cd said to be as low as .30, and I felt no perceptible lift or wind buffeting.

The Tochigi track's high-banked ovals were designed for hands-off cruising at 109 mph. Even at 134 mph, the turbocharged, five-speed version of Nissan's new 300ZX sport coupe was just beginning to hit its stride. In fact, the new Z's top speed of 137 mph in U.S. trim could be higher if it weren't for an automatic fuel shutoff that keeps the V6 from revving above 6,000 rpm.

This new, lighter, more compact and rigid V6 engine replaces the venerable in-line Six that powered all previous Z-cars from the 1970 240Z through the 1983 280ZX. The 1984 V6 began life in the Nissan Cedric four-door and currently comes in two sizes for the Japanese market: two and three liters. Nissan uses only the bigger block in the 300ZX.

The even-firing 60° V6 has pentroof combustion chambers in crossflow heads. It has an unusual 1-2-3-4-5-6 firing order, the right-bank cylinders being odd-numbered, the left bank even. One overhead cam per bank activates the valves through virtually unfloatable hydraulic lifters and rocker arms. All Z engines since 1975 have used direct port injection, with turbocharging introduced in mid-1981. The same Garrett AiResearch T-5 turbo remains optional. It boosts horsepower by 25 percent and makes a big difference in performance.

I could get the nonturbo, five-speed 300ZX up to a maximum speed of "only" 117 mph. The turbo with over-

*(Please turn to page 129)*

## MORE KICK FOR '84

Oil injection, improved ignitions and bigger motors are all at your local marina.

BY RAY HILL, *Outdoors Editor*

Until now, oil injection has been something used mostly on two-stroke motorcycle engines. These two-wheeled powerplants have logged millions of reliable miles with it. For 1984, several outboards will feature oil injection, which eliminates the hassle of mixing two-stroke oil with the gas before every trip. All you have to do is keep oil in the oil tank. The engine does the rest.

Another nice thing about oil injection is that a pump can meter varying amounts of oil into the fuel at different engine speeds. For many outboards, an optimum mixture might be a lean 150 parts of fuel to one part of oil at idle, but a much richer 50 parts of fuel to one part of oil at wide-open throttle. With premix, you are stuck with one oil/fuel mixture at all engine speeds.

### Oil injection started in '80

Suzuki began the trend to oil injection back in 1980 with its 85-hp outboard. In '81 the 115 and 140 received oil injection. In '83 the brand-new 60- and 75-horse models came out with it. And for '84, the 40- and 50-hp motors have it also—which means that all Suzukis of 40 hp and above now have oil injection.

Most of the other major manufacturers have oil-injection models in their new lineup, too. And those that don't are taking a hard look at it.

Evinrude and Johnson offer it in all their V4 and V6 engines in the 90 to 235-hp range.

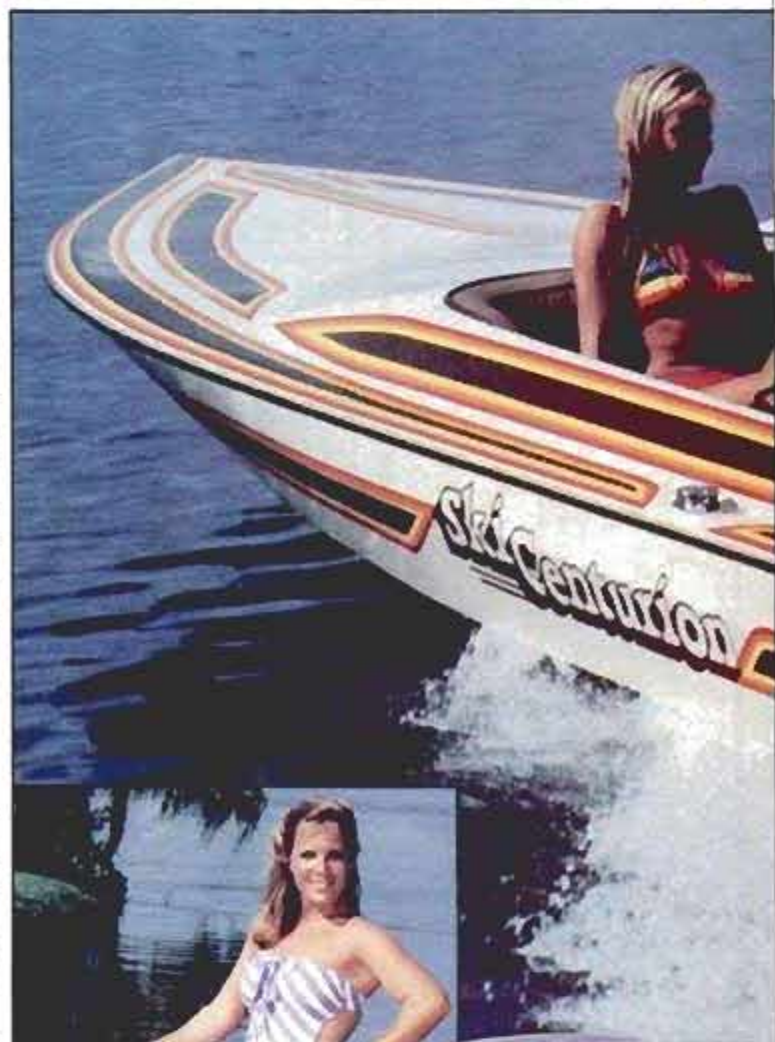
Unlike Suzuki, which uses a mechanical oil-injection pump, Evinrude and Johnson use a diaphragm-type pump which operates from crankcase pressure. OMC calls its system "Variable-Ratio-Oiling."

Yamaha, which has as much experience as anybody with oil injection on its two-stroke motorcycle and snowmobile engines, offers it on all electric-start outboards that are 40 hp and bigger (nine models).

Not to be outdone, Mercury and Mariner also have oil-injection models in their new lineups.

Although oil injection is by far the biggest

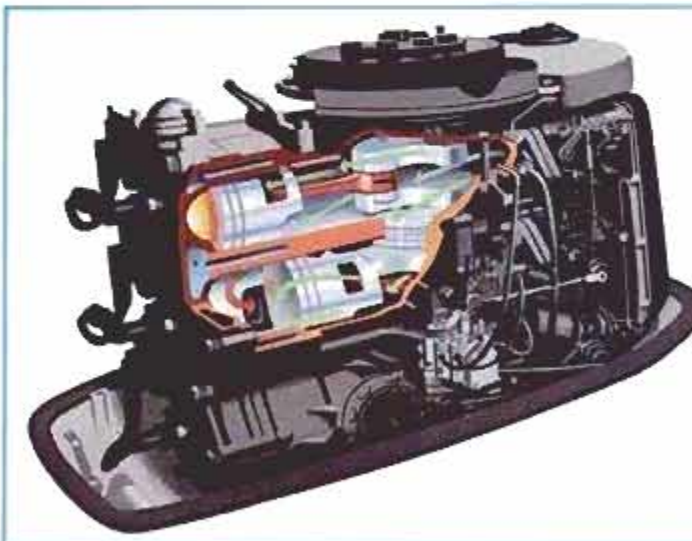
*(Please turn to page 124)*



Who said that outboards are heavy? Chrysler 4 weighs only 35 pounds, while Yamaha's new muscle V6 (right) has 220 hp.



Evinrude 140 (above, left) uses crankcase impulses to control its variable-ratio oil pump. Mariner V6 200 (above, center) has an auxiliary tank for its oil-injection system. Johnson's new eight (above, right) has a fish-line cutter in prop hub to eliminate tangled line that might damage the prop-shaft seal. Johnson's new V6 185 (below) replaces last year's 175 and 200 models. One-piece forged crankshaft adds strength.



Suzuki's 50-hp outboard (above) uses oil injection this year. As with all Suzuki outboards that have oil injection, it uses a mechanical worm-gear oil pump (left) that is driven off the crankshaft. As the crankshaft speed changes, the pump automatically delivers the correct amount of oil (arrows).

# Compact Disc

## IS NOW THE TIME TO BUY?

**W**hatever you've been hearing about the new Compact Disc players is likely to be true—if what you heard was good. A CD stores one hour of noise-free stereo sound on a tiny 4<sup>3</sup>/<sub>4</sub>-inch disc that's not particularly bothered by scratches, fingerprints and dust. In a CD player, the disc is read by an invisible laser beam and the information it yields is decoded from its digital format into a signal that any stereo amplifier can turn into very clean and accurate music.

Digital sound is an extremely precise computer description of the master tape original. There is no hiss, no blurred clarity and no decrease in impact. Since it is a nearly perfect storage medium for music, there is

no need to play tricks with the original master to get the music onto a Compact Disc. The result: wide-open, full-range sound.

Although there is a temptation to turn the volume up and hear what a digital *1812 Overture*, complete with cannon, sounds like, the most impressive demonstration of the CD system is to play very quiet music. Remember hearing some of those rich, deep chords in parts of *Star Wars*? It is possible, even with an inexpensive home stereo, to reproduce these same passages—with no hiss, no turntable rumble and with just as much deep bass as there is in the original recording.

If your loudspeakers will go down that low, you can



Compact Disc players achieve sonic perfection using a laser beam to read the small, rainbow-colored discs. Above (left to right) are: Sony CDP-101, with its super-fast search without distortion (\$900); Akai CD-D1, featuring variable-level output on back (\$1,000); Magnavox CD-1000, a top-loader with simplified controls (\$800); Sanyo DAD-8, with a separately controlled headphone output (\$599).

# Players

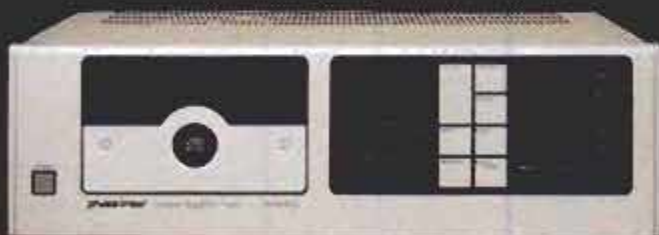
BY CHRISTOPHER GREENLEAF

even hear the softly plucked string basses of acoustic jazz as if they were right in your listening room. Another real discovery is the way bells, snare drums and castanets sound on a CD. Even with an inexpensive pair of speakers, the improvement over the 12-inch long-playing record can be almost startling.

All the Compact Discs offer more than just information on where a given song or band is. They also tell the player which part of a disc—to the second—is being played, how much time has elapsed on the whole disc or in one band, and how much music is left on the disc or in just the selection that's being listened to.

In future generations, CDs may also offer video stills. If you're an opera buff, your TV screen could

*(Please turn to page 135)*



Stack of disc players above reads like a who's who of audio. They sound even better than they look. From the top down: Hitachi DA-1000, which samples starts of selections (\$1,000); Kyocera DA-01, with easy-to-use programming controls (\$1,050); Phase Linear 9500, with variable outputs and easy cueing (\$995); Toshiba XR-290, with audio proof of control presses (\$1,000); Technics SL-P10, which can program 63 selections (\$1,000); and Sharp DX-3, which is an easy player to learn (\$950).



# COMING: The Fastest Train In The West

At 160 mph, these Bullets will take you from Los Angeles to San Diego in less than an hour.

BY DENNIS ESKOW, Science Editor; Illustrated by Willardson & White

**T**he sleek, silvery machine bombs down the roadbed at a hot 160 mph, leaving the nearby freeway traffic in its dust. It speeds along railroad tracks, but the noise it makes is closer to the buzz of a gliding speedboat than the din of a fast-moving railroad train. It's the California Bullet, flying down the Amtrak corridor from Los Angeles to San Diego in 59 minutes. The fastest train in America operates only on paper today, but it's slated to become a \$3 billion reality by the Fourth of July in 1987.

"We want to get off to a smooth start, so we're going to rely almost entirely on established Japanese technologies," says Nick Brand, director of planning for American High Speed Rail, the company that will operate the nation's first bullet train. Japanese and French bullets have been running at speeds of over 140 mph since the 1970s, but nothing

rolling on American rails has even come close.

The California Bullet operators have already completed studies of the Santa Fe railroad trackbed that will carry 100 trains a day between Los Angeles International Airport, downtown Los Angeles and downtown San Diego. Late next month, the rail company will submit an environmental impact statement to the California Environmental Protection Agency. And, before year's end, contracts will be awarded to several firms for building trains, laying special high-speed track and digging a series of tunnels to take the Bullet through Southern California's mountains.

Whether it's built in America or Japan, the first American bullet will use Japanese motors and power-collection systems. Two locomotives—one at the front and one at the rear—will power 8 to 10 cars. The



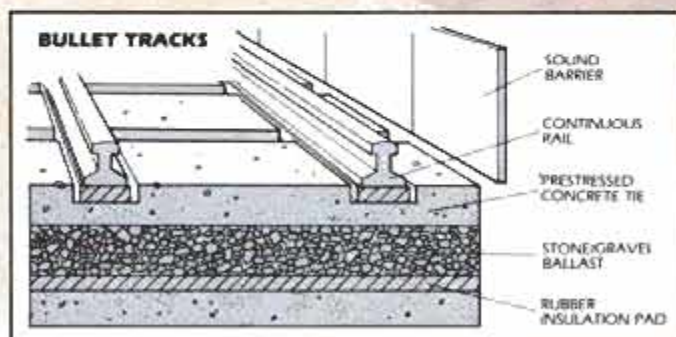




locomotives house the train's power transformer, converting d.c. power supplied by an overhead wire to a.c. power for distribution to the individually powered axles.

"We'll tap into the Southern California power grid's 250-kv. lines for our energy," says Brand, adding that the train will need several substations along the way to transform the utility's power to 25 kv.

The interiors of the trains will differ greatly from their Japanese counterparts. The American version will have fewer seats per car in an attempt to provide legroom and traveling comfort. The line operators expect to attract 100,000 passengers a day by 1988, the first year



Artist's conception of first American bullet (above) is streamlined and low to the special track joined by prestressed concrete ties (left). Another concept shown on PM's cover would have upper and lower compartments. All proposed American bullets would run power from the locomotive to motorized axles on each car.

of full operation. In addition to luxury seating, the American trains will include a bar car.

The outer shell of the American bullet will be far sleeker than the original. "The Japanese train goes through snowy territory," explains Roger Ansbarger, consulting engineer to the U.S. Department of Transportation. "A high-speed train in California wouldn't need a snowplow in the front, so it could be more aerodynamic."

Traveling at average speeds of about 140 mph, the California Bullet will use

special tracks with prestressed concrete ties atop stone and gravel ballast, supported by a rubber insulation pad on concrete. To lay down the new track, American High Speed Rail will take up most of the current Santa Fe railroad 100-foot right-of-way. The present tracks support trains with top speeds about half that of the Bullet and use about 20 feet of right-of-way.

Digging tunnels at mountain locations in the La Jolla and San Clemente areas is about the lowest-tech item on the rail company's list of priorities.



A Japanese bullet makes a stop at a station in Tokyo. American models will be sleeker.

## PM EXPERIENCE: Riding The French Bullet



France's TGV bullet reaches speeds of up to 165 mph. The motorman goes along for the ride since the train is controlled by microprocessors in the tracks.

If you're going to ride France's *Tres Grande Vitesse* (very high speed) train, get one northbound from Lyon or—even better—from farther south. Boarding at Marseille or Avignon, you'll twist along the Rhone River at merely 80 to 90 mph. Heck, that's Amtrak stuff. But once Lyon has drifted by, things begin to happen.

At Sathonay, a northern suburb of Lyon, the TGV shunts onto its own roadbed. Assuming the interval is correct, as monitored by the TGV central command post 240 miles away in Paris, the *mecanicien* (engineer) gets an authorization to increase his speed. He'll get either a direct digital indication of the maximum, 165 mph, or one of several intermediate steps.

The engineer is alone in the cab. If he doesn't respond to the changing digital inputs on his panel within seconds, the train can be brought to a stop automatically. These signals are fed through the tracks, changing every

1,700 meters as the train enters a new electrical "canton" (discrete circuit).

Even at relatively low speed, the smoothness of the roadbed, heavily ballasted with concrete ties, is apparent—and welcome. Before we know it, we are hitting 165 mph, or better.

Yet it all seems so... conventional. Water, or whatever you're drinking, sits level in the glass on your seat tray.

The standard TGV unit—eight cars with locomotive power at each end totaling about 8,500 hp—could routinely operate at speeds near 200 mph.

Non-French planners were prone to call the \$1.5 billion TGV system, including road-

bed acquired and built at the cost of \$4 million per mile, an "extravagance" when it was first announced. Now, as passenger revenues run far ahead of projections, they are silent. This fall, the final 65-mile stage on the Paris-Lyon high-speed line will open, further cutting what was in 1930 a 3-hour, 50-minute trip to two hours flat.

—Robin Nelson

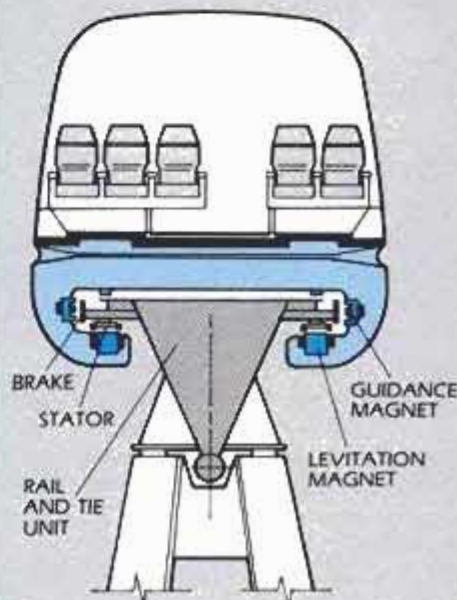


The smooth *Tres Grande Vitesse* offers first-class comfort, including bar car.

This past summer, West Germany's "maglev" train—two sleek, cream-and-green-colored cars accommodating 196 passengers in first-class jetliner comfort—began zipping along at speeds of over 200 mph on a specially built 20-mile test track between the villages of Lathen and Doerpen in northern Germany.

The "Transrapid-06" vehicle is 178 feet long, 12 feet wide, 10 feet high and weighs an astonishing 224,000 pounds, every ounce of which is kept aloft over the track edge by 64 powerful levitating and 56 guiding electromagnets. When it moves, the only sound inside is a faint, pleasant hum.

However, a reduction in funding by the West German railroad authority may prevent this maglev from getting beyond the trial-run stage. But if the technology "flies" over the next year



The maglev's upward-pointing "longitudinal flux magnets" make the vehicle rise above the tracks. These magnets lift the train with a force of nearly 1.8 tons per magnet. Guiding magnets at the sides of each car pull the train along the special rail at speeds of up to 200 mph. Maglev trains may be in the United States by the 1990s.

"The rock is so soft you can mine it like a coal mine," Brand explains. "Work can start less than two years before we begin operation."

High-speed railroading is potentially the wave of the future in American intercity travel. With an undisclosed amount of cash from Japanese backers, the California enterprise received a stateside boost last summer when the First Boston Co. announced it will help arrange backing from American investors. Meanwhile, the California company has plans on the drawing boards to

build high-speed systems linking Houston and Dallas and perhaps Miami and Orlando, Fla., by the end of the century. On a similar note, the U.S. Department of Transportation is studying a possible maglev high-speed system to connect Los Angeles with Las Vegas.

"We hope to contribute to a revival of the rail-car-building business in America," Brand says. "Japanese technology is just a starting point. I can see American aviation manufacturers and others providing concepts for second-generation bullet trains." **PM**



American bullet will have a two-man cockpit like its Japanese forerunner shown here.

## WILL MAGLEV FLY?

and a half, maglev trains may be operating in the United States by the 1990s.

Transrapid is the result of 13 years of development by a West German consortium. The current testing calls for 18 hours of daily commuter operation under all kinds of weather conditions and temperatures. "I've been waiting for this moment for almost five years," gushed Günter Steinmetz, chief of the project. "Of late, we Germans have fallen behind in the high-technology race. But for the first time people will not be saying that we've 'reinvented the wheel.' In fact, we've abolished it." This past spring, the operational Transrapid was rolled out onto a guideway that is entirely elevated, set on airy, concrete pylons so that the vehicle operates 16 to 20 feet above the ground.

The U.S. Department of Transportation has already approved the Transrapid as the basic vehicle for a proposed 8,800 passenger-a-day Los Angeles to Las Vegas connection. That system is still in the conceptual stage, but federal officials have said that the Transrapid's success could lead to funding for the American version.

Though Transrapid is slower than its Japanese competition—whose experimental vehicles have hit more than 320 mph over very short hauls—the German electromagnetic technology is less complicated. Transrapid, for example, does not require the vestigial wheels that the Japanese vehicle needs when resting and starting up.

"Levitation is as simple as using a toy magnet," said Peter Wurm, a consortium engineer. He compares the system



Transrapid guideway is elevated 16 to 20 feet above ground on concrete pylons.

to a three-phase synchronous electric motor. The stator, which provides the energy that turns the rotor, is laid out in the track. The rotor, that part of any electric motor which actually moves, is the train itself. Even the power source is conventional, drawn from a 110-kilovolt high-tension line.

Each of the two cars has 60 magnets painted bright red, measuring 59 inches long and about 12 inches square. They are held in place within the bogies by hinges and powerful primary springs. Thirty-two of the magnets, 16 on each side of each car, are mounted horizontally so that they point up to the underside of the track where the iron-cored stator packs are located. These are the longitudinal flux magnets that levitate the vehicle, lifting it up toward the stator packs in the track with a force of nearly 1.8 tons per magnet. The other 28 magnets, 14 on each side of the car, with a magnetic flux perpendicular to the track, serve to guide the train.

The trial program will check the general performance of the vehicle under simulated long-distance conditions. The program will also examine the viability of the track, as well as other factors.

"Everything now depends on these trials," said Gert von Lieres of the West German consortium. "But we are confident that by the mid-1980s, Transrapid will have proven itself."

—John Dornberg



Side view of Transrapid shows guiding magnets that keep the 178-foot-long train on its forward run. Each car has a total of 60 magnets. Power is from a 110-kilovolt line.

# Add-On Dream Shop Packed With Ideas

This addition is loaded with custom features and storage systems you can use in your shop.

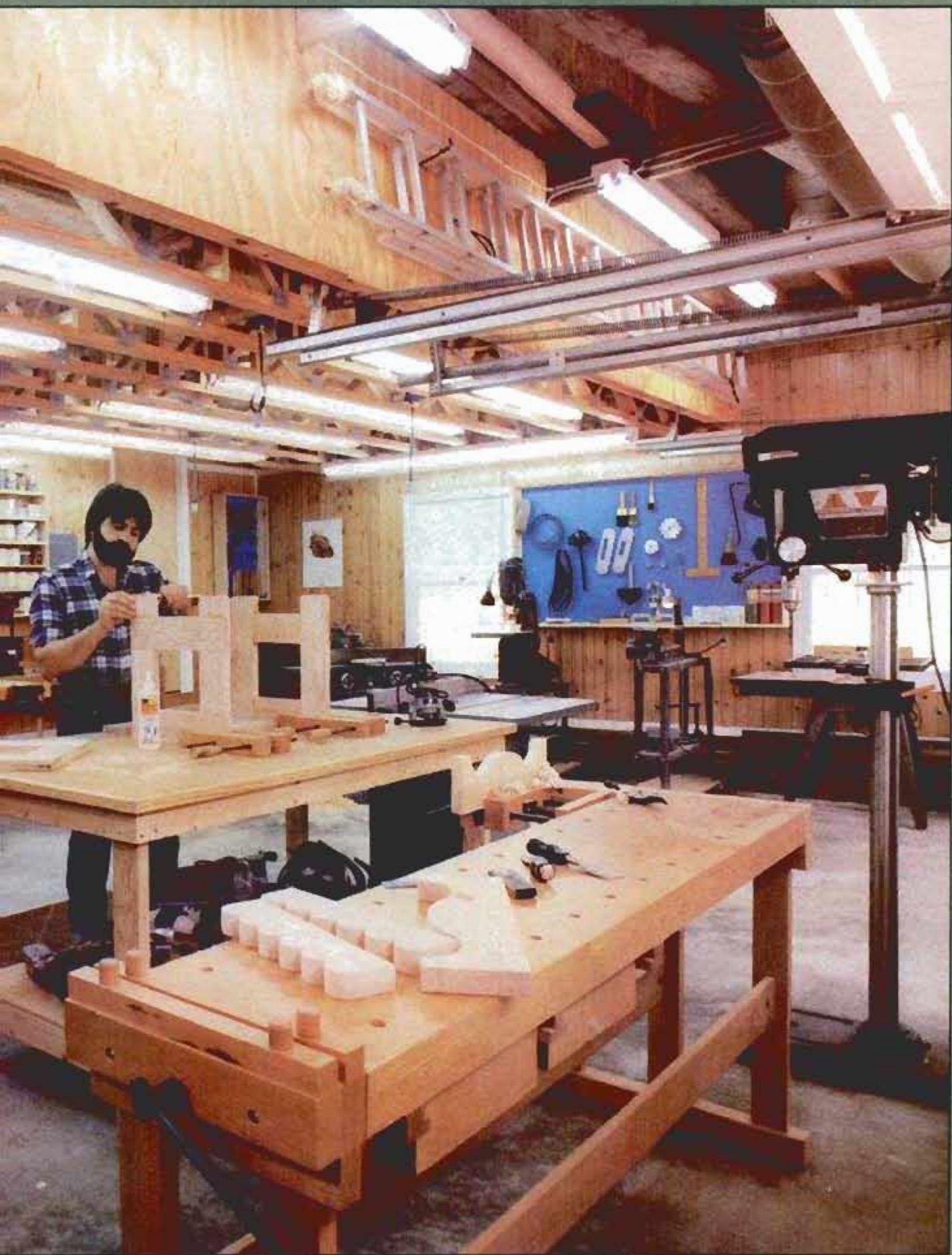
BY AUGUST AND SUSAN CAPOTOSTO

House addition designed by Leslie Walker, AIA  
Shop design consultant: Rosano Capotosto

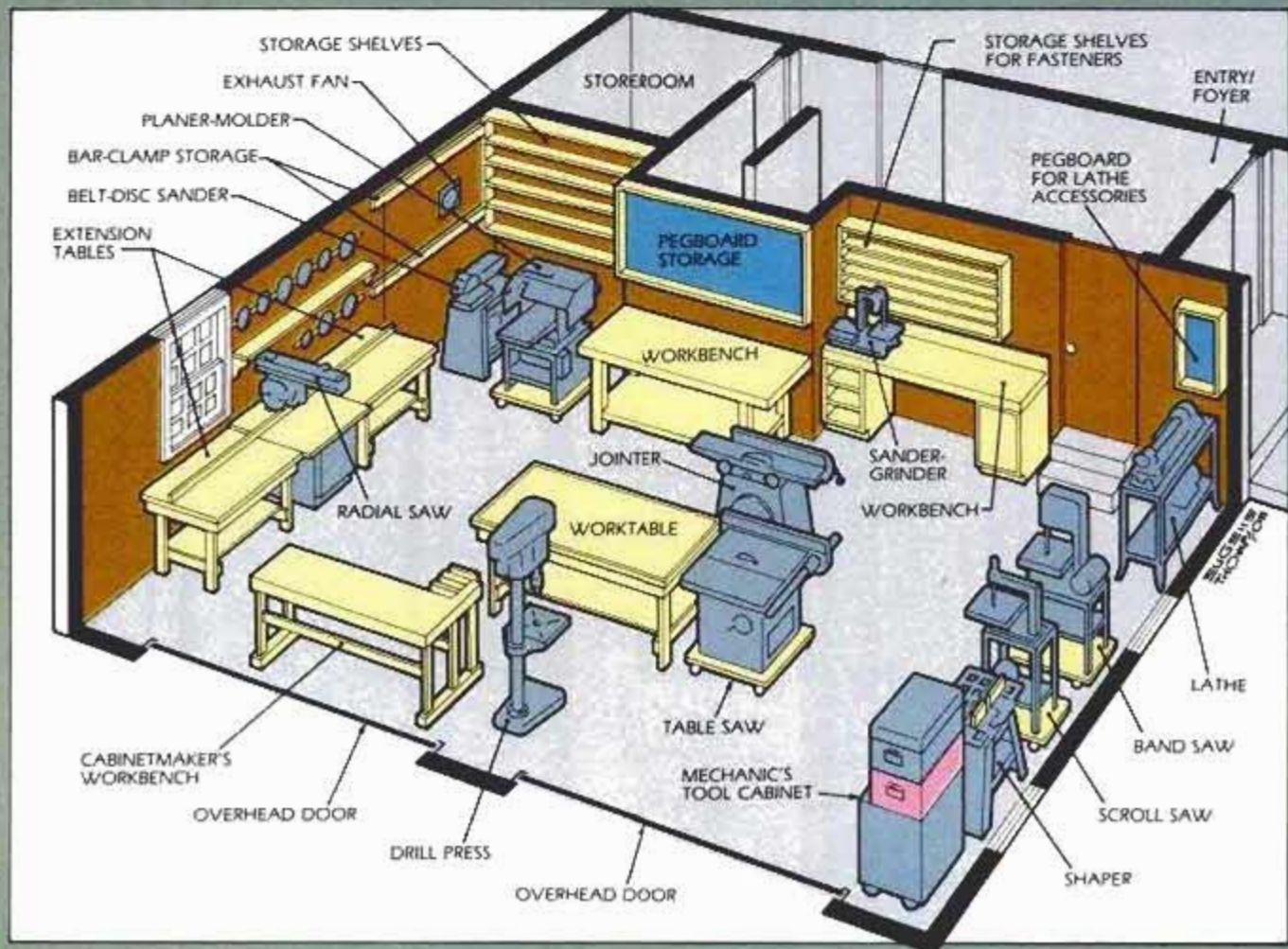
**A**lthough we'd always enjoyed our small home, we had minimal space for woodworking and craft activities in the basement. Occasionally, we flirted with the idea of adding a shop wing to the house. This came to a head when we both became deeply involved in still another activity—food preserving. The only logical location for this operation was in the basement. Thus, the workshop became even smaller. That was the last straw, and we

View from the garage doors (right) displays storage space under tables, on walls and overhead. Door at back leads to house. Exterior view of shop wing (below) shows second-story window of crafts studio.





The workshop contains over 600 sq. ft. of floor space (see floor plan at bottom). Equipment on plywood dollies is stored in the nook (below), where a six-tier shelf holds canned shop items. A recessed space at floor level stores lumber on dollies. Platforms at both ends above the overhead doors (right) provide extra storage space. A 20-ft.-long shelf above the doors holds molding and strip stock. The space between the overhead doors (below, right) holds a drill press and shelves.



POPULAR MECHANICS  
**Great Shop**



Hand tools are stored above workbench on a Peg-Board toolrack. Screwdrivers are stored in holes bored in the ledge. Plans for building rack are on page 99.

began making plans for a shop/crafts studio wing.

The requirements for an efficient woodworking shop were basic: adequate space around stationary power tools and workbenches to allow clearance for large workpieces, plenty of storage space for tools and lumber, sufficient electrical power plus good lighting and ventilation.

We used graph paper and cardboard templates scaled to size to represent currently owned machines and workbenches, and anticipated acquisitions. Then, we arranged and rearranged the templates until we came up with the ideal floor plan for our requirements. However, this tentative arrangement established the need for a gigantic shop wing out of proportion with the rest of the house. To compromise, we planned to mount some power tools on casters and store them out of the way when not in use. To minimize shop noise in the house, we designed a buffer zone. Part of this area was to be a storeroom, with the remainder used for food preserving work. However, the buffer zone turned out so well that we decided to use it as the house foyer. We needed to put in a handicrafts studio, so a second floor was planned. This also offered the opportunity to improve the exterior lines of our house.

During the preliminary planning stages, we consulted our local building department many times to be certain that our plans conformed to the building code. When our rough plans were finalized, archi-

*Do you know a shop that we should consider for the Popular Mechanics Great Shop Series? If so, tell us about the owner and send snapshots plus a description of the shop to: Home and Shop Editor, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. If we're impressed, too, we'll visit the shop, photograph it and share it with PM readers.*

The new foyer (left) now includes the front door and stairs leading to crafts studio. The bright and airy studio (below) provides about 375 sq. ft. of floor space.



POPULAR MECHANICS  
**Great Shop**

tect Les Walker developed a design and made architectural drawings for construction.

Our next move was to make a complete shopping list so we could check prices and figure the total cost. After finding that the project was within our budget, we decided to enlist outside help with the foundation, slab and framing. The total outlay for the 1,200 sq. ft. shop wing was under \$18,000.

The spacious new shop inspired me to upgrade my stationary power tools with the following: Rockwell's 10-in. Unisaw and 6-in. deluxe long-bed jointer; DeWalt's 10-in. No. 7749 radial-arm saw; and the Sears Craftsman planer-molder, 15-in. drill press, high-speed shaper, and sander-grinder. Since the radial-arm saw requires ample work clearance on both sides, it is located on a wall which is shared only by movable tools. This allows long workpieces to be handled without obstruction.

Two simple but sturdy work support/storage tables were built to adjoin the saw (see construction drawing on the next page). The plastic laminate tops lie in the same plane as the saw's table. Backup extension fences attach to these tables. Two sets of holes in the tabletops permit backshifting the fences whenever the saw fence is repositioned for maximum width cutoffs.

One of our goals was to ensure adequate storage. We designed open shelves below all of the worktables to store shop accessories. On the wall to the left of the overhead doors, above the radial-arm saw, a narrow shelf and strips with angled projecting dowels hold accessories and saw blades. Farther along this wall are strips with projecting

*(Please turn to page 118)*

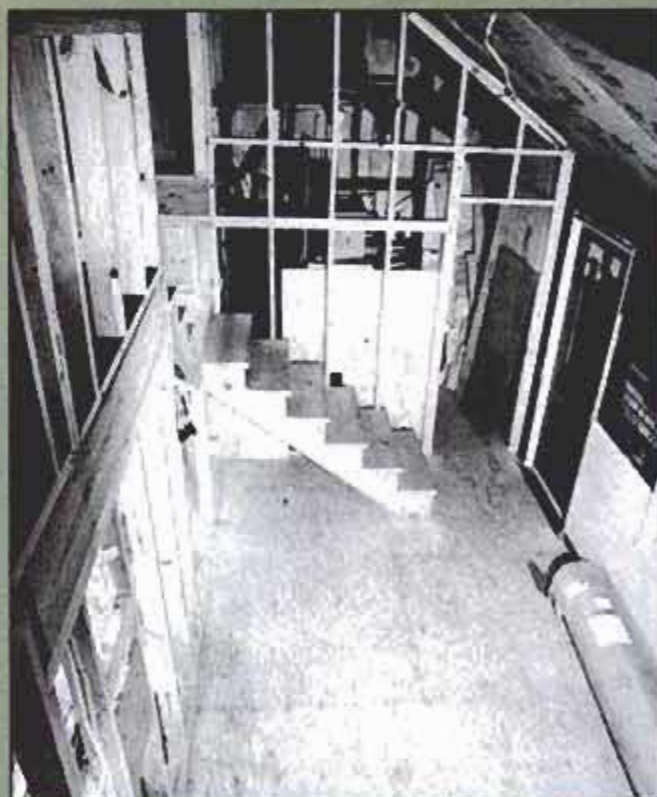
To gain support for long work, radial-arm saw is nestled between two tables. Both have drop-in fence extensions.



The 2x4 wall framing is almost complete. Anchor bolts spaced every 8 ft. in the masonry secure the mud sill to the slab.



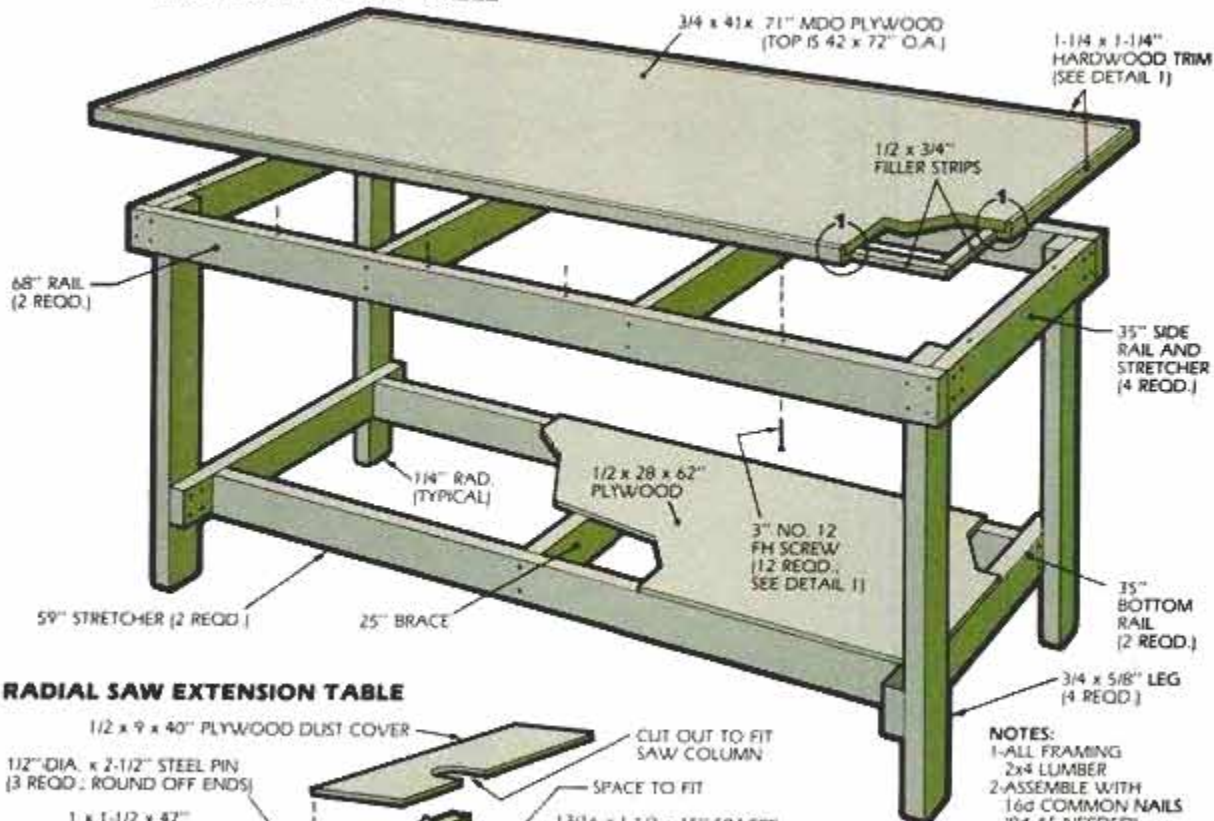
Photographs showing wiring paths on all sides of the room were taken for reference, should work on the walls be done later.



Storeroom boasts great deal of overhead space, which is used for studio storage. Similar storage is also over the entry door.

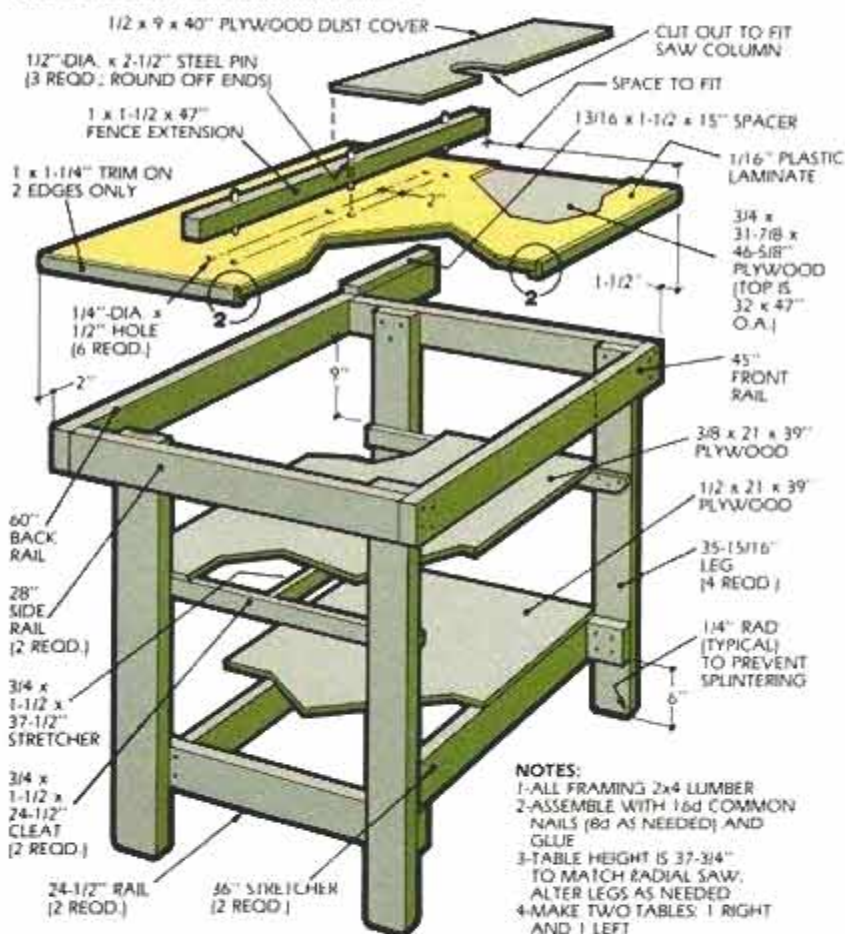


## TABLE SAW BACKUP TABLE

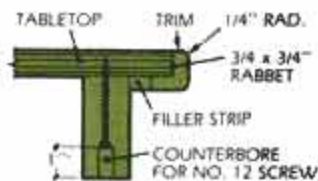


- NOTES:**
- 1-ALL FRAMING 2x4 LUMBER
  - 2-ASSEMBLE WITH 16d COMMON NAILS (8d AS NEEDED) AND GLUE
  - 3-TABLE HEIGHT 35-3/8", 1/8" LESS THAN TABLE SAW; ALTER TO SLIT

## RADIAL SAW EXTENSION TABLE

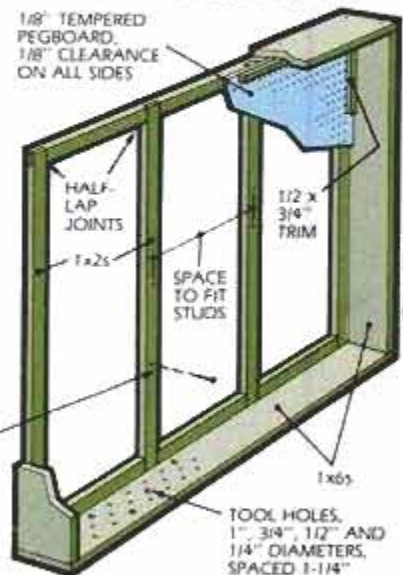


- NOTES:**
- 1-ALL FRAMING 2x4 LUMBER
  - 2-ASSEMBLE WITH 16d COMMON NAILS (8d AS NEEDED) AND GLUE
  - 3-TABLE HEIGHT IS 37-3/4" TO MATCH RADIAL SAW; ALTER LEGS AS NEEDED
  - 4-MAKE TWO TABLES: 1 RIGHT AND 1 LEFT



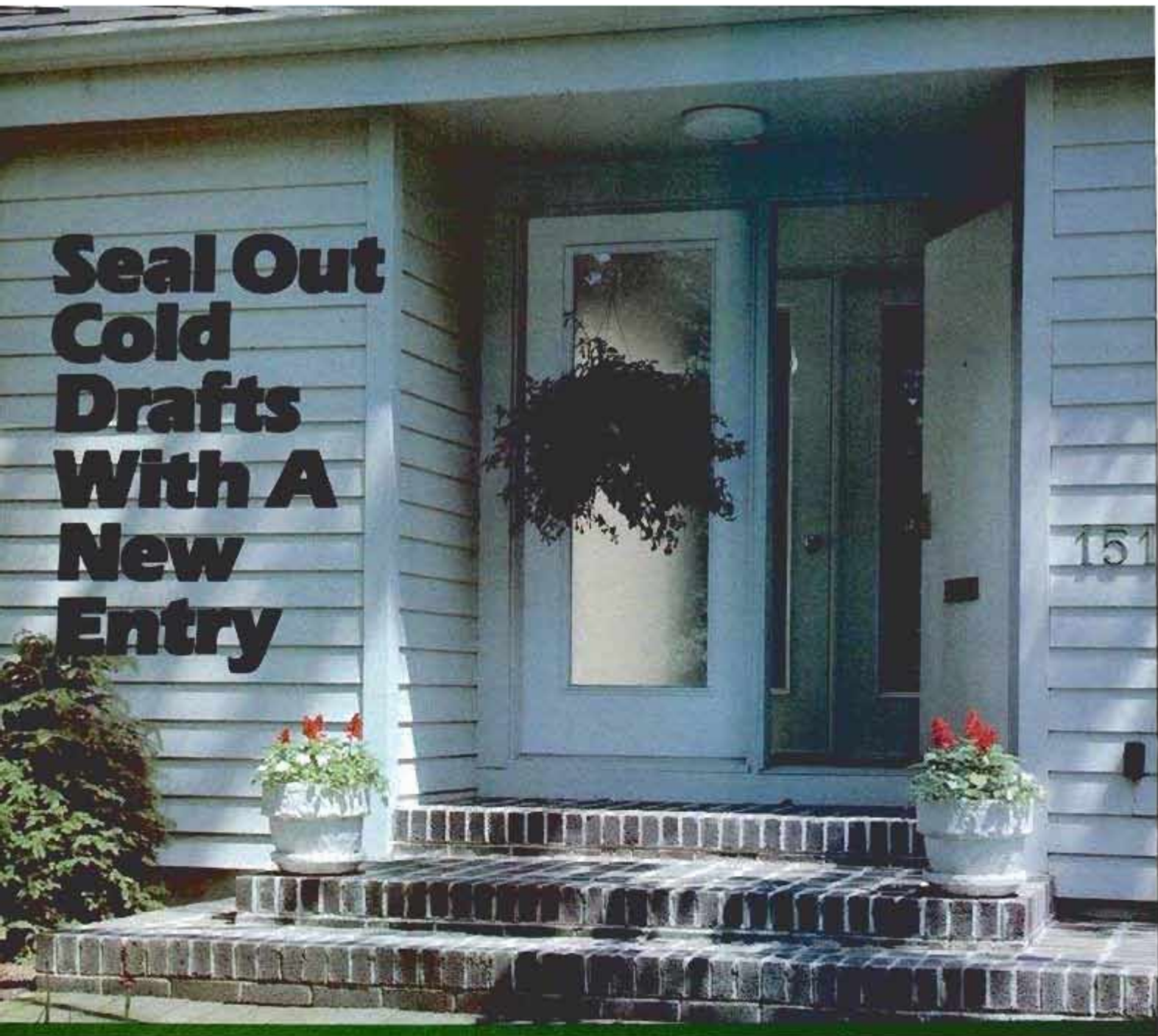
DETAIL 1

## PEGBOARD TOOL RACK



DETAIL 2

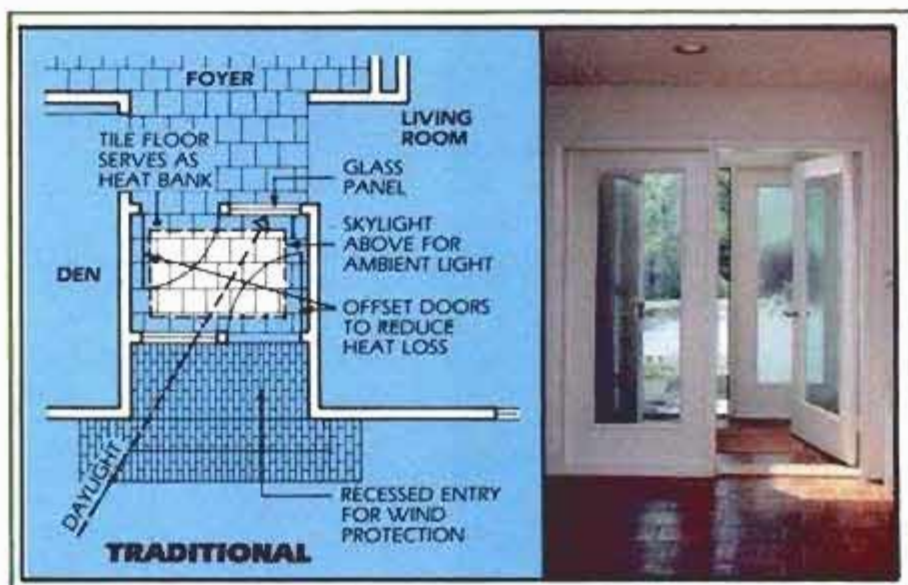
# Seal Out Cold Drafts With A New Entry



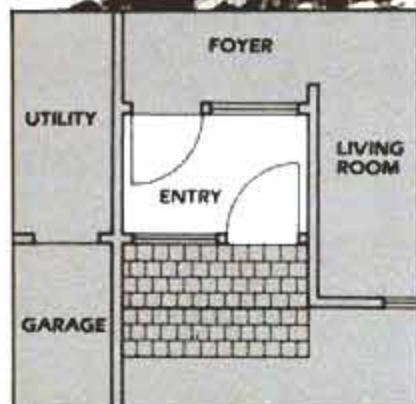
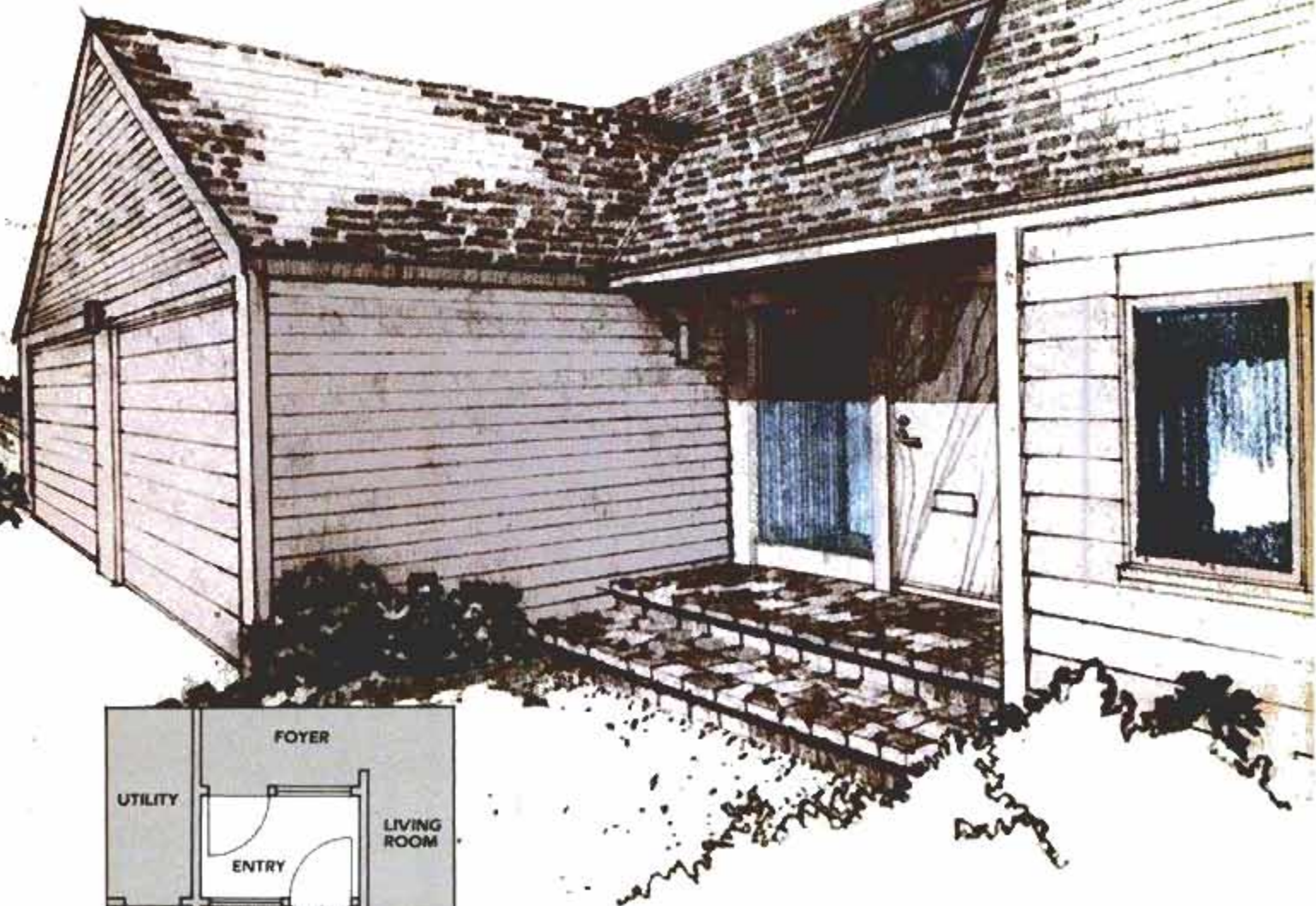
Besides being protective enclosures, vestibules are handsome additions.

It's commonly called a vestibule or, among builders, an air-lock entry. A small entry room leading via a second interior door to the main part of the house has three distinct advantages: It can offer aesthetic appeal, it maximizes creature comforts and it reduces heat loss.

A well-designed vestibule, added to a home's exterior, creates a focus of interest and dramatically changes a home's appearance. Both exterior vestibules (those added onto the existing home) and interior vestibules (created within the existing home by partitioning off part of the foyer) add to family



Shown above are the floor plan and interior view of a traditional house entry.



We added an entry to this contemporary home much like the one in the traditional house on the preceding page, to show that entries can be adapted to suit a home. The addition was made by partitioning off the front of the foyer (see plan). Narrower foyers that don't require a fixed window or other panels would be simpler to build in most cases.

comfort by blocking wind gusts from entering the house. Properly designed and properly used, both types of vestibules serve as a buffer between the weather and a house's living space to reduce heat loss.

Such an entry is not fully effective unless the outside door is closed before the inner one is opened. They're also not effective unless the inner door is closed each time a person passes through it. This may involve reconditioning the family attitude about doors.

The entry shown on the preceding page was actually included in the architect's original plan for a traditional house with classic touches. It incorporates design features and materials to be discussed that make it an effective air-lock entry. We added a similar entry

to the contemporary home shown above (see floor plan) by partitioning the front of the foyer. We added exterior air-lock entries to two other popular home styles on the following pages. Our aim was to show that an entry room could be added gracefully to almost any style home.

### Important design features

There are several design features that will ensure an effective entry. First, the position of the doors is important. An exterior door which is recessed—that is, set back from the house's front plane—gains protection from airflows. Offset doors—one opening from the right and the other from the left—form a baffle to deflect airflow.

On the other hand, if the doors aren't offset, you can use the main entry as a means of ventilation in summer, by using a screen door and supplying an outlet such as a back door for airflow. In

a small space, an exterior door that opens outward is more convenient to close before the interior door is opened. (But then you cannot screen the entry.)

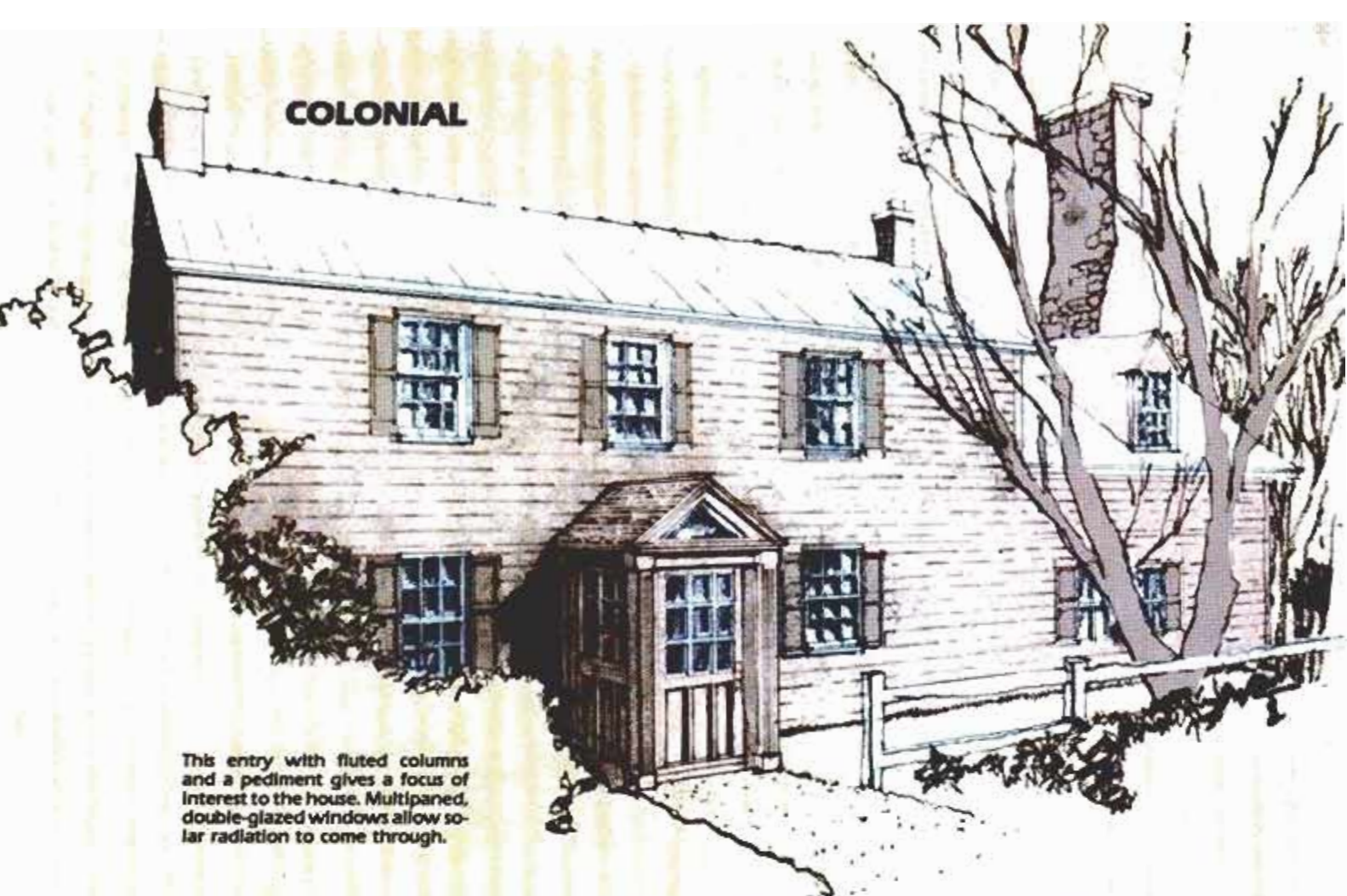
Shading devices for solar control and window insulation for entries with glazing are advantageous. Overhangs block summer radiation, yet let in the lower angled radiation during winter. Exterior awnings and shutters are even better than overhangs at excluding such radiation. Yet in winter we want the sun's warmth during the day. We can cover the windows at night with insulated shutters or insulated fabric to reduce heat loss. Shrubs and trees planted near an entry act as shading devices in the summer and as windbreaks in winter.

### Effective entry materials

To be an efficient buffer zone, an air-lock entry should be built of materials that reduce heat flow. Since more

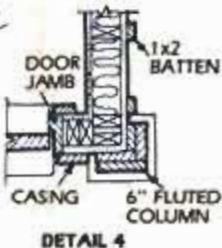
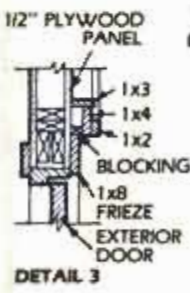
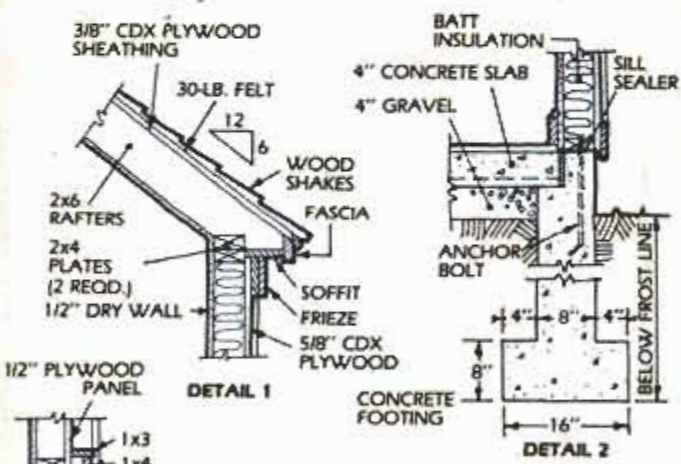
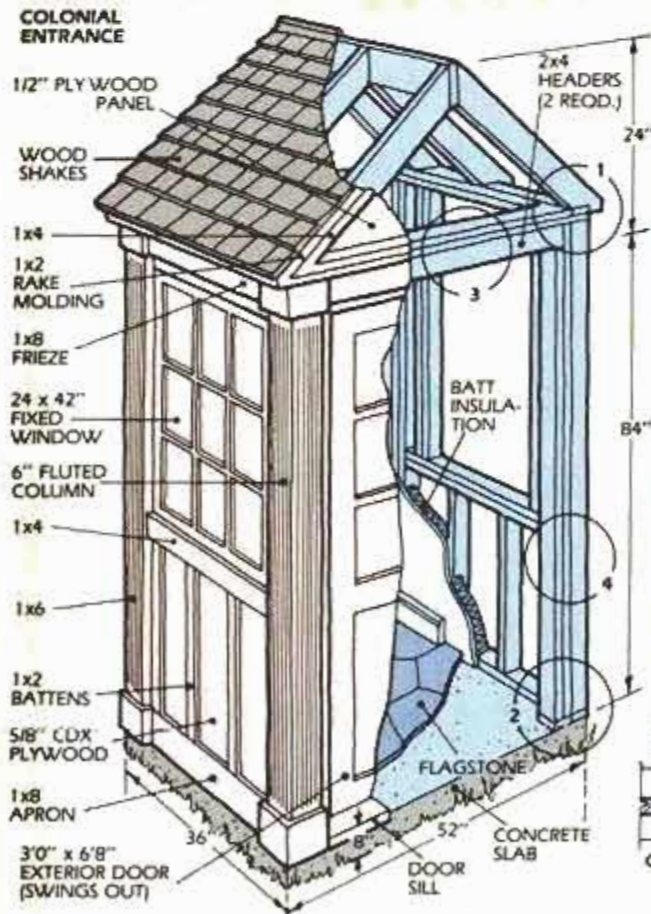
PM color photos: Jim D'Addio  
Illustrations, architectural design: Ira Grandberg  
Technical art: J. Dyck Fiedlerus

# COLONIAL



This entry with fluted columns and a pediment gives a focus of interest to the house. Multipaned, double-glazed windows allow solar radiation to come through.

## COLONIAL ENTRANCE



energy is lost around a door than through it, weatherstripping, threshold design and a properly fitted and hung door are important on the interior and exterior doors. As with the rest of the house, insulation in the entry walls and ceiling helps reduce heat flow.

Double glazing on windows reduces heat loss over a single-pane window by over 40 percent. Windows should also be completely caulked or weatherstripped.

In general, light-colored materials such as white walls, white marble and polished aluminum reflect rather than absorb radiation, and will help maintain lower temperatures within a structure. Materials such as red clay brick, quarry tiles, gray paint and black panels absorb radiation and can be advan-

tageous in the winter. Not every house can accommodate the recessed type of entry shown on the previous pages. Two common house designs that might well require a different approach are shown on these pages: a two-story colonial and a Cape Cod.

To give a basic idea of what is involved in building one of these add-on entries, we've supplied the drawing on the facing page and comments about good building practice.

### Adding an exterior entry

If you decide to do the work yourself, excavate to the depth for your area that will put footing bottom below the frost line. Then, build forms for the footings. Pour the concrete to the top of forms and screed it level. Cover overnight, if

### Wall construction

Begin by framing the three exterior walls. Build them on the ground; they'll be lifted upright later. Bore holes through the bottom plates for the anchor bolts. Next, position a straight 2×4 up flat against the house wall, so its outside edge is placed where the outside of the fluted 1×6 trim board on the entry sidewall will fall.

Plumb the stud, then draw a line along its outside edge onto the house siding. Cut along this mark using a circular saw with its blade set to a depth that cuts the siding, but not through the sheathing underneath. Do this on both sides of the entry and remove the siding in between. Repeat this procedure for the rafters. Be sure to al-

trim the rafter tails as shown in the drawing. Install the plywood panel for the pediment above the new entry door. Next, sheath the exterior walls, install both windows and the door and complete the remaining trim details as indicated. Keep in mind that the entry door swings out, so it requires fixed-pin butt hinges—not the removable pin type—for security purposes. Sheath

## CAPE COD



necessary, to prevent rain damage. Wait three or four days before continuing with the foundation block wall.

When constructing a foundation wall, be sure to install anchor bolts shown in the drawing. Your local building code will specify the size required, as well as spacing and placement. Wait two days, remove the forms, then backfill both sides of the walls with the dirt you excavated. (Note: Footings must be inspected before you backfill.) Use gravel as fill material for the top 4 in. within the foundation walls for proper drainage under the slab. Cover the gravel with 6-mil polyethylene (vapor barrier), then pour the concrete, screed it level and float it. Be sure to install wire mesh during the pour to reinforce the slab.

low for the sheathing and shingles.

Apply sill sealer to the top of the foundation walls and stand the two sidewalls in place. Brace them plumb, then secure them with washers and nuts turned onto the anchor bolts. Next, erect the front wall and nail all three together after checking all walls for square. Hold them that way with 2×4 diagonal braces secured to well-anchored stakes.

Attach the sidewalls to the house sheathing, using 3/8-in.-dia. toggle bolts. Install three toggles per side, spaced evenly over the height of the studs. Make certain that all walls are level, plumb and square before continuing. Run a bead of silicone caulk between the studs and the sheathing.

Install the rafters and ridge, then

Entry roof of this Cape Cod house is the same pitch as the house roof. Clapboard siding, glazing also are matched to house.

the roof and apply the 15-lb. felt. Bend the flashing over the felt so it lies flat on the roof and insert it under the house siding. Apply the shakes.

### Finishing

Install insulation between the studs and rafters and finish the interior with 1/2-in. dry wall. Also apply dry wall to the house wall where the siding was removed. Once the dry wall is taped and sanded, install the window and door casings and paint the interior. Apply the flagstone flooring and the baseboard above it, then prime and paint the exterior.



Table-saw tenoning jig allows safe, easy execution of lap, spline, and mortise and tenon joints. Here, a tenon is being cut for a mitered open mortise and tenon joint.

**PART  
1**

## 2 Great Woodworking Jigs For Your Shop

No matter what level your woodworking skills, these easy-to-make shop jigs can help you build more professional-looking projects.

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO

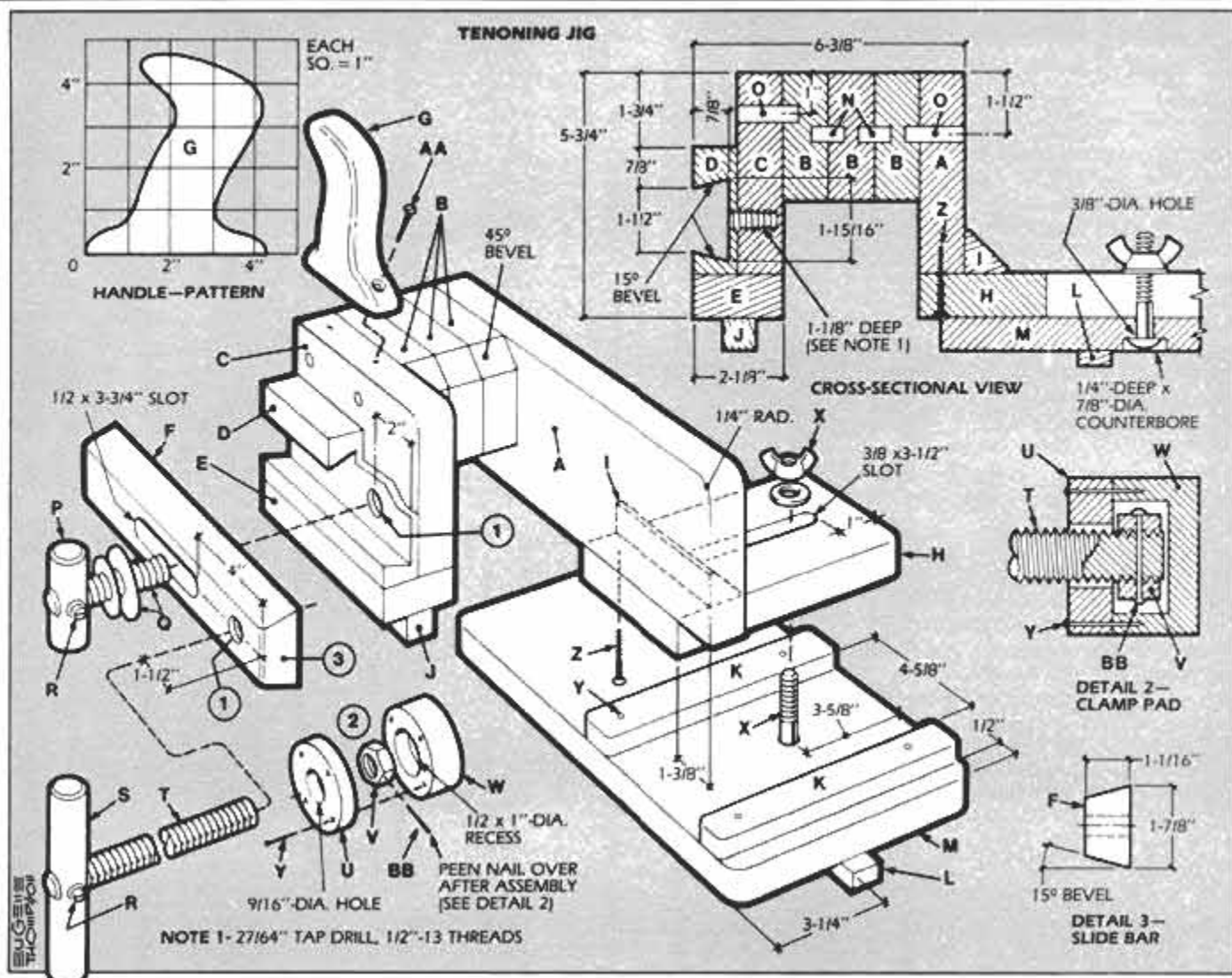
**E**very experienced woodworker has his favorite shop jigs and PM's Master Craftsman is no exception. Here, in Part 1, we show how to build jigs that range from the simple to the elaborate. But, they all have one common purpose: to help you create more expert woodworking projects with greater accuracy and safety.—*The Editors*

### 1 Table saw tenoning jig

A tenoning jig provides a safe and quick means of cutting intricate woodworking joints. Unfortunately, tenoning attachments cost as much as \$185. But here's the PM way to get a precision tenoning jig at a fraction of the cost—make it yourself, using our plans.

Build the jig of solid  $\frac{3}{4}$ -in. hardwood. We used ash, but maple or oak would work as well. The jig shown is designed for a 10-in. Rockwell Unisaw. Minor alterations may be necessary to accommodate other brands.

Start by cutting all the parts according to the materials list. To form the dovetail-shaped slide bar channel (D), first adjust the saw blade for a  $15^\circ$ ,  $\frac{3}{8}$ -in.-deep cut. Then, make two passes



over the blade to cut each angled side. Next, make repeated cuts, each time adjusting the blade progressively towards 0°, to remove the waste.

Dry-assemble the jig, with the work-bearing wall (A) perpendicular to the saw table and the carriage (H) at a right angle to the saw blade. Test the jig's operation before gluing and final assembly.

Protect the jig with several coats of clear satin finish. Apply paste wax to the sliding surfaces to reduce friction.

#### MATERIALS LIST—TENONING JIG

Key	No.	Size and description (use)
A	1	1 1/2 x 4 3/4 x 14 1/2" ash (work-bearing wall)
B	3	1 1/2 x 3 x 5 1/2" ash (spacer block)
C	1	1 1/2 x 4 1/2 x 7 3/4" ash (slide bar support)
D	1	1 1/2 x 2 1/2 x 7 3/4" ash (slide bar channel)
E	1	1 1/2 x 2 1/2 x 7 3/4" ash (support block)
F	1	1 1/2 x 1 3/4 x 12" ash (slide bar)
G	1	1 1/2 x 4 1/4 x 4 1/2" ash (handle)
H	1	1 1/2 x 4 3/4 x 7 1/2" ash (carriage)
I	1	1 x 1 x 4 3/4" ash (corner block)
J	1	3/4 x 3/4 x 7 3/4" ash (rest)
K	2	3/4 x 1 1/2 x 7 3/4" ash (cleat)
L	1	3/4 x 3/4 x 15 3/4" ash (guide)
M	1	3/4 x 8 x 15" A/C plywood (pad)
N	4	3/8"-dia. x 3/4" hardwood dowel
O	4	3/8"-dia. x 1 1/2" hardwood dowel

P	1	3/4"-dia. x 2" hardwood dowel (handle)
Q	1	1/2-13 x 2 3/4" threaded rod, 1"-O.D.
R	2	B-32 x 1" rh machine screw, washer, nut
S	1	3/4"-dia. x 4" hardwood dowel (handle)
T	1	1/2-13 x 6 3/4" threaded rod
U	1	3/4 x 1 3/4"-dia. ash (collar)
V	1	1/2-13 hexnut

W	1	3/4 x 1 3/4"-dia. ash (clamp pad)
X	1	3/4"-dia. x 2 1/2" carriage bolt, 1"-O.D. washer, nut
Y	4	3/8" brads
Z	2	2 1/2" No. 10 fh screw
AA	2	1 1/4" No. 8 fh screw
BB	1	No. 6 finishing nail (locking pin)

Note: Use nominal 3/4" ash (actual dimension: 1 1/16").

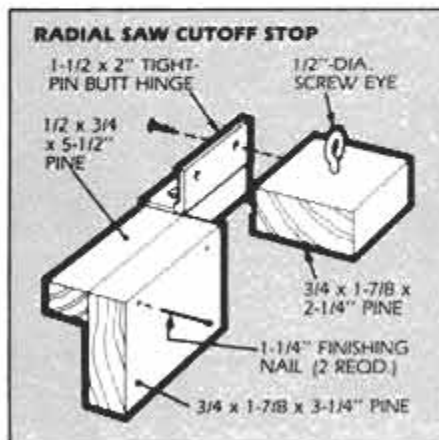
## 2 Radial saw cutoff stop

Although it looks quite simple, the radial saw cutoff stop is one of the most utilized jigs in the shop. To use it, simply clamp the stop to the saw fence at the desired distance from the blade.



Raised block provides room for the cut piece to move away from the blade. This prevents chipping and dangerous kickback.

Place the hinged portion of the stop down and butt the workpiece against it. Now, lift the hinged block by the screw eye and cut the wood.



## 3 Drill angle guide

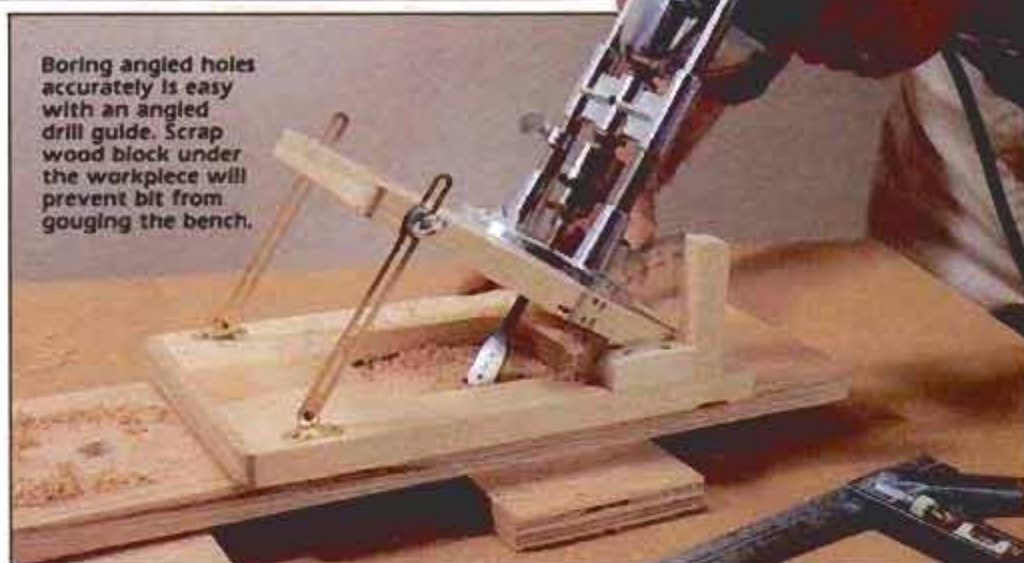
This jig allows a portable drill to bore angled holes with the precision of a drill press. A Portalign drill guide, available at Sears stores, is installed on the drill for mounting to the jig.

Begin by cutting the base (A) and platform (C) as shown. Oak strips glued to the end grain prevent warping. Now join the platform to the base with a continuous hinge. Next, install the protractor used to set the angle of the drill. Locate the protractor's centerpoint—where 0° and 90° lines intersect—directly over the center of the hinge pin. Mark an arrow on the platform edge, opposite the protractor's 0° line, to indicate the drill's angle.

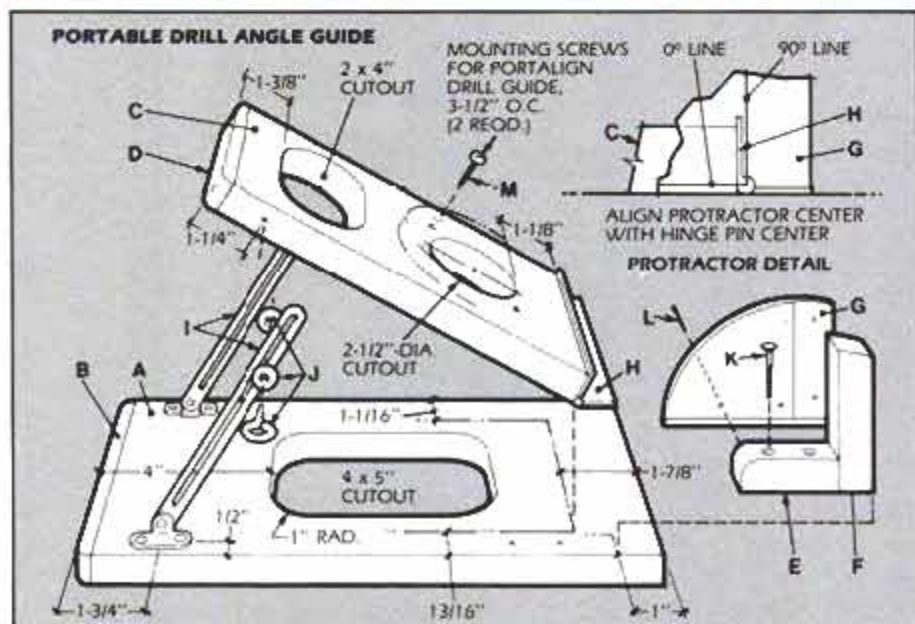
Two 6-in. lid supports are used to hold the drill at the desired angle. Discard the friction fittings that come with the supports and replace them with two 3/4-in. screw eyes. To set the jig, align the arrow with the desired number of degrees and tighten the screw eyes. Finally, glue 220-grit sandpaper to the jig's underside for a nonslip surface.

### MATERIALS LIST—DRILL GUIDE

Key	No.	Size and description (use)
A	1	3/4 x 7 1/4 x 12" pine (base)
B	1	3/4 x 3/4 x 7 1/4" oak (end strip)
C	1	3/4 x 5 1/2 x 8 3/8" pine (platform)
D	1	3/8 x 3/4 x 5 1/2" oak (end strip)
E	1	3/4 x 3/4 x 2 1/8" pine (block)
F	1	3/4 x 3/4 x 3 1/4" pine (block)
G	1	7 1/2"-dia. plastic protractor
H	1	1 1/2 x 5 1/2" continuous hinge
I	2	6" friction lid supports
J	2	3/4"-dia. screw eye, washer
K	2	1 1/4" No. 8 fh screw
L	As reqd.	3/8" brads
M	2	1" No. 14 panhead sheet-metal screw



Boring angled holes accurately is easy with an angled drill guide. Scrap wood block under the workpiece will prevent bit from gouging the bench.



## 4 Self-locking fence stop

This jig allows accurate execution of stopped cuts on a table saw. To use the jig, position it on the saw fence at the desired distance from the blade. Then, push down on the lever (B) to squeeze the clamping blocks (A) together, locking the jig to the fence. To release, simply lift the lever. The dimensions given

accommodate a 1-in.-thick fence. Alter the lever and steel plate (D) dimensions to suit other size fences.

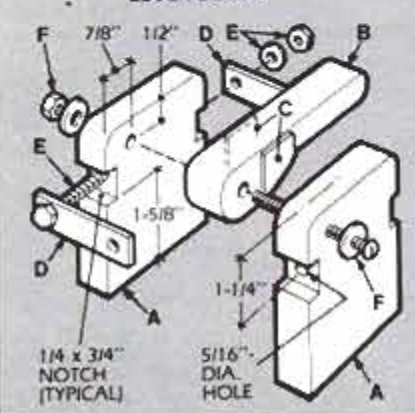
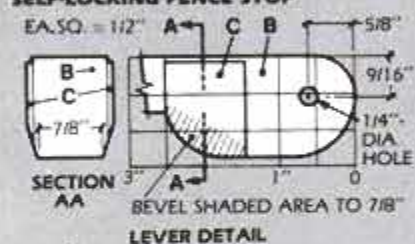
### MATERIALS LIST—SELF-LOCKING STOP

Key	No.	Size and description (use)
A	2	3/4 x 3 1/4 x 4" pine (clamping block)
B	1	1 x 1 3/8 x 5 1/2" pine (lever)
C	2	1/2 x 1/2 x 1 1/4" oak (wedge)
D	2	1/8 x 3/8 x 2 1/2" steel mending plate
E	2	1/4"-dia. x 3" machine bolt, washer, nut
F	1	1/4"-dia. x 3" rt bolt, washer, nut



With the lever raised, position the jig at the desired distance from the blade (left). Then, push the handle down to lock the jig so that you can make exact, repetitive stopped cuts.

### SELF-LOCKING FENCE STOP





# 5 Crosscut platform

Here's a time-saving accessory for use in the shop and at the jobsite. It provides precise 90° crosscuts and left and right miter cuts up to 45°, using a portable power saw. The jig shown is designed for a 5½-in. Skil trim saw and can handle a board up to 7/8 in. thick × 12 in. wide. Alter dimensions to support other saws and larger workpieces.

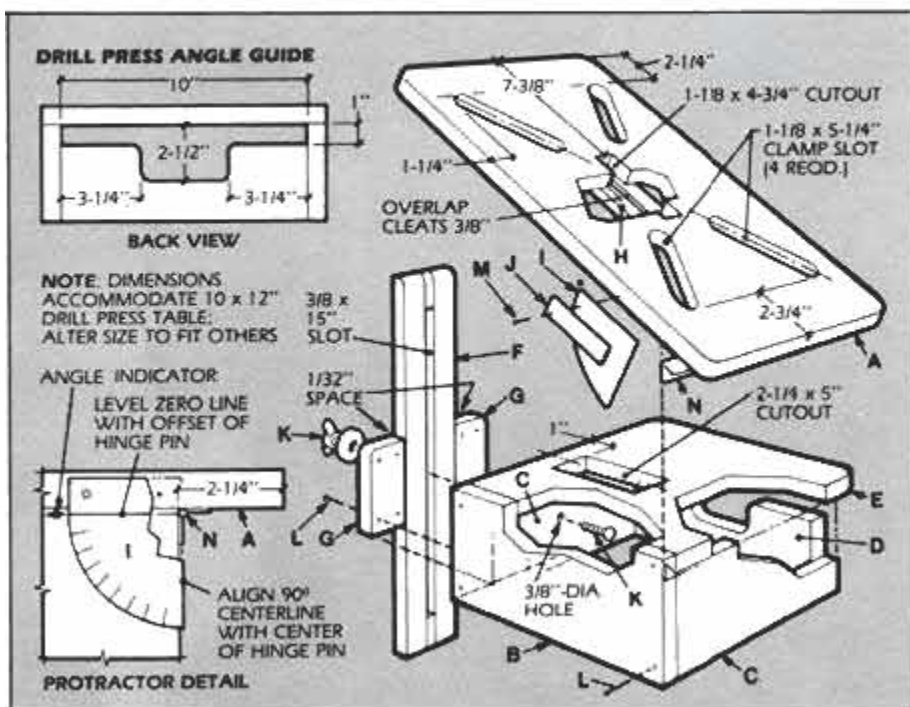
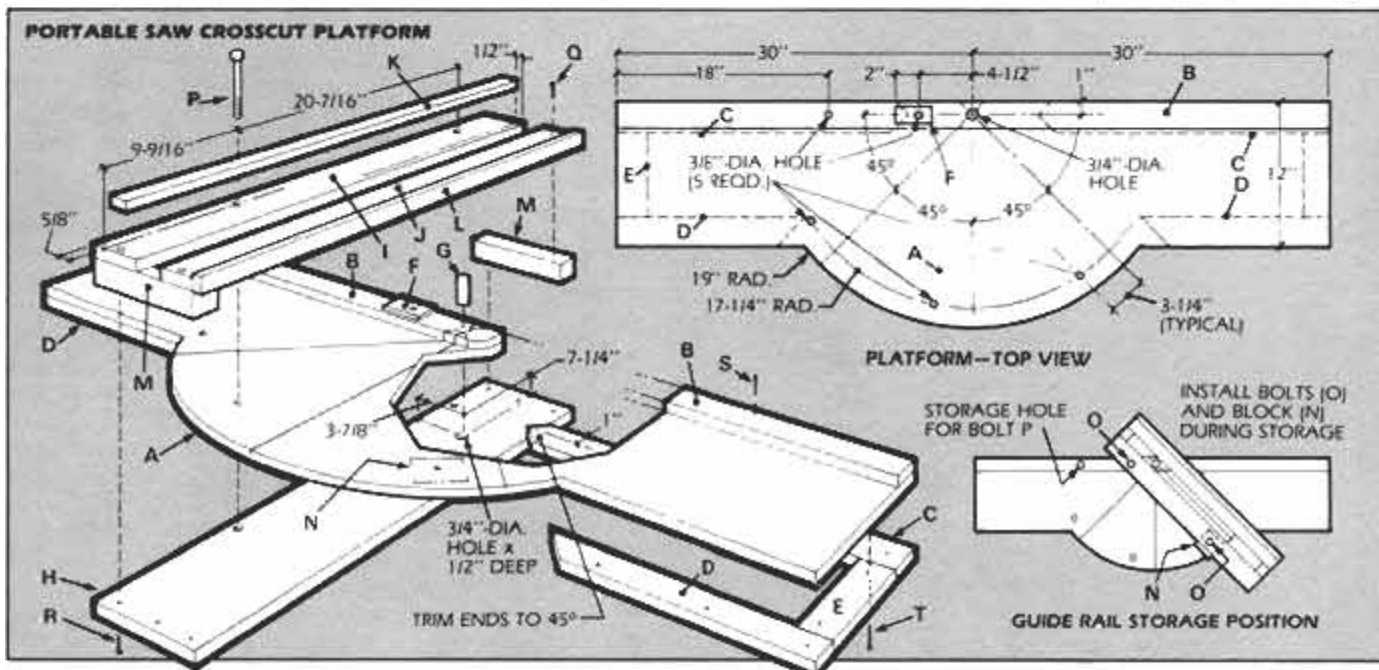
To set the guide rail for either 45° or 90° cuts, drop the positioning pin (P) into the appropriate hole. For cutting in-between angles, secure the guide rail with a C-clamp.

## MATERIALS LIST—CROSSCUT PLATFORM

Key	No.	Size and description (use)	Key	No.	Size and description (use)
<b>PLATFORM</b>					
A	1	5/8 × 20 × 60" particleboard (base)	Q	4	1½" No. 8 fh screw
B	1	3/4 × 2 × 60" pine (fence)	R	6	2" common nail
C	2	3/4 × 2½ × 24½" pine (cleat)	S		1½" finishing nail
D	2	3/4 × 2½ × 18" pine (cleat)	T		1¼" finishing nail
E	2	3/4 × 2½ × 7" pine (cleat)			
F	1	1/4 × 1½ × 3" oak (spacer block)			
G	1	3/4"-dia. × 1½" hardwood dowel (pivot)			
<b>GUIDE RAIL</b>					
H	1	3/4 × 7½ × 34" pine (base)			
I	1	3/4 × 3¼ × 34" pine (saw support)			
J	1	3/4 × 2½ × 34" pine (saw support)			
K	1	1/2 × 1½ × 34" pine (guide)			
L	1	1/2 × 1 × 34" pine (fence)			
M	2	1½ × 1½ × 7½" fir (end block)			
N	1	1 × 3 × 3" pine (storage block)			
O	2	3/8"-dia. × 4" machine bolt, washer, nut (storage bolt)			
P	1	3/8"-dia. × 3" machine bolt (positioning pin)			



Here, a 45° miter is cut. Notice that guide rail is locked in place by the positioning pin.



# 6 Drill press angle guide

Many drill presses have fixed or nonadjustable worktables, especially the more affordable home workshop models. This makes boring angled holes a difficult chore. The drill press angle guide shown features an adjustable table for quick, accurate angle settings. The jig slips over the existing worktable with no clamping or bolting. The dimensions of the jig shown accommodate a 10 × 12-in. worktable.

Start by cutting all the pieces according to the materials list. Construct the box so that its inside dimension equals the width of the drill press worktable. Alter the drawing's dimensions if necessary. Next, cut four long diagonal slots into the table (A) to permit the use of clamps. The rectangular cutout in the table center holds a solid wood backup

(Please turn to page 112)

# Refinish Furniture So You Can Be Proud Of It

Removing an old finish can be drudgery, but putting on a new one so that it looks professional is sheer joy.

TEXT AND PHOTOGRAPHS BY WILLIAM BEYER



Handsome oak chair is the end result of careful stripping, repair work and refinishing.

For many people, acquiring furniture is limited to a choice between new production-made pieces and older, high-priced antiques. But these needn't be the only options. Refinished furniture is a third choice: Its growing popularity is based on being such a suitable compromise between the other two.

Frequently, an older, well-designed piece of furniture can be obtained at bargain rates simply because its appeal has been obscured by a ruined finish. When properly reworked, such a piece can be made structurally sound again and given a new finish that will be durable for years to come. Following is a step-by-step primer to get you going on your own.

It's not always necessary to strip away the old finish from a fine piece of furniture to give it a professional face lift. Sometimes, an old finish has merely collected a film of wax and grime that can be easily removed.

To rejuvenate a shellac finish, for instance, mix a 50/50 solution of boiled linseed oil and shellac in a plastic detergent bottle and apply the mix to the surface, using a 4/0 steel wool pad. Work carefully with the grain, using short, light strokes. Repeat the process with a clean 4/0 steel wool pad to remove streaks left behind. As the piece dries, periodically wipe the surface with a clean cloth to remove any excess linseed oil before it dries in place. The oil has a tendency to leach, or "sweat" to the surface and can leave behind a mottled pattern if it's not removed.

To renew a varnish finish, mix two parts turpentine with one part boiled linseed oil. Work this lightly over the surface with 4/0 steel wool, then wipe off the excess using a clean, dry cloth. Always wipe in the direction of the grain. Allow the first application to dry for a few hours, then repeat the procedure. You may well have to go over the piece several times before the old finish is brought back to life completely.

## Make minor repairs first

Many minor repairs can be accomplished without any need for stripping. For instance, shallow surface scratches can be touched up with a high-quality paste furniture wax. When applying the

All stripping and refinishing products used for this project, as well as the electric burn-in knife shown on page 110, are manufactured by Mohawk Finishing Products Inc., Route 30 North, Amsterdam, N.Y. 12010

wax, rub first across the grain and then with the grain. Allow the wax to stand according to the manufacturer's directions, then rub it to the desired shine with a clean, dry cloth.

If, however, a scratch has penetrated through the finish and removed some of the stain underneath, use a colored wax touch-up stick to hide the scratch. These sticks come in a wide range of colors at paint and hardware stores.

Also available in different colors are similar products called shellac sticks. These are used to fill larger cracks and gouges that the wax can't hide. These sticks are melted on an electric tool called a burn-in knife, which functions much like a soldering iron. It maintains a temperature sufficient to melt, but not burn, the shellac. Once the shellac starts flowing, use the knife to force it into the cracks and then to smooth the surface when the hole is filled. With some practice, you can even blend colors when the shellac is in the molten form to match the existing wood tones more closely.

Some of the most frequent and unattractive faults in old finishes are rings left by wet glasses or cups. Sometimes,



*Though refinishing can be a messy and time-consuming task, the rewards will be clear when you apply the last coat of wax.*

the damage is so severe that the old finish will have to be stripped.

There are two methods to try before you go that route. First is a lifting procedure. Place a blotter over the ring and a warm clothing iron onto the blotter for a few seconds. Be sure to set the iron at low heat for materials such as rayon or silk. If it doesn't lift the ring after a few trials, move onto the second method. Abrasives such as pumice or very fine (4/0) steel wool and a lubricant like linseed oil or lemon oil can sometimes rub out the rings caused by water staining. And a few drops of

household ammonia on a dampened cloth can occasionally do the trick for rings left by alcohol. If none of the above methods works, you'll have to strip the piece.

### If you must refinish

Before starting a refinishing job, be aware that you need the proper tools, the right materials for stripping and refinishing, and time. Allowing for drying time and the fact that you probably won't be putting in eight-hour days on the project, you can count on investing three days for stripping and refinishing even a small item, such as a nightstand or a mirror frame. It will take up to five days to refinish a large bookcase or a medium-sized, unadorned chest, and a week or so to redo something the size of a dining table. Large projects like a roll-top desk may require up to 10 days to complete.

The tools required for refinishing are simple ones. They include a low-priced paintbrush for applying the finish remover, disposable plastic or rubber gloves, lots of clean rags, both coarse (3) and fine (4/0) steel wool, a package of assorted sandpaper from 120 grit to



Begin by checking piece for stability. Try to wobble it back and forth to make sure all joinery is sound. If it isn't, repair it.



If the old finish must be stripped away, try to remove as many parts as possible beforehand. Smaller sections are easier to strip.



When the old finish begins to bubble and dissolve—about 15 minutes—scrape it away with a dull-edged putty knife.



Apply a heavy coat of stripper using an inexpensive brush. To get the best solvent action, brush lightly in one direction only.



After finish is removed, sand down all rough spots, using 220-grit abrasive paper. Sand with grain to avoid scratching.



Raise dents by placing a moist paper towel into the depression with a hot soldering iron. The steam produced will swell pores.



To fill gouges and cracks, melt stick shellac on the blade of an electric burr-in knife, then flow molten shellac into the hole.



When stripping and repairs are complete, apply finish. The product here, a Danish oil finish, stains and finishes in one coat.

220 grit and a good-quality, natural bristle brush for applying the new finish.

It's more complicated to choose the right materials for removing the old finish. First, you must determine exactly what type of finish is presently on the piece. Do this by testing—in an inconspicuous spot—several different solvents. To begin with, denatured alcohol will easily dissolve shellac. Just brush some on, wait a few minutes, then rub off with a rag. If this doesn't remove the finish, then try a commercial stripper. These products will dissolve most other finishes, such as oil, varnish, lacquer and polyurethane varnish. However, some newer two-part epoxy and poly-

ester resin finishes will be largely untouched by commercial strippers. Instead, these must be removed with applications of heat. For the beginner, this is a job better left to a pro.

There are basically two types of commercial finish removers that are readily available to the consumer: those containing flammable solvents and those containing nonflammable solvents. Most of the flammable variety contain the same solvents. However, they may differ in additives, like waxes, that form a surface barrier to keep the volatile solvents from evaporating rapidly. These additives do nothing themselves to soften the old finish. Obviously, flammable removers should be used only in well-ventilated areas away from any open flames, including furnace and hot-water tank pilot lights. If you must work in an enclosed area, be sure to use an exhaust fan equipped with an explosion-proof motor. Outdoors is the best place to work, especially in the shade where the sunlight will not cause too rapid evaporation of the stripper solvents. Always wear long-sleeved clothing, gloves, goggles and a respirator.

Nonflammable removers differ from the flammable types in their solvents and because they are generally less costly. A key ingredient in most nonflammable removers is methylene chloride, which has an extremely high



If a glue joint is loose, separate the mating pieces, then scrape off old glue and dirt. Apply new glue and clamp overnight.



Allow one-step finishes like Danish oil to penetrate for about one hour. Then wipe away excess with a clean, dry cloth.

evaporation rate. If you have a choice of removers, always go with the one that has the higher percentage of methylene chloride listed on the container label.

## Stripping procedure

The stripping process is necessarily a messy business, so be sure to cover your work area with a drop cloth or plenty of newspapers. If the piece you plan to strip is small and light enough, lift it onto a bench or table for working ease. Then, before applying any stripper, remove all knobs, hardware, escutcheons, mirrors and other parts. The more flat surfaces you have, the easier the stripping will be.

Next, read the instructions carefully

for the remover you have chosen. They will tell you how long to leave the remover on the piece before wiping it off. As a rule of thumb, five or six minutes will be sufficient if you're removing one layer of old finish. But if you're removing several layers, you may need to leave the stripper untouched for 15 minutes or more.

Brush on a thick coat of remover all in the same direction. Do not brush back and forth over the surface because this action breaks down the surface barrier formed by these products and allows the solvents to evaporate faster. If the remover dries in place, do not try to scrape it off. Instead, apply more remover to soften the prior coat.

As the remover works, the old finish will wrinkle and bubble. At this point, start to scrape away the residue, using a dull-edged putty knife. Do not use a new knife unless you've filed the edge and corners over. Sharp edges can gouge the wood. Have lots of old newspaper on hand to wipe the residue off the blade as you work.

After most of the material has been removed by scraping, switch to No. 3 steel wool to remove the finish from tight corners, carvings and rounded surfaces, such as the seat area, legs and stretchers on the chair shown in the photographs. Don't use a whole pad of steel wool at once. It's more economical to unroll a pad and tear off small pieces. As each one becomes saturated, discard it.

If your piece has tiny grooves, carvings, or other decorative elements that steel wool can't handle, a length of small-diameter wood dowel, with its end cut at a 45° angle, makes an effective "close quarters" scraper. These dowels won't damage the surface and their ends can be cut easily to any shape needed. It's a good idea to have several on hand so you can switch quickly between them, depending on what you are scraping. After you have removed all the old finish, wipe down the entire piece with lacquer thinner.

Even though some strippers are water-soluble, it's a bad idea to rinse a stripped piece of fine furniture with water. Water can stain some woods (particularly white oak), it can raise havoc with old glue joints, and it can raise wood veneers off the body of the piece. It can also substantially raise the grain of unprotected wood, thus requiring a great deal of sanding before the



When applying a pigmented oil stain, brush it on straight from can, allow it to stand for about 10 minutes, then wipe off excess.



Allow stained wood to dry for at least 24 hours, then apply a sealer coat of 2-lb. cut shellac. Use a natural bristle brush.

new finish is applied. It's better to stick with the lacquer thinner, but keep in mind that it's not necessary to saturate the piece. Wet one side of a folded cloth, wipe the piece, flip the cloth and wipe again. Repeat the same method until all the residue is removed.

### Making repairs

Once the old finish has been removed, it's time to make any necessary repairs to the piece. Begin by checking all joints closely to make sure they are tight. When you find a loose joint, separate it completely and scrape away the old glue and dirt from both mating surfaces. Then sand both surfaces smooth, using 220-grit sandpa-

per. If a joint is loose but will not come apart easily, use a rubber-faced mallet to knock it apart. Next, apply a waterproof resin glue to both surfaces, then clamp firmly together and let dry overnight. Be sure to wipe any glue squeeze-out off the joint with a damp cloth.

Dents may become more apparent after the old finish is off, and these can be repaired in two ways: raising them or filling them. Raising a dent is relatively simple. Just wet a corner of a folded paper towel and lay it directly over the dent, then bring the tip of a hot soldering iron down lightly against the paper. The heat from the iron will change the water in the towel to steam which, in turn, will penetrate the wood cells, causing them to swell out to their original shape. Let the piece dry overnight, then sand the area with 220-grit sandpaper.

Cracks and gouges should be filled at this point, as well, using the shellac sticks mentioned earlier. However, on bare wood first apply some petroleum jelly to the surface around the area to be filled. This will keep the hot shellac from adhering to these areas and restrict it only to the spot that needs filling. Once the shellac has cooled, rub it with 4/0 steel wool to smooth the area with the surrounding surface.

If you find loose veneer, you must first clean out the old glue and dirt before you attempt regluing. Use a knife with a thin, pointed blade and carefully work back and forth between the veneer and the glue surface. Once the surfaces are clean, work in fresh waterproof resin glue, using the same knife. Be sure to get the glue as far back under the veneer as possible. Then clamp a wood block over the area and let the piece dry for at least 24 hours.

If the piece has a large area to be repaired, such as a deep cigaret burn, a patch is required. Finding just the right wood for the patch is important. Ideally, it should be taken from some inconspicuous place on the piece itself such as the underside of a chair seat or a tabletop.

Make a pattern of paper or cardboard that duplicates the area of the burn, then transfer this shape to the patch material. You should match the grain direction of the patch to that of the area to be repaired. Next, using a sharp chisel, cut a shallow notch or "grave" to

*(Please turn to page 116)*

## 9 GREAT JIGS

(Continued from page 107)

block for through drilling. Nail two cleats (H) to the table underside to support the blocks. As the block wears away, replace it.

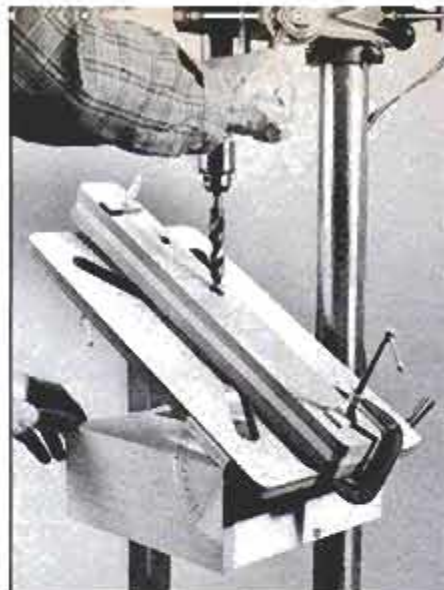
Install the table to the box with a continuous hinge. Note that the hinge attaches to the side (C), not onto the box top (E). Attach the adjustable support (F) that holds the table at the desired angle.

Next, fasten the protractor to the table edge as shown. Pre-drill the protractor and oak mounting strip (J) before nailing to help prevent splitting. Be sure that the protractor's 0° line is parallel to the table and the 90° line is centered on the hinge pin. Paint a white

field behind the protractor for better visibility. Ink an arrow opposite the 0° mark as an angle indicator. To set the jig, lift the table by the adjustable support to the desired angle and tighten the wingnut.

### MATERIALS LIST—ANGLE GUIDE

Key	No.	Size and description (use)
A	1	3/4 x 12 x 20" ash plywood (table)
B	1	3/4 x 4 1/4 x 11 1/2" pine (front)
C	2	3/4 x 4 x 10 3/4" pine (side)
D	1	3/4 x 3 1/4 x 10" pine (back)
E	1	3/4 x 11 1/2 x 12 1/4" pine (top)
F	1	3/4 x 3 x 18" pine (adjustable support)
G	2	3/4 x 2 1/4 x 4" pine (guide)
H	2	3/4 x 3/4 x 4" pine (cleat)
I	1	6"-dia. plastic protractor
J	1	1/4 x 3/4 x 3" oak (mounting strip)
K	1	3/4"-dia. x 2" carriage bolt, 1 1/2" washer, wingnut
L		2" finishing nail
M	As reqd.	3/4" brads
N	1	1 1/2 x 11 1/2" continuous hinge



Adjustable worktable permits drilling precise angled holes. Attach a protractor to the worktable for accurate angle settings.

## 7 Saw blade height gauge

This easy-to-make gauge gives a precise height measurement reading of the table saw blade. Begin by cutting the parts as shown. Then, bore a 7/8-in.-dia. hole in the top block (C). Cut a 1/8-in.-wide slot in the upright (B) before nailing it to the base (A). Attach the top to the upright with the hole set back 1/8 in. beyond the edge.

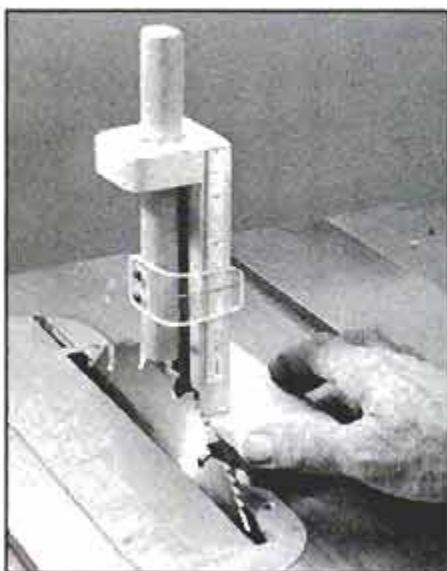
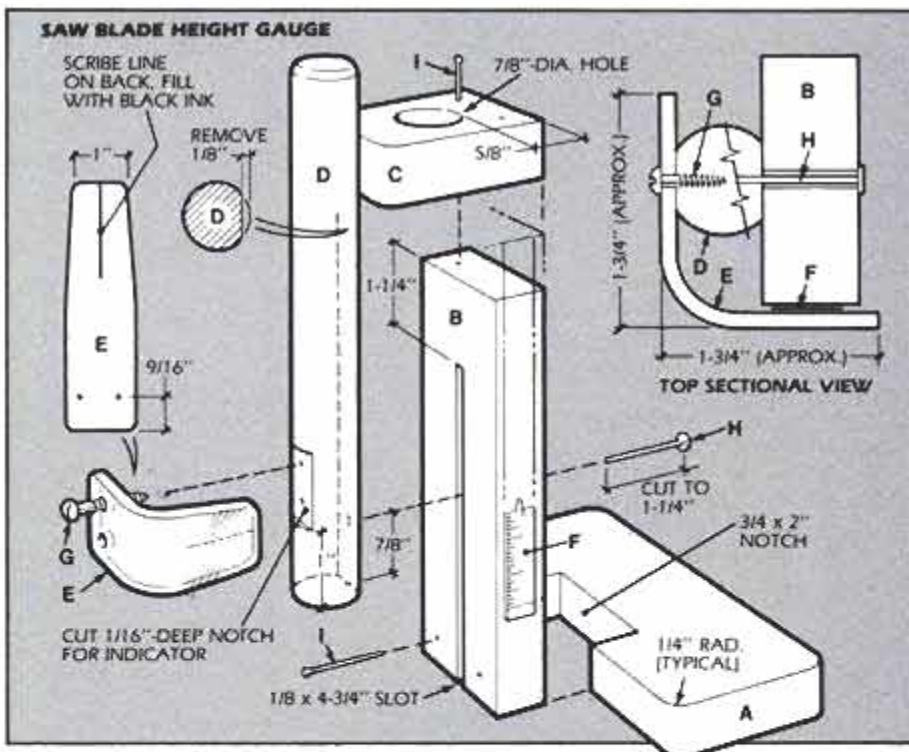
Next, sand a flat surface on the post (D), as shown. Before assembly, bore a 1/8-in.-dia. hole in the post's flat surface 1/8 in. up from the bottom edge. Slide the post through the top with the flat surface against the upright. Install a common nail, cut down to 1 1/4 in. long, through the upright slot and into the hole in the post. The nail keeps the post in line during use.

The saw blade height is measured by

a Plexiglas indicator (E) positioned in front of a rule (F). Heat-form the indicator, using a blow dryer or a flameless heat gun. Then, scribe the back with a sharp awl to form the crossline. Fill the crossline with ink to make it more visible. To use, first place the post over the saw blade. Then, adjust the blade until the scribed line indicates the height.

### MATERIALS LIST—BLADE HEIGHT GAUGE

Key	No.	Size and description (use)
A	1	3/4 x 2 1/4 x 6" pine (base)
B	1	3/4 x 2 x 6" pine (upright)
C	1	3/4 x 2 x 2 1/4" pine (top)
D	1	1/4"-dia. x 7" hardwood dowel (post)
E	1	1/4 x 1 1/2 x 4" Plexiglas (indicator)
F	1	5" plastic rule
G	2	3/4" No. 8 rh screw
H	1	2" common nail (guide)
I	4	1 1/2" finishing nail



Use the saw blade height gauge for quick, accurate depth-of-cut settings. Crossline on the indicator shows height of saw blade.

## 8 Sander jig

The belt sander is an indispensable tool for sanding large projects, but it isn't very well suited for precision sanding of smaller workpieces. This jig holds the sander securely in a cradle (F) for

two-handed control of small workpieces.

The cradle shown is designed for a Rockwell 3 x 21-in. sander (Model 337). Here's how to cut cradles for other sanders: First, trace the sander's back end profile onto a cardboard tem-

(Please turn to page 114)

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## 9 GREAT JIGS

(Continued from page 112)

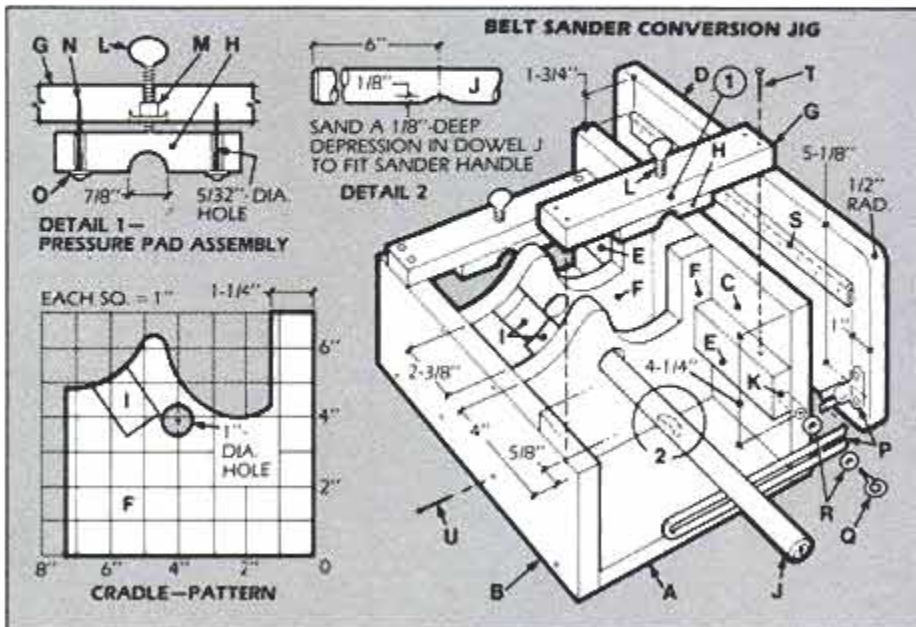
plate and transfer its profile to the workpiece. Cut out the cradle with jig-saw or sabre saw. To use the jig, place the sander on the cradle, with the dowel (J) passing under the pressure pads (H) and through the sander handle. Tighten the two thumbscrews to force the dowel against the handle and hold the sander upright.



The belt sander jig features an adjustable worktable for sanding miters and bevels.

### MATERIALS LIST—SANDER JIG

Key	No.	Size and description (use)	K	2	3/8"-dia. x 1" hardwood dowel
A	1	3/4 x 7 1/4 x 12" pine (bottom)	L	2	1/4-20 x 1 1/2" thumbscrew
B	1	3/4 x 5 1/2 x 12" pine (back)	M	2	1/4-20 Teenut
C	1	3/4 x 7 1/4 x 12" pine (front)	N	4	1 1/2" No. 6 rh screw
D	1	3/4 x 8 3/4 x 14" pine (top)	O	4	Flat washer
E	2	3/4 x 2 x 4" pine (cleat)	P	2	6" lid support
F	2	3/4 x 7 x 7 1/4" pine (cradle)	Q	2	3/4" screw eye
G	2	3/4 x 1 1/2 x 8" pine (cleat)	R	4	Flat washer
H	2	1 3/16 x 1 3/16 x 4" oak (pressure pad)	S	1	1 1/2 x 12" continuous hinge
I	2	1/2 x 1 1/4 x 2" pine (cradle cleat)	T	8	2" hot-dipped galvanized common nail
J	1	3/4"-dia. x 12" hardwood dowel	U		2 1/4" finishing nail

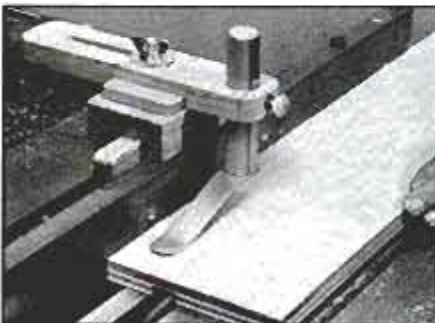


## 9 Table saw hold-down

When you're executing cuts that require you to apply downward pressure over or near the saw blade, use this hold-down jig instead of your fingers. It's especially helpful when cutting dadoes, rabbets, grooves and narrow wood strips.

Attach the jig by screwing through the fence and into the mounting block (B). Be certain to countersink the screwheads so that they don't protrude.

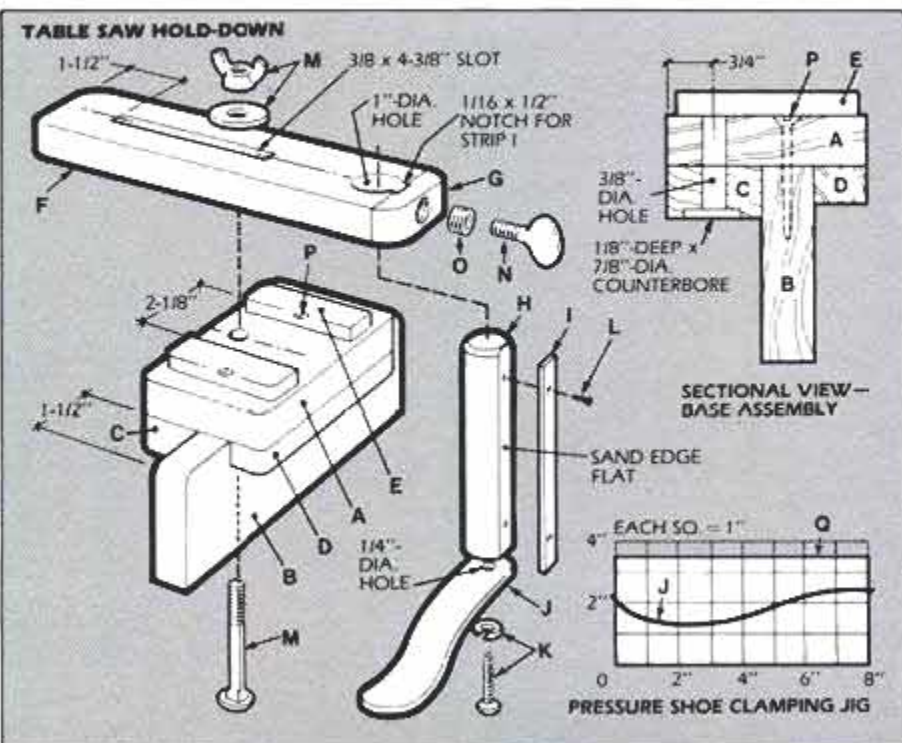
The jig shown here can accommodate stock up to 2 3/4-in. thick and has a horizontal reach of 3 1/4 in. from the fence. Alter the dimensions for greater capacities. **PM**



Curved shoe, made of hot-rolled mild steel, applies downward pressure for a uniform cut. Fingers are safe distance from blade.

### MATERIALS LIST—TABLE SAW HOLD-DOWN

Key	No.	Size and description (use)	J	1	1/4 x 1 x 5 1/2" steel (pressure shoe)
A	1	1 3/16 x 3 1/8 x 5" oak (support block)	K	1	1/4"-dia. x 1 1/4" lagscrew, lockwasher
B	1	1 3/16 x 3 1/8 x 8" oak (mounting block)	L	2	1/2" No. 6 fh screw
C	1	1 3/16 x 1 1/2 x 5" oak (cleat)	M	1	3/8"-dia. x 3" carriage bolt, 1 1/2" Flat washer, wingnut
D	1	9/16 x 1 3/16 x 5" oak (cleat)	N	1	1/4-20 x 1" thumbscrew
E	2	7/8 x 7/8 x 2 7/8" oak (guide)	O	1	1/4-20 steel threaded insert
F	1	1 3/16 x 2 1/8 x 8 1/2" oak (extension arm)	P	2	2" No. 10 fh screw
G	1	9/16 x 1 3/16 x 2 1/4" oak (end block)			<b>Note:</b> Use nominal 3/4" oak (actual dimensions: 13/16").
H	1	1"-dia. x 4 3/4" hardwood dowel			
I	1	1/8 x 1/2 x 4 3/8" steel strip			





# The Amazing FUELTRON™ Gasoline Vaporizer

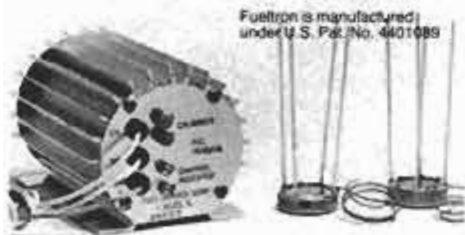
Gives your car more power,  
better acceleration, easier starts



Fueltron's vibrating crystal oscillates 1.3 million times a second to instantaneously vaporize gasoline into a high density, cold vapor. Read about its benefits below.

## WHAT FUELTRON DOES

Fueltron has only one purpose—to vaporize gasoline in the intake manifold of a car engine. Every one of its benefits results from its superb ability to do just that. Here's a fast way to visualize how Fueltron works: Imagine you're sitting in front of a roaring fire with a fistful of wood chips in one hand and a handful of sawdust in the other. Throw the sawdust into the fire, and it will flare up and burn while it's still in the air... almost instantaneously. Throw the wood chips into the fire, and first their edges will begin to glow. After a while the chips will ignite, and eventually burn away. Droplets of gasoline from your carburetor behave like the wood chips. Pulled into the combustion chamber, their outside surfaces will start to burn right away. Many will burn completely, but some will be swept, unburned, out of the cylinder with the exhaust stroke, or will trickle down the cylinder walls, washing away vital engine lubricants.



Fueltron is manufactured under U.S. Pat. No. 4401989

Model 7000 (2 or 4 Barrel) Fueltron Kit consists of Dual Channel Amplifier, two crystal transducers.

Vapor from Fueltron behaves exactly like the sawdust, igniting completely and burning with high energy before it can be exhausted. Fueltron is the most effective gasoline vaporizer we've ever seen. Its vibrating crystal rips apart the molecules in a drop of gasoline, turning it into an easy-to-ignite vapor in *millionths of a second!* The photo, above, shows gasoline being vaporized by a Fueltron crystal.

## WHAT FUELTRON ISN'T

Fueltron is not one of those miraculous, gas-saving horsepower boosters you're always reading about. It won't eliminate the need for tuneups (though you'll probably need fewer), it's not a substitute for properly firing spark plugs, and it won't breathe life into a neglected engine.

## YOU NEED FUELTRON...

...if you're sensitive to the way your car's engine operates... if you *know* it should be capable of faster throttle response, smoother idle and quieter running... if the waste of gasoline caused by hard starts, stalls and engine flooding concerns you... if you want to use lower octane fuel with reduced engine knock. Nothing else you can do will increase your car's performance more, or is as economical and easy to install as Fueltron.

## HOW YOUR ENGINE WASTES FUEL

Every fuel intake system on every carbureted or throttle-body injected engine performs the same tasks. The carburetor atomizes gasoline into droplets which are carried into the manifold by the rushing stream of air. The manifold's job is to vaporize as many droplets as possible on hot manifold surfaces, mix them uniformly with air and carry an equal charge to each of the cylinders. When everything is warmed up, the system works pretty well. But cold-engine starts waste fuel, because the cold manifold can't vaporize the droplets of gasoline before they're swept into the cylinders, so they don't all burn. Low speed operation can be a problem, because air isn't flowing rapidly enough through the manifold to mix the fuel droplets evenly, resulting in an uneven mixture and ragged running. Acceleration causes two problems: First, the stream of gasoline from the accelerator pump can't be vaporized quickly enough by the manifold, so it tends to "flood" the nearest cylinders. Second, as acceleration continues, partially atomized fuel from the carburetor goes through the manifold so fast it can't mix evenly with air, so cylinders nearest the carburetor get a too-rich mixture, while those farthest away are starved for gas, and can suffer from lean-mixture knock.

## HOW FUELTRON CUTS FUEL WASTE

Because Fueltron vaporizes gasoline instantaneously, it fools the engine into thinking it's hot even when it's cold, thus giving fast starts. Because vaporized gasoline mixes more quickly and uniformly with air you get many benefits: Your engine runs smoother because the fuel mixture is evenly distributed among the cylinders, giving quieter operation, better driveability and increased low end torque. (In certified tests Fueltron increased engine response by 34%, with no increase in

fuel consumption).<sup>(1)</sup> The uniform fuel/air mixture virtually eliminates lean-cylinder knock, hesitation, stalls and flooding. Fueltron makes gasoline burn more completely, providing a boost in energy while reducing waste and pollution. Speaking of pollution, this is a good time to mention that Fueltron meets the requirements for sale in California.<sup>(2)</sup>

## THE DETAILS

A complete Fueltron system consists of an amplifier which provides an ultrasonic signal, and either one or two vibrating crystals called "transducers". Two and four-barrel carburetors require two transducers (photo at left); single barrel carburetors require only one. In the unlikely event that Fueltron fails, failure will *not* affect normal engine performance. Installation is simple; if you know how to remove your carburetor, the rest is easy. Simply insert transducers into the manifold, where they're held securely by retaining spring supports. Mount amplifier anywhere under the hood and make the simple electrical connections. No modifications to carburetor or manifold required. Complete instructions and warranty come with kit.

(1) Certified by Coordinated Research Council Driveability Test; Conducted by the Ethyl Corporation Laboratory, Detroit, Michigan.

(2) State of California Air Resources Board Executive Order No. D-132.

**Fueltronics Corporation**  
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<input type="checkbox"/>	Model 7100 (1 Barrel) \$69.95 + \$4.75 shipping/handling	
(Illinois residents add 6% S.T.)		
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## REFINISH FURNITURE

(Continued from page 111)

remove the damage and cut a corresponding piece of wood from the patch material. It's a good idea to cut the patch slightly oversize and then trim it to size for the best fit. Keep in mind that the more time you spend on cutting the grave and patch, the less conspicuous the repair will be. When the mating is satisfactory, use waterproof resin glue to fix the patch in place, then clamp it for 24 hours. If tiny crevices are still apparent around the patch when the clamp is removed, fill these with stick

shellac matched to the proper color.

Sometimes water rings have penetrated so deeply into the wood that the stripper will not remove them. Short of sanding the whole area down below the point of the stain, wood bleach is the only solution. Carefully follow the instructions and wear rubber gloves, a thick apron, eye protection and a respirator while working. The chemicals that wood bleach contains can be harmful to your skin.

In addition to removing the old finish, stripping agents will also lift away the filler material used to fill open-grained woods such as oak, mahogany

and walnut. Before refinishing these woods, you will have to replace the paste wood filler to achieve a smooth, flat surface for the new finish.

Paste wood fillers vary in drying time and consistency, so read the manufacturer's instructions before applying. In general, the filler should be reduced to the consistency of heavy cream by adding benzine or pure gum turpentine.

Apply the filler with a brush, first stroked in the direction of the grain and then across the grain. Allow the filler to set until it loses its shine, (about 20 to 30 minutes). Then wipe it off with a coarse cloth such as burlap. Work against the grain at first, but make sure all final wipes are with the grain. Allow the filler to dry overnight, then sand the surface with 220-grit paper.

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### How to apply stain

There are at least six basic kinds of wood stain available these days: penetrating resin, water-based aniline, pigmented oil (wiping), nongrain raising, padding, and varnish and lacquer stains. All have advantages and disadvantages, but for the beginning refinisher the pigmented oil stains are probably the best bet. They are widely available and their coloration is easier to control than with the other types.

To use this stain, begin by wiping the entire piece with a clean cloth dampened with turpentine. Next, wipe the whole surface with a tack cloth, then wipe linseed oil on any end grain areas to slow down the stain absorption. (The end grain always absorbs more stain than the surface grain.)

Apply the stain, using rags or a brush, and allow the stain to set for 5 to 10 minutes, depending upon how dark you want the piece to be. When it's at the desired color, wipe off the excess with a clean, lint-free cloth. Always wipe with the grain and allow each coat of stain to dry for at least 24 hours. Remember that it's better to stain too light and then add a second coat, than to go too dark with the first one. However, if your first coat is too dark, it can be lightened by rubbing the piece with a cloth soaked in turpentine. Finally, seal the stain with a coat of 2-lb. cut water white shellac thinned 50 percent with denatured alcohol. Let the piece dry overnight.

There are as many different kinds of finishes as there are stains, and probably as many application techniques as there are serious refinishers.

The different types include oil, shellac, varnish, polyurethane, lacquer and French polishing. But because the oil, lacquer and French polishing methods—to be done correctly—require a lot of work and experience, the beginning refinisher should avoid them.

The first step in applying shellac,

varnish or polyurethane is to buy a good brush. Pick a natural bristle type. At home, knock the brush against the palm of your hand several times to shake out any loose bristles or bristle clippings. Then dip the brush in brush cleaner, let it dry out and knock it on your palm again to loosen the bristles. This preparation will remove any impurities in the bristles.

Shellac is an attractive finish. It's also easy to master, inexpensive and fast drying. But it does have one big drawback: It does not resist water, alcohol or chemicals on its surface. All of these either discolor or soften the finish. For this reason, tabletops and countertops require a different finish.

Shellac comes two ways, either water white or orange. For most jobs it's better to stick with the white shellac because it dries almost clear. But if you are finishing darker woods, such as walnut, mahogany, or even red oak, the orange type imparts a slight amber cast to the wood that is often appealing.

Shellac also comes in different "cuts," usually 3-, 4-, or 5-lb. cut. This designation simply refers to the amount of shellac in pounds that has been dissolved in one gallon of denatured alcohol. Therefore a 3-lb. cut would mean that 3 pounds of shellac are dissolved per gallon of alcohol. For beginners, the 3-lb. cut is best because it's the thinnest, and thus the easiest to work.

#### Using shellac

Apply shellac in long, even brush strokes. Overlap the succeeding strokes slightly to minimize brush marks. Shellac must be applied quickly and always in the direction of the wood grain. When you are done with an area, for instance the top of a dresser, and you spot a flaw in the finish, do not brush over it. Wait until the shellac dries, then sand away the flaw, using 220-grit, open-coat sandpaper.

The first coat should dry in about 30 minutes. After it's sanded and wiped with a tack cloth, apply the second coat in the same manner as the first. Once it's dry, sand again. Repeat the same method up to five coats if you desire, then let the piece dry thoroughly for two days and apply a paste furniture wax.

Varnish is generally a better choice than shellac for the beginner because it has a slower drying time and is therefore easier to work. And, it resists water, alcohol and chemicals. However, its working ease is also the source of its greatest drawback. Because it takes so long to dry, a lot of dust tends to settle on the finish, which has to be sanded off between coats for a smooth finish. Therefore, it is mandatory that you work in the most dust-free environment possible. Also keep a ready supply of

tack cloths to remove any loose dust just prior to finishing.

Start by thinning the varnish 50/50 with turpentine for the first coat. Brush the varnish onto the surface with the grain, then brush again at right angles against the grain. Finally, go back over the piece in the grain direction with the brush tipped at a 30° angle to remove all brush strokes and even out the surface. This is called tipping off.

Sand lightly with 220-grit sandpaper between coats and put the last two coats on full strength from the can. Let the final coat cure for several weeks, rub the surface with 4/0 steel wool and

then apply paste wax, if desired.

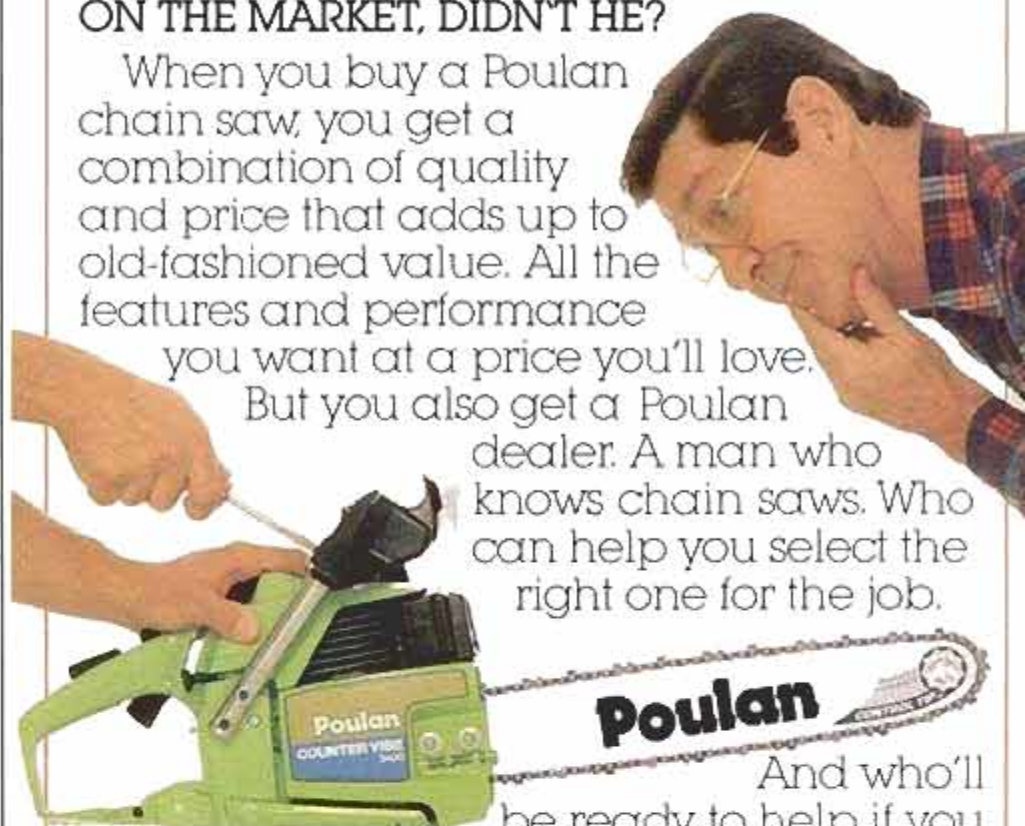
Polyurethane finishes are applied in the same manner as conventional varnishes. They have the advantages of better durability and shorter drying time so that settling dust is not as much of a problem. Depending on the product you buy, application methods and drying times can vary, so be sure to read the manufacturer's instructions carefully. Many purists consider a polyurethane varnish finish to lack some of the depth and luster of a natural resin varnish, so compare the two finishes side-by-side before choosing the one you want to apply. **PM**

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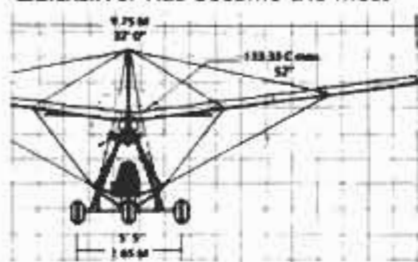
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## ADD-ON DREAM SHOP

(Continued from page 98)

nails which hold bar clamps. An exhaust fan is also in this wall. The fan is not an explosion-proof model. It is used only to exhaust nonvolatile odors that frequently occur in a shop.

On the back wall, a recess on the left contains a six-tier shelf for canned items. The sander and planer are wheeled into this spot when not in use. A deep space below the entire back wall, directly under the elevated floor of the adjoining storeroom and entry area, provides storage for lumber and plywood. Casters mounted on a sheet of old plywood permit the load to be moved out for selecting and stacking stock. Boards are also stacked directly on the floor in other spaces. The plastic vapor barrier under the slab keeps the floor dry.

A 7-ft. workbench is centrally located against the back wall. Above it is a Peg-Board rack for hanging hand tools (see construction drawing). The bottom frame member of this Peg-Board has a series of holes for holding screwdrivers and other small tools.

In the right recess of the back wall is a smaller workbench with a metalworking vise. Shelves above the bench hold cans of nails and other fasteners. The lathe is set up in the back right corner with a Peg-Board rack above it to hold chisels and accessories.

The scroll and band saws and the shaper, located against the wall to the right of the overhead doors, can be used in place. When necessary, either saw can be rolled out to an open area. A Peg-Board rack between the windows of this wall stores power-tool accessories and other tools. A mechanic's tool cabinet stands in one corner. The space between the two overhead doors is an ideal spot for the drill press. A shelf behind it holds bits and accessories.

The table saw positioned on wheels is usually located in the center of the room. A large, sturdy worktable made of 2x4 stock and topped with 3/4-in. MDO plywood stands 1/8 in. lower than the table saw (see plan for building the table on page 99). It is stationed directly behind the saw to support long work as it exits from the saw. Otherwise, it functions as a layout and assembly table. A large shelf below the table stores numerous portable power tools. Working at the cabinetmaker's workbench, located in front of one of the raised overhead doors, is the next best thing to working outdoors.

### Powering the shop

All work areas have ample and convenient electrical power. Fourteen duplex outlets fused at 20 amps. are situated about the shop. Six other single

dropcord outlets hang from the ceiling—four are 110 v. and two are 220 v. The latter supply power to the table saw and thickness planer. With the exception of the 220-v. line, there are four outlets per circuit. All the outlets are protected by ground fault circuit breakers.

Lighting is another area where we didn't skimp. The shop is evenly illuminated throughout by 14 double-8-ft. and two double-4-ft. fluorescent fixtures. These are divided among three circuits. Each fixture has individual toggle switches that conserve energy when maximum lighting isn't needed.

### Real wood paneling

We splurged on the wall paneling and decided to use real wood in the shop and next door in the foyer. The crafts studio on the second floor has walls surfaced with vinyl-clad gypsum wallboard.

The crafts studio gets plenty of natural light from a round-top and a standard window plus two skylights. Two fluorescent light fixtures and a three-light ceiling fan provide artificial light and a gentle breeze.

The workstations in the crafts studio include a cabineted workshop (see *Build PM's In-The-Wall Workshop*, page 126, Apr. '83). There's also a large, plastic laminate-topped worktable. A built-in cabinet and shelf unit is tentatively planned over the entire wall opposite the round-top window wall. Two closets provide plenty of storage.

The planning and work involved in creating the shop wing for our house was tremendous. However, the results have been rewarding beyond all expectations. **PM**

### SHOPPING LIST

- Ceiling tiles: Armstrong World Industries, Box 3001, Lancaster, Pa. 17604, Chatham, 12 x 12 in.
- Entry door: Sears, Roebuck and Co., Sears Tower, Chicago, Ill. 60684, four-panel, four-window, steel.
- Shop equipment: DeWalt div. of Black & Decker (US) Inc., 715 Fountain Ave., Lancaster, Pa. 17601, 10-in. radial-arm saw; Rockwell International, Power Tool Div., 400 North Lexington Ave., Pittsburgh, Pa. 15208, 10-in. Unisaw, 6-in. deluxe long-bed jointer; Sears, Roebuck and Co., Sears Craftsman, planer-molder, 15 1/2-in. drill press, high-speed shaper, sander grinder.
- Ceiling fan: Nichols-Kusan Inc., Jacksonville, Tex. 75766, American Pride five-blade 42-in., 3-light.
- Exhaust fan: NuTone Div., Scovill, Madison and Red Bank Roads, Cincinnati, Ohio 45227.
- Vinyl flooring: Armstrong World Industries, Box 3001, Lancaster, Pa. 17604, Premier Sundial Solarian, Baytown.
- Floor pads in shop: Kendall Plastics Inc., Kendallville, Ind. 46755.
- Vinyl gutter: Genova Inc., 7034 East Court St., Davison, Mich. 48423.
- Exterior paint: PPG Industries Inc., 600 Third Ave., New York, N.Y. 10016.
- Wall paneling: Georgia Pacific Corp., 133 Peachtree St., Atlanta, Ga. 30303; shop, Bridgeport-Lantern Pine; foyer, Barnplank-Weathered White; studio, Eternawall-Field Grass and Golden Reed.
- Skylights: Kennedy Sky-Lites Div., Kenenergy Corp., 3647 All American Blvd., Orlando, Fla. 32810, H.V.P. 22 1/2 x 22 1/2-in. self-opening, ventilating.
- Windows: Marvin Windows, Warroad, Minn. 56763, round-top and E-Z tilt.

## RIDE TO FREEDOM

(Continued from page 81)

landed on the flat roof of the facing building. Again there were moments of fright and waiting. They had brought only four arrows with them.

Bethke took aim once more. This time he scored, but not right on target. Although the third arrow went over the roof of the West Berlin house and into the courtyard behind it, their accomplice could not find where it had landed. He spent an entire hour searching, while Becker and Bethke "sweated blood." The arrow was found shortly before 4:30 a.m., stuck in a tall bush.

Now the East Germans tied a thick high-seas fishing line, strong enough to hold 198 pounds, to the first line and played it out to Bethke's relative. To the end of this they attached one end of the steel rope. When most of the cable had been snaked over, they fastened their end around the brick chimney shaft. In the West Berlin courtyard, meanwhile, their accomplice secured his end of the cable to his BMW 525 and drove out.

"We thought the chimney would be cut right through when the cable tightened," said Becker. "Mortar and pieces of brick flew all around us. And the noise seemed deafening." But no one heard anything, not even an elderly woman living in a fifth-floor apartment right under the attic.

### Soaring free

Bethke tied a rope around his waist, hooked it onto the handhold of his roller, climbed through the window to the sloping roof, hooked the roller over the cable, bolted it and soared off.

Their target on the other side was a small, balcony-like clothes-drying area, just under the flat roof of the Bouche-strasse building. Bethke got within two yards of it when his roller stopped. The decline between the two buildings was less than they had thought. Swinging his legs up over the steel rope, Bethke just crawled and shinnied the rest of the way. Then he beckoned to Becker and hung his own weight on the cable.

Becker slipped the belt over one wrist, and the loop onto the handheld bolt of his roller, clambered on the roof, hooked the roller and looked down once more. Moments later, he was free.

For a second or so the two looked at each other, then whooped up a storm of joy. The din woke up West Berliners and the old lady on the fifth floor of the other building, but not the guard.

"People say we took a lot of risks," Becker reminisced as he showed PM the site from the safety of the West. "Everything was carefully planned. I call them calculated risks, not a gamble. But face it. Life in freedom is impossible without risk." **PM**

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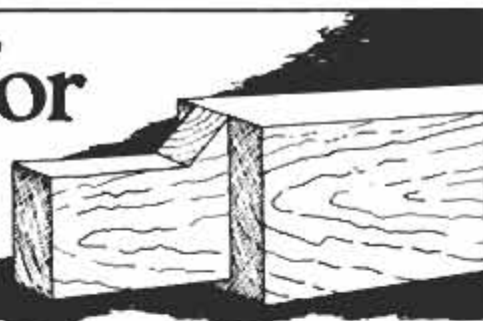
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## NEW OUTBOARDS

(Continued from page 86)

news item for '84, there are other interesting developments.

Yamaha's new V6 outboard, a 220-hp powerplant that's designed to move your eyeballs back in their sockets on command, has a computerized ignition system. It automatically advances and retards the ignition timing so that the engine derives maximum power from the fuel it is using without detonating. This doesn't mean that you can burn kerosene. But it does let you run the engine with fuel that might be of less than the optimum octane without the problems of detonation.

Yamaha uses a similar antidetonation system on its 650-cc turbocharged motorcycle.

The loop-charged Yamaha V6 has six crankshaft journals, one for each connecting rod. This lets a cylinder fire

every 60° of crankshaft rotation, resulting in a very smooth-running engine. Another interesting feature on the V6 is a sacrificial anode in the cylinder block's cooling system. The idea here is that corrosion will focus on the sacrificial anode (which can be discarded and replaced), rather than throughout the cooling system.

Yamaha has several new engines this year, including a series of in-line, three-cylinder models: a 40, 50, 70, and 90—all with oil injection. Chrysler's 55 has been upgraded to a 60. A performance motor, it features exhaust tuning, modular electronic CD ignition, and a computer-designed lower unit for improved speed and performance.

### New from Mercury

Mercury offers oil injection on its 150 and 200 V6s. For 1984 its 70-hp has become a 60, the 80 a 75, and the 40 a 35. There are new power-trim systems

on the 70, 90, and 150. The 18 and 25 have been reworked. And there's a completely new 2.2 outboard.

There's no question that 1984 is a buyer's year. Regardless of the type of boating you're interested in, there is a tremendous variety of outboards to choose from. Evinrude alone has 70 models.

### Evinrude's performance prop

Evinrude also has an interesting new performance prop to add to its accessory line. Called the Raker, because of its high-rake, custom-engineered design, this highly polished propeller is available in sizes to fit the entire range of V4 and V6 motors in the Evinrude and Johnson lineups.

Ready for a new outboard? Take your time choosing from the many brands and models available. Compare features, prices and warranties—you'll find the perfect one for your boat. **PM**

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**TEXACO**



## TOMORROW'S FIGHTERS

(Continued from page 77)

could react fast enough to keep it on an even keel. The principles of destabilized flight have been known for decades, but could not be applied until the advent of quick-thinking computers and digital fly-by-wire control systems that actuate a plane's control surfaces electronically.

In the AFTI/F-16, one of the first deliberately destabilized testbeds, a computerized control system constantly compares what the plane is doing with what it ought to be doing and makes instantaneous corrections, independent of the pilot's control inputs. The pilot tells the computer what he wants the plane to do and the computer sees that the plane does it without going out of control in the process.

### Strange new controls

Another new technology that's part of the high-agility fighter of tomorrow is so-called decoupled flight control—the use of control surfaces independently of each other or in other-than-normal ways, instead of coordinating all controls together as in a conventional aircraft. Turning the AFTI/F-16's canards to the left, for instance, moves the nose to the left independently of the tail. If you also want to move the tail to the left, you apply right rudder—the opposite of what you would normally do in a left turn. This moves the tail to the left independently of the nose. Together, these two separate motions cause the entire plane to move sideways to the left—a maneuver not possible with coupled controls.

In a similar manner, other decoupled control applications will enable a future fighter to turn without banking, point its nose to the side while traveling straight ahead, or move up and down while remaining level. Such decoupled movements are called direct lift in the vertical plane and direct sideforce in the lateral plane. By snowplowing the canards—turning them so they both point inward—a pilot can also induce sudden drag for rapid deceleration. This is known as drag modulation—a fancy name for speed brakes.

In the AFTI/F-16, only conventional aileron and elevator functions are handled by the usual control stick. Unconventional maneuvers are accomplished by a special twist-grip control on the throttle that operates the wing flaps and tailplanes, and by foot pedals that actuate not only the rudder, but also, at certain times, the canards and flaperons. It is this decoupling, or separating, of control functions that gives the plane its uncanny maneuverability.

Canards, though not new in concept, have only recently been thought of as

active control surfaces. They first appeared on the Swedish Viggen fighter more than a decade ago, but were fixed foreplanes designed primarily to improve lift and stability. In later models, flaps were added to the trailing edges, but were still used only in special situations, such as during takeoffs and landings.

In the latest Swedish fighter, the JAS-39, a successor to the Viggen now undergoing tests, the canards are fully movable control surfaces that pivot up and down like the diving planes on a submarine. Unlike the near-vertical fins under the nose of the AFTI/F-16, the

canards on the JAS-39 are horizontal mini wings that look like small ears growing out behind the cockpit. While both types of canards provide similar functions, most advanced fighter designs now on the drawing board use horizontal foreplanes like the JAS-39's in combination with a deep, delta-shaped wing that eliminates a conventional tail.

The canards are tilted up or down to raise or lower the nose and are used either separately for pitch pointing or in conjunction with wing flaps to move the entire craft up or down in level flight.

(Please turn to page 126)

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## TOMORROW'S FIGHTERS

(Continued from page 125)

To move the nose sideways, the canards are operated differentially—one tilted up, the other down. A down-tilted canard on the right forces the nose to the left and vice versa. This, working with the rudder, moves the entire plane sideways. As in the AFTI/F-16, the canards can also be snowplowed—both tilted down together—to provide abrupt deceleration.

A design similar to the JAS-39 is the much-heralded but still highly hush-hush Israeli Lavi, an advanced canard-

delta configuration rumored to be one of the hottest new fighters of the present decade. Both it and the JAS-39 are expected to be operational by the late '80s and thus will probably be the first production fighters with all-moving canards to see actual military service. The AFTI/F-16 is a research aircraft not expected to go into production in its present form.

### Fighters of the future

In the meantime, other, longer-range projects for the '90s and beyond are taking shape both here and abroad. A European consortium consisting of

British Aerospace, Italy's Aeritalia and West Germany's Messerschmitt-Bolkow-Blohm (MBB) has already built a full-scale mock-up of a sleek, twin-tailed, canard configuration dubbed the ACA (for Agile Combat Aircraft).

The French firm of Dassault-Breguet, maker of the vaunted Mirage fighter, has a similar mock-up it calls the ACX (for Aircraft Combat Experimental). MBB and Dornier, another German firm, are also working independently on their own canard-configured concepts. The objective: an all-Eurofighter designed specifically for the defense needs of Western Europe and the Middle East.

### New fighter for the U.S.

Here at home, the U.S. Air Force will soon start evaluating competitive proposals for a next-generation fighter known generally as the ATF (for Advanced Tactical Fighter). When chosen, it will ultimately replace the current McDonnell Douglas F-15 Eagle and General Dynamics F-16 Fighting Falcon sometime in the mid to late '90s. The contenders, in addition to McDonnell Douglas and General Dynamics themselves, will include such other prestigious names as Grumman, Boeing, Northrop, Lockheed, Fairchild and Rockwell, most of whose entries are still under wraps.

One project not being kept secret is Grumman's X-29A, a daringly different concept that incorporates not only canards, but wings that sweep dramatically forward instead of back. Like destabilized flight, the advantages of the forward-swept wing (FSW) have long been known, but until recently no one could make a wing strong enough to point into the airstream at supersonic speeds without tearing off. Now high-strength alloys and graphite composites make the FSW idea feasible.

In conventional aft-swept wings, airflow migrates out toward the tips, imposing an outboard load that results in loss of lift and premature stall. In Grumman's FSW design, airflow moves inward toward the fuselage, leaving the wingtips clear. The benefits are increased lift, reduced drag, less danger of stalling at low speeds and high angles of attack, and greatly improved combat maneuverability.

The X-29A prototype is nearing completion and is expected to begin flight testing early next year. If it proves successful, it may start a stampede toward other FSW applications.

### Improving the present breed

In the interim, still other programs are under way to improve existing fighters to fill the gap until the competition for tomorrow's ATF is resolved.

(Please turn to page 128)

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## TOMORROW'S FIGHTERS

(Continued from page 126)

McDonnell Douglas is rumored to have a canard version of the F-15 in the works, and General Dynamics may be encouraged to revive its FSX/F-16 project—which was started earlier, then shelved—if Grumman's X-29A sparks new Air Force interest.

Another variation on the ubiquitous F-16 is the F-16XL, a new delta-wing configuration designed to have significantly greater speed, range and payload than the standard F-16. Two updated versions of the F-15 are also undergoing tests. One, the F-15E, is aimed at increasing the F-15's capabilities as a ground-attack fighter as well as an air-to-air interceptor. Its highly sophisticated avionics will, among other things, eventually enable a pilot to fly treetop-level missions at night or in heavy weather without having to see or know the terrain—a sensitive radar altimeter hooked to the autopilot will fly the plane for him, automatically following the earth's contours and avoiding obstacles.

The second new F-15 variant is known as the IFFC/Firefly III F-15B. The IFFC stands for Integrated Flight and Fire Control, a computerized guidance system that combines the aiming

of weapons with the actual flying of the aircraft in one automated package. Once an enemy radar lock-on is made, the plane will virtually fly itself to the target, automatically firing its weapons at the correct instant to assure a kill. The system will eventually be incorporated into the AFTI/F-16 and possibly the Navy's F-14 Tomcat.

### Flexible plastic wing

Another intriguing development is the Mission-Adaptive Wing (MAW) currently being grafted onto a General Dynamics F-111. The Wing, made of flexible plastic composites, automatically varies its shape (camber) to suit different flight needs—straight for low drag at high speeds and curved for high lift at low speeds. In addition, the leading and trailing edges flex to simulate the functions of slats, flaps and spoilers, even twisting in opposite directions to create aileron effect for roll control.

The MAW-equipped F-111 is scheduled to fly next summer. Among its objectives: reduced drag, increased lift, a tighter turning radius and more agile maneuvering control, including all the new decoupled modes of flight.

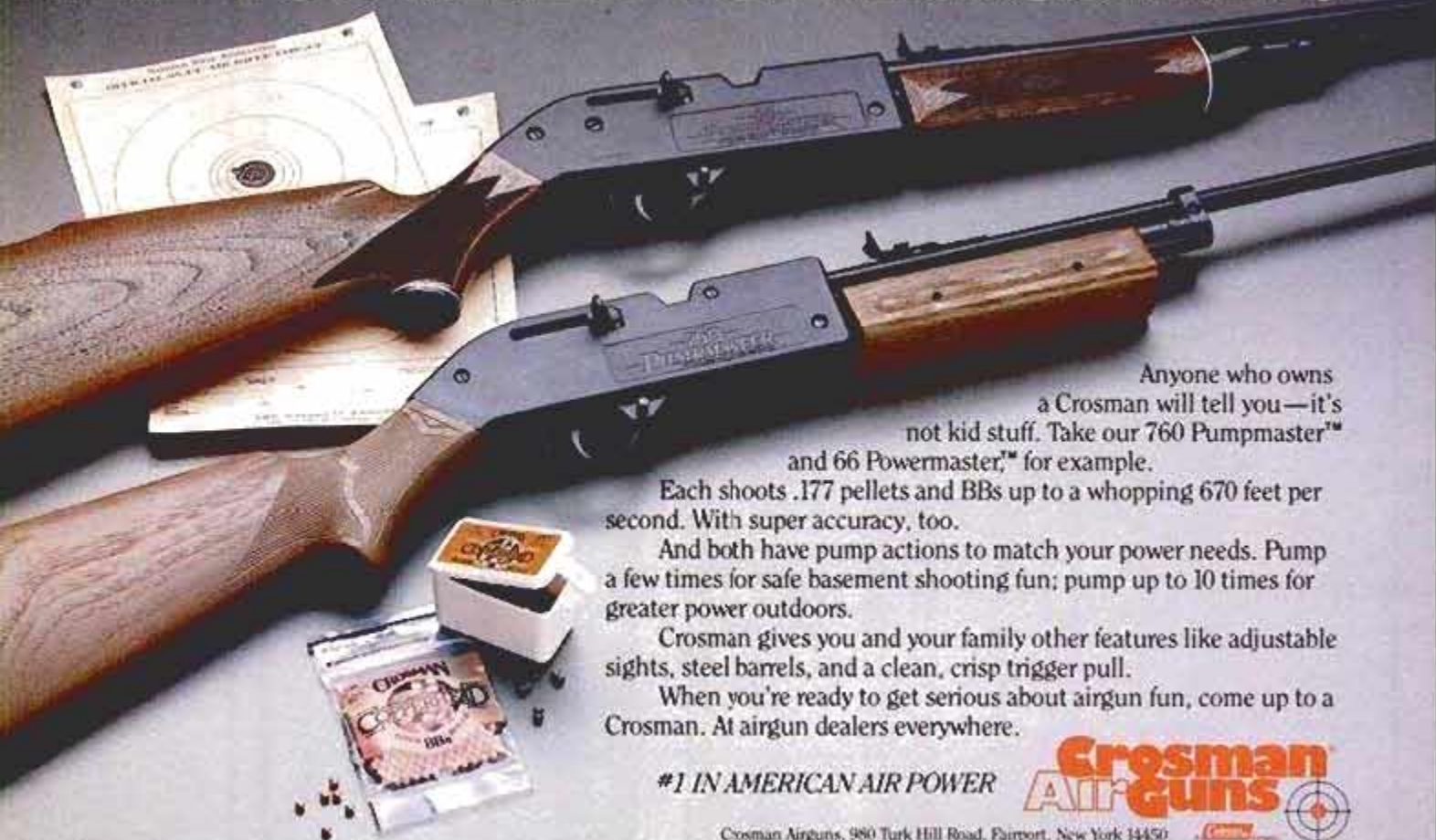
As tomorrow's fighters unveil themselves, two widely held assumptions of the past are likely to be shattered. One is that, as closing rates move up into the

Mach 2 range—twice the speed of sound—fighters simply won't be nimble enough to engage in old-fashioned styles of dogfighting. The other is that no one type of combat aircraft can hope to satisfy such widely divergent mission requirements as high-altitude interception, long-range bombing strikes and low-level ground attack.

Today, such highly maneuverable, multitasking aircraft as the AFTI/F-16 are proving both assumptions to be untrue. A single, versatile, multirole fighter, able to do it all, is now conceivable. Eliminating the need for many specialized types, it could save vast amounts in production, deployment, maintenance and crew-training costs. And 21st-century dogfights, though fought over a wider sky, could be just as wild as ever.

How good will the fighter of tomorrow be? There's a rule in the industry that if a new design can't be a quantum jump better than anything else in existence, there's no point in building it. The reason: It can cost as much as \$2 billion to develop a brand-new fighter prototype from scratch—even before it's tested and ready for production. For that kind of money, it had better be good. Today, a lot of companies are betting a lot of bucks that it will be awesome. **FM**

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## DRIVING NISSAN'S NEW 300ZX

(Continued from page 85)



Z-car family resemblance is strongest from behind. The T-roof is standard on the 300.

drive automatic buzzed the track at 125 mph.

The turbocharger lags a tad off the line, but comes into focus around 2,000 rpm. That's when you begin to hear its razor-edged whine and feel the seat-back sweep you firmly ahead. According to factory figures, the 1984 turbo five-speed does 0-to-60 mph in 7.1 seconds flat. Compare that with 9.1 seconds for the normally aspirated manual Z. Estimated fuel economy ranges from a low of 20/27 mpg city/highway for the turbo automatic to a high of 22/33 for the nonturbo manual.

### Something old, everything new

The 300ZX is totally new from the skin inward. As you can see, there's a strong genetic link to the 280ZX. Suspension parts look as if they've been carried over, but there's no interchangeability.

The 1984 model, as introduced in Japan, comes in two body styles—2-seater and 2+2—and two equipment levels: SF and GS. Trouble is, Nissan product planners don't intend to import the SF, at least not right away. Yet, in my opinion, the SF's cleaner styling, lighter weight and lower price make it a much more desirable sports car than the GT-ized GS.

If an SF version is sold here, it will come minus power steering, minus body side moldings, minus the soft air dam, and without a lot of the jazz that makes up the GS package.

The SF, though, does have smaller rotors on its four-wheel disc brakes. And yet brake performance is one of the strong points of both versions. I pulled several 300ZXs down from well over 120 mph a number of times and never experienced the slightest fade. By way of contrast, the 280ZX (provided by Nissan at Tochigi for comparison) stopped fine from over 100 mph but



Even 2+2 hatchback can hold lots of luggage, which can be kept hidden from view.

then, at the track turn-off, took a great deal more pedal effort than any 300ZX for a normal second stop.

As for handling, new Z-cars with manual transmissions proved much more controllable than those with automatics, and the two-seaters seemed a little twitchier than the 2+2s. All tended toward mild understeer, moving into oversteer during hard cornering while accelerating. Both conditions, though, proved easy to control with the accelerator pedal in five-speed cars, less so in the automatics due to less rear-axle braking. Turns lock-to-lock with the power-assisted rack-and-pinion setup are 2.8.

The comparison 280ZXs used a very similar suspension system—MacPherson struts, coil springs plus semitrailing arms in the rear and stabilizer bars at both ends—but didn't handle nearly so well as the 300ZXs. Not that the 280s didn't corner well, but their structure

(Please turn to page 130)



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## DRIVING NISSAN'S 300ZX

(Continued from page 129)

felt noticeably less rigid than the 300s, and shock control was also softer. This showed up not just on hard turns, but when driving both cars over Tochigi's rough Belgian-block roads. The 300ZXs were also quieter and smoother riding on bumpy surfaces.

The new 300ZX turbo comes with three-way adjustable shock absorbers. You can set these shocks on SOFT, NORMAL, or FIRM with a switch on the center console. An electric motor inside each shock cylinder brings different-sized orifices into alignment. Frankly, though, try as I might, I couldn't tell any difference for any of these settings—either in cornering or over the Belgian blocks.

Nissan engineers told me that the 300ZX can pull a maximum lateral acceleration figure of 0.79 g. That's not bad, but it also isn't great. Current Z-28 Camaros, for example, corner consistently at 0.83 g. I have to give Nissan engineers top marks for the Z-car's manual transmission shifter and for steering feel. The five-speed practically shifts itself, and there's just the right amount of steering feedback at both high and low speeds.

The four-speed, overdrive automatic transmission incorporates an electronic sensor and microcomputer that chooses one of two shift modes: power or economy. If the microprocessor senses that the driver needs power for accelerating or hill climbing, it delays upshifts and even downshifts sometimes to a lower gear. For gentle acceleration, it selects the highest optimal ratio.

The 300ZX automatic also shifts down when you hit the brakes hard. It



Unique 60° overhead-cam V6 engine produces 160 hp, 200 hp with turbocharger.

does this for two reasons: 1, to add the decelerative force of engine braking; and 2, to have a lower gear ratio ready for quicker response after braking.

The GS-version 300ZX comes with such standard amenities as air conditioning, T-roof, a really fantastic eight-position adjustable sport seat, premium 40-watt sound system, power disc brakes/steering/windows/hatch, dual electric outside mirrors, complete analog (normal dials) instrumentation, voice-synthesized warning monitor, presettable cruise control, four-position tilt wheel, four-lug 15-inch alloy wheels with premium tires and an antitheft system. Those, though, are just the barest highlights.

Nissan really offers only three basic

## 1984 NISSAN 300ZX—SPECIFICATIONS

<b>Dimensions</b>	<b>2-seater</b>	<b>2+2</b>
Wheelbase	91.3 in.	99.2 in.
Overall length	170.7 in.	178.5 in.
Overall width	66.5 in.	66.5 in.
Overall height	51.0 in.	51.6 in.
Tread, front/rear	55.7/56.5 in.	55.7/56.5 in.
Weight	2,888 lbs.	2,974 lbs.
Weight distribution	51/49	50/50
Fuel capacity	19.0 gal.	19.0 gal.
<b>Engine, type</b>	Ohc V6, iron block, 4 mains, water cooled, electronic fuel injection.	
Bore & stroke	3.43×3.27 in. (87×83 mm)	
Displacement	180.6 cu. in. (2,960 cc)	
Max. hp @ rpm	160 @ 5,200 (turbo = 200 @ 5200)	
Max. torque @ rpm	173 @ 4,000 (turbo = 227 @ 3600)	
Turbo max. boost	6.8 p.s.i. (350 mm Hg)	
Compression ratio	9.0:1 (turbo = 7.8:1)	
<b>Drive train, type</b>	5-speed standard; automatic optional	
<b>Gear ratios</b>	<b>Nonturbo</b>	<b>Turbo</b>
1st	3.321	3.350
2nd	1.902	2.056
3rd	1.308	1.376
4th	1.000	1.000
5th	0.759	0.779
Final drive	3.545:1 (turbo = 3.700:1).	
		<b>Automatic</b>
		2.458
		1.458
		1.000
		0.686
		—

options for the 300ZX: the overdrive automatic transmission, the turbo-charger package and a combined leather upholstery plus digital instrument group.

When you order the turbo, you also get Goodyear Eagle GT P215/60R15 tires on wider five-bolt alloy wheels, headlamp washers, front spoiler extension, rear spoiler, turbo door and seat graphics, rocker panel and wheel lip extensions, turbo boost gauge, oil temp gauge, fuel antiknock control, plus the three-way adjustable shocks. And if you order the turbo with the automatic trans, it comes with a manual overdrive lockout switch.

The leather and digital package includes full LCD instrumentation, compass, acceleration/braking gauge, leather upholstery and trim, electric eight-way seat, leather-wrapped steer-



Interiors are plush. In recent Z-car tradition. Leather version shown is sportiest.

ing wheel, driver's vanity mirror, bronze-tinted glass, body accent striping, interior woodgrain trim, trip computer, drive reminder that gives miles to empty plus average and instant fuel economy (also available on the turbo), and an 80-watt, eight-speaker, electronically tuned AM/FM/MPX with dual antenna systems. And those, again, aren't full lists!

I'm not a great fan of digital instruments, but the 300ZX's are the best I've seen to date. They're clear, legible and not terribly distracting. I do like the analog compass, but I have mixed feelings about the acceleration/braking gauge. This registers up to .50 g either way, but the 300ZX can pull around .60 g during a panic stop, so that part of it tends to become academic.

The eight-way seats—with or without power—are really terrific. They're comfortable for everyday driving, and they hold you firmly in place during high-g cornering.

To me, the ideal 300ZX would be an SF two-seater with the turbo package, five-speed, slightly larger stabilizer bars for more roll stiffness and the sport seats. That's getting back to the basic Z-cars that made the line so popular from the beginning. Whether such a car will become available here, though, remains a question mark. **PM**

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# PM OWNERS REPORT:

BY MICHAEL LAMM WEST COAST EDITOR

## CHEVROLET CORVETTE

"Absolutely thrilling to drive."  
—TENNESSEE ATTORNEY

"Body rattle is frustrating."  
—TEXAS RETIREE

"Beautiful in its styling, but  
poor workmanship."  
—FLORIDA SALES REP



"It does everything they claim. Good  
acceleration. Tremendous handling."  
—SOUTH CAROLINA NAVY OFFICER

"Rough ride on bad roads."  
—NEW YORK SALESMAN

"The car is great. Sometimes makes me  
think it's not an American car."  
—FLORIDA DOCTOR

### Performance wins praise, but early-production bugs really bother Vette owners.

**C**hristmas for Corvette lovers came on March 21, 1983. That's the day Chevrolet started selling its first totally new American sports cars in 15 years.

At a base price of \$21,800, some people considered the 1984 Vette a bargain, while others just whistled and walked away. Very few buyers, though, actually paid \$21,800.

The median price paid—ignoring destination charge, tax, license and so on—came to \$24,733. A few early customers spent as much as \$30,000. On the other hand, several GM employees (who happened to be among the owners we surveyed) got their new Vettes for as little as \$19,000!

Our questionnaires went out to the very first people who bought '84 Corvettes. At that time, customers pounded on showroom doors, and the cars not only brought premium prices, but often there simply weren't any to be had. As a result of this tremendous demand, dealers tended to pack their cars with accessories and "services." This led to a group of very peeved owners.

### A NATIONWIDE SURVEY BASED ON 632,629 OWNER-DRIVEN MILES

Keep in mind, too, that the cars in our survey were the very first ones assembled. A few bugs simply hadn't been



Styling, advanced engineering and anticipated performance were main reasons for buying.



worked out, and dealers hadn't had time to put certain parts into their stock bins. In all, 35.8 percent of our owners agreed that early 1984 Corvette parts availability was poor. It's undoubtedly better now, but at the time, a lot of owners got stuck.

One problem was the early smog-pump pulley. The pulley, which is driven by the Poly-Vee belt, had a habit of loosening up or falling off. Since all engine accessories, including the water pump, take their spin from this single, wide, flat, ribbed belt, the cars wouldn't run without the smog pump, which is why a few owners told us they had to wait weeks for new bolts to arrive.

Those initial glitches, though, weren't enough to damp the enthusiasm of most 1984 Corvette buyers. People drive Corvettes for all sorts of reasons, but brand-newness turned out to be one of the car's main attractions.

A California retiree wrote: "I was the first person in my town to own a 1984 Corvette. What a genuine thrill! Whenever I park, a crowd gathers, and I have to oblige by going through my little show-and-tell. I'm 63 years old, and while I might be slowing down on my feet, I'm plenty fast on my new wheels!"



Surprisingly few owners had any comments about Vette's color graphic instruments.

A Texas executive proudly pointed out, "This is the only car I've been stopped in by the state police just so they could check it out."

A California physician wrote, "Public response to my new Vette has been incredible. Seems Americans are pleased to see quality and innovation in a U.S. car again. Moreover, Japanese tourists have photographed my car, and my neighbor is trading his Porsche for a new Corvette—if he can find one."

It goes without saying that Corvette owners have to be more than a little car nutty. Almost all who responded to our survey had owned sports cars before (82.3 percent), and nearly a quarter had even owned earlier Vettes. Many told us they still had older collectible

*(Please turn to page 134)*

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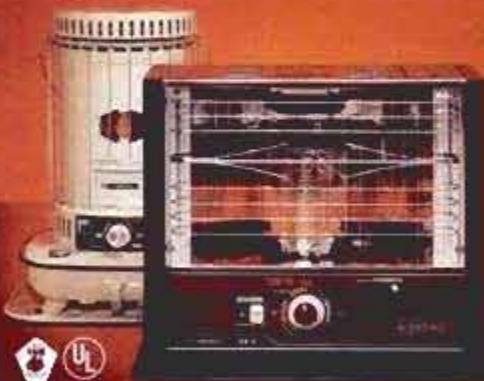
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## OWNERS REPORT: CORVETTE

(Continued from page 133)

Corvettes in their garages, and 1.5 percent owned eight or more cars.

Several owners said "investment" was their reason for buying. A New York life insurance salesman said, "As there are no official 1983 Corvettes, I

hope collectors will consider all 1984 models built before August 1983 to be '83s, and thus worth more than the rest of the '1984' production run." Time will tell.

The question for the moment, though, remains: How do these new Corvettes feel? How do they perform and handle?

"Looks sexy and goes like a bat out of hell, and it handles better than any other car I've ever driven," commented a self-employed Iowan. A California firefighter: "Sticks to the road like glue and corners flat as a board."

"Great handling," said a retired Georgia air controller. "but you pay a

(Please turn to page 150)

## SUMMARY OF 1984 CORVETTE OWNERS REPORTS\*

<b>Total miles driven</b> 632,629	<b>Specific dislikes:</b>	<b>Had any mechanical trouble?</b>	<b>Two cars</b> . . . . . 30.2
<b>Average miles per gallon:</b>	Rough ride . . . . . 19.4%	Yes . . . . . 56.9%	<b>Three cars</b> . . . . . 31.2
Overdrive automatic transmission	Noise and rattles . . . . . 13.1	No . . . . . 43.1	<b>Four or more cars</b> . . . . . 25.1
In town . . . . . 16.6	Entry and exit . . . . . 9.1	<b>What type of trouble?</b>	<b>Makes of other cars owned:</b>
On the highway . . . . . 22.8	Squaky brakes . . . . . 8.6	Brake squeal . . . . . 21.7%	Chevrolet . . . . . 39.5%
<b>Transmission choices:</b>	Parts aren't available . . . . . 6.3	Power window mechanism . . . . . 20.0	Cadillac . . . . . 20.3
Overdrive automatic . . . . . 100.0%	<b>What changes would you like?</b>	Smog pump . . . . . 10.4	Corvette (included in Chev. above) . . . . . 15.7
Seven-speed manual . . . . . 0.0	No changes . . . . . 17.3%	Windshield wipers . . . . . 10.4	Ford . . . . . 14.5
<b>Option choices:</b>	Better ride . . . . . 12.1	Automatic transmission . . . . . 9.6	Oldsmobile . . . . . 12.2
Delco-Bose sound system . . . . . 80.9%	Simpler T-top locks . . . . . 9.2	<b>Dealer repairs satisfactory?</b>	Buick . . . . . 11.6
Z-51 handling package . . . . . 86.6	Better materials . . . . . 8.7	Yes . . . . . 62.9%	<b>Would you buy another Corvette?</b>
Sport seats . . . . . 33.8	More horsepower . . . . . 7.5	No . . . . . 37.1	Yes . . . . . 71.1%
<b>Why did you choose the Corvette?</b>	<b>How much did you pay?</b>	<b>Dealer service opinion:</b>	No . . . . . 7.8
Styling . . . . . 56.4%	Average . . . . . \$24,733	Excellent . . . . . 25.1%	Maybe . . . . . 21.1
Past experience . . . . . 24.1	Range . . . . . \$19,500-\$30,500	Good . . . . . 39.2	<b>Would you buy another Chevrolet?</b>
Performance . . . . . 21.5	<b>Workmanship opinion:</b>	Average . . . . . 25.7	Yes . . . . . 79.1%
Handling . . . . . 16.9	Excellent . . . . . 52.3%	Poor . . . . . 9.9	No . . . . . 4.0
Made in America . . . . . 11.3	Good . . . . . 42.6	<b>Have you owned a sports car before?</b>	Maybe . . . . . 16.9
<b>Specific likes:</b>	Average . . . . . 4.6	Yes . . . . . 82.3%	<b>Age distribution of owners:</b>
Styling . . . . . 78.8%	Poor . . . . . 0.5	No . . . . . 17.7	15-29 years . . . . . 13.3%
Handling . . . . . 65.7	<b>Comfort opinion:</b>	<b>Number of vehicles owned:</b>	30-49 years . . . . . 70.9
Performance . . . . . 60.6	Excellent . . . . . 61.5%	This car only . . . . . 13.6%	50-plus . . . . . 15.7
Comfort . . . . . 19.2	Good . . . . . 34.0		
	Average . . . . . 3.0		
	Poor . . . . . 1.5		

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

## COMPACT DISC PLAYERS

(Continued from page 89)

show still scenes from an opera, the libretto in three languages (choose the one you want) or even the musical score, so you can follow the orchestra and singers as blood and thunder storm out of your speakers. A live recording of a rock concert could have either stills of the event or the lyrics and music.

The players in our present roundup are part of the first CD generation. Judging from their sophisticated performance, digital sound is going to make a lot of friends. It won't be cheap at first. After all, who can afford to spend about a thousand bucks on hardware every time something new crops up? But it looks as though the CD, once large production runs in the factories bring the cost down a bit, will revolutionize how we listen to music . . . and how much more of the music we'll hear. Here is how the units stack up.

**Akai CD-D1 (\$1,000):** The Akai looks suspiciously like a cassette deck. In fact, it even looks as simple as one. Well, that's correct as far as the outside is concerned, but the *inside* is something else. That holds true for other CD players as well, but this is an especially good example. On the back there's an output that's variable so you can adjust

the unit's signal to a level your amplifier is best equipped to handle. You can zip to the chosen band or song on a disc and there's even a feature that allows you to home in on individual phrases within that selection. You can also see just where the head (the laser optical unit that "reads" the digital information on the disc) is in relation to the start and end of the disc, because there's a meter to follow it.

**Hitachi DA-1000 (\$1,000):** This player is small enough to fit nearly anywhere it's convenient to have a front-loading piece of audio equipment. It can sample brief segments at the start of each selection on a disc. The headphone output is separate from the rear-panel jacks, allowing headphone levels to be adjusted independently. It shows elapsed time, what band is playing, and indicates the location of the laser head. The label side of the spinning CD is visible, and the entire unit has a very simple, no-nonsense look.

**Kyocera DA-O1 (\$1,050):** Displays on this unit show elapsed time and what track is being played. A variable output allows matching to amplifier input capability. As far as programming goes, this player offers the best indication of what these first-generation players can do with a CD. Using its simple controls is a straightforward

process that makes you forget you're controlling a very advanced version of home entertainment equipment that is more computer than "record player."

**Magnavox CD-1000 (\$800):** This is the least costly of them all, and also offers the most simplified controls. Its sonic but simple performance is a good reminder of the fact that sophisticated programming control is very nice to have, but that digital sound with its clarity and transparent reproduction of the original master tape is still the heart of the Compact Disc. Incidentally, there are two other players in the same line, both offering more control functions. All three are made by Philips, which developed the CD with Sony. The CD-1000 is top-loading.

**Phase Linear 9500 (\$995):** The 9500, too, has variable outputs and will locate bands or phrases within bands. It shows elapsed time and, if you have a CD without phrase-indexing cues, you can set the player to start playing at any given time within a band. For example, you can cue the player to band 12, time 3:40, and play will start that amount of time into the 12th selection on the disc. A very thorough and clear manual explains the player's operation and is a good intro to the world of the CD.

**Sanyo DAD-8 (\$999):** In shape, this

(Please turn to page 136)

# DRIVE A BARGAIN.

If you've been wanting to buy a driving computer or cruise control, now's the time.

Because right now Cal Custom is offering a \$5 rebate on their popular ZT-4 Driving Computer and their ZT-10, ZT-11, and ZT-12 Cruise Controls. They fit all domestic and foreign cars. And they're easy to install, so you can do it yourself. They're great buys, too. Even before the \$5 rebate.

You'll find all the details at participating automotive stores and departments everywhere. This rebate offer expires December 31, 1983, so hurry. While you can still cash in on a real bargain.



## \$5 REBATE

on the ZT-4 Driving Computer. This 15 function trip information center will tell you exactly how much fuel you've used since you started your trip, or since your last fill-up. It accurately displays your speed, current MPG, average MPG and the time of day. It even converts from English to metric to imperial measurements. (Kit for electronic fuel injection available.)

## \$5 REBATE

on all the ZT Cruise Controls. The ZT is more sophisticated than most original equipment cruise controls. After using the brake, a tap on the "resume" button will accelerate you smoothly back to your pre-determined speed. And you can adjust your chosen speed up or down by simply tapping another button. The coast-resume button makes the ZT ideal for congested highway driving. The small command module can be easily mounted on the steering column, console or under the dash.

# \$5 REBATE

On Cal Custom's ZT-4 Driving Computer and their ZT-10, ZT-11, and ZT-12 Cruise Controls. Details available at participating dealers everywhere.



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## COMPACT DISC PLAYERS

(Continued from page 135)

Sanyo is like the Hitachi, but has more visible controls. A nice feature is fast-forward and fast-reverse sampling that lets you move quickly through the music, hearing properly pitched samples (not speeded-up "Donald Duck" passages) of everything as you go along—very handy for finding a spot within a song or symphony. The headphone output is separately controlled, so a headphone listener doesn't have to compromise with speaker volume and other listeners. Program in your band

numbers, and this player will go through selections in any order you choose.

**Sharp DX-3 (\$950):** Like the Hitachi and Sanyo players, the Sharp is just over a foot wide. It repeats songs, plays chosen selections in order and has an indicator that shows time played on the disc or the relative place in time of a selection just cued up for play. Its outputs allow a choice of levels so as to match what the amplifier handles best: high or low level. This player, too, is very easy to use.

**Sony CDP-101 (\$900):** First-time use of this sleek and glamorous player con-

firms that Sony, one of the developers of the CD, is also one of the best supporters of the CD format. You can search backward and forward in proper musical pitch, at fast and double-fast speeds, until you hear the part of the music you're looking for. It shows total time and remaining time as well as displaying the time played. And, so you don't have to stay at the machine itself to do all this, there is an infrared remote control box that duplicates virtually all the functions of the front panel. If you want it to, the main unit will even give a muted "chirp" when it receives remote instructions.

**Technics SL-P10 (\$1,000):** With the ability to program up to 63 selections, the SL-P10 is not likely to become a museum piece soon. It will program songs in any order, regardless of whether they are punched in by band number, phrase index number or time. You can even program when to stop playing a selection. Multipurpose or not, this is a remarkably simple deck to use, and it grows under your fingers, as new uses suggest themselves. Changing the order of movements in Beethoven's *Fifth Symphony* used to mean hunt-and-peck needle dropping, but now it can happen painlessly and without returning to the machine.

**Toshiba XR-290 (\$1,000):** This unit will sample the music in fast forward or fast reverse, too, letting you find the spot you want. It's as simple to use as any of the players. You can switch on a little "chirp" that lets you know a command has been received—a nice confirmation, because the touch-plates and buttons of most CD players are so quiet you wonder if you've done anything when you touch them. The XR-290 is massive enough to be the centerpiece of any audio system, yet it's small enough to fit where any other component should.

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## The CD and the future

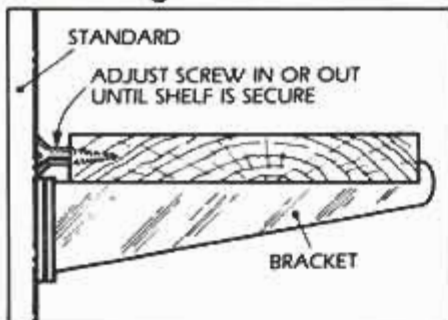
There currently are about 450 Compact Disc titles available, about 40 percent of them classical. At a list price of \$17 or so, most of them are in the same price league as budget records that cost five bucks. Future players will handle today's CDs and, of course, this first generation of the CD players will remain compatible.

The prices for the discs and players are high now, and we can't guarantee when they will come down. So if the availability of absolutely pure music is tempting even at this price, you may want to be among the first to spin a Compact Disc in your own home. But as more of these are sold, we think the prices will fall to more accessible levels. It seems sure that, someday, a disc player will not cost much more than a turntable does now.

PM

# HINTS FROM READERS

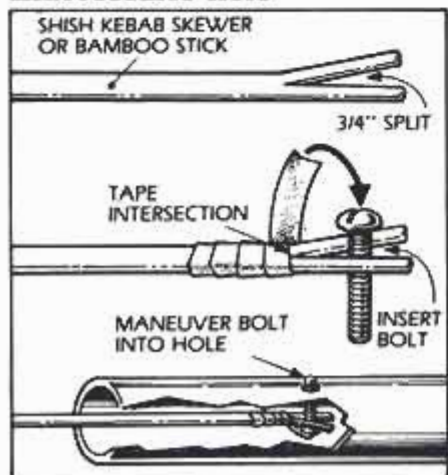
## Stabilizing shelves



A flathead screw can stabilize a shelf when inserted into the back and supported by brackets and standards. Adjust the depth of the screw until it presses firmly against the standard and the shelf front touches the bracket.

—Dr. Tom Baker

## Inaccessible hole



Recently, I needed to insert a bolt through a hole about 8 in. from the end of one wall of a length of 1/2-in.-dia. conduit. To place the bolt, or similar fastener into an inaccessible hole, I devised a tool made of a thin bamboo shish kebab skewer. I purchased a package of skewers at the grocery store. First, I carefully made a 3/4-in.-long split in the end of the stick. Next, I wrapped tape around the closed end of the split to strengthen it, leaving a loose tape end. Then I slipped the shank of the bolt into the split, secured the bolt with the loose tape end and maneuvered the bolt into the hole. After grabbing the end of the bolt and running a nut up it so it wouldn't fall out, I pulled away the bamboo stick.—Mees Trussell

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# TECHNOLOGY UPDATE

## MILITARY

### Russia's strong suit

There's no escaping chemical weapons unless one is equipped with sophisticated protective gear, such as the butyl rubber suit reportedly issued to Soviet troops in Afghanistan. At a European human rights conference, Afghan rebels turned over to the Institute for Foreign Policy Analysis a captured Russian suit and gas mask. According to a report released by the U.S. Defense Intelligence Agency, the suit provides excellent protection against "yellow rain," a deadly chemical the Russians reportedly use in Afghanistan. Chemical warfare is prohibited by the 1925 Geneva Protocol and the 1972 Biological and Toxic Weapons Convention.

PM, which acquired the gear through sources at the Cambridge, Mass., Institute, found it to be very hot, heavy and difficult to maneuver in. The suit includes a coat, knee-length boots and gloves. To provide complete protection against chemical or biological agents, the suit must be worn with a specially treated undergarment.

The mask—which fits completely over the head—is effective only when attached to its filtered canister. The small eyepieces restrict side vision and the lack of voicemitter hinders communication. In addition to providing protection against chemical weapons, the suit can be used as a raincoat, ground cloth, field shelter and flotation bag.

Afghan rebels testifying before the U.S. Congress have said that all Soviet troops carry the special gear.



Photographs by Layman/Newman

This Soviet chemical warfare suit, reportedly captured by Afghan rebels, includes a hooded coat, gas mask, gloves and knee-length boots. In tests, it provided excellent protection from deadly "yellow rain." For authenticity, we added an AK-47 rifle, supplied by Navy Arms Co. of Ridgefield, N.J.

### RADAR FINDS TOXIC WASTE

Experimental Sub-surface Interface Radar (SIR) is being used in Michigan to search for hundreds of drums of cyanide, hydrochloric acid and paint sludge buried in landfills sometime in the late 1970s. The SIR, made by Geophysical Survey Systems Inc., consists of a rope-pulled dolly under which an antenna is fixed. The antenna sends out radar pulses and receives reflections from objects buried 20 feet or more. Computerized recorder units on the dolly can be removed and hooked up to larger computers after an area is dragged. That produces clear images of where the drums are located.



### 'SPOTLIGHT' FOR LASER TARGETS

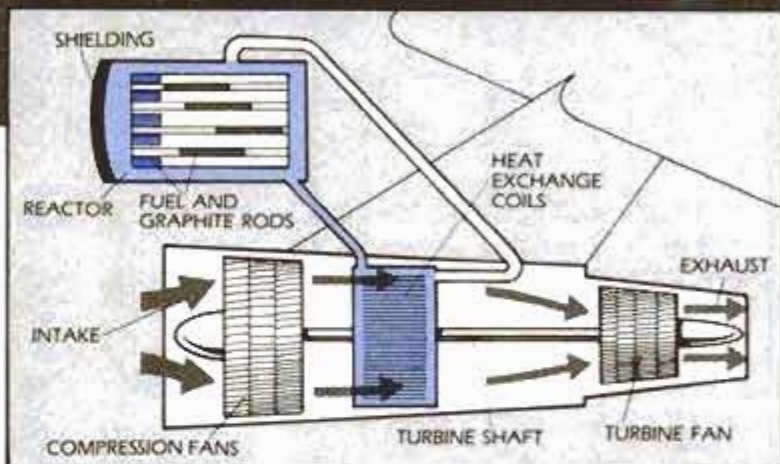
Before there were laser-guided missiles and artillery shells, the Army used flares and spotlights to highlight targets for gunners. But today's weapons are often guided to their target by laser light. Hughes Aircraft's new Modular Universal Laser Equipment (MULE) can be carried into the field on foot by a soldier who points the laser at a target, then adjusts a computerized rangefinder device to put the enemy in the middle of a site. When the laser light is fired, it triggers the missile, which adjusts its heading toward the target based on reflected laser light.





### Will atoms take off?

A nuclear-powered airplane could be airborne by the 1990s if the military or an airline company ordered one, according to our sources at the Air Force Institute of Technology. In 1961, the government scrapped the idea of a nuclear-powered jet, but the concept was revived in the past few years by a team at Wright-Patterson Air Force Base. The key strategic use of an atomic plane would be in submarine surveillance: The A-Plane would use two conventional engines to get off the ground, but a pair of nuclear-powered engines could be fired permitting the craft to stay aloft for months at a time. The airplane envisioned is of a canard-type design, allowing engineers to place the reactor farther away from the crew than would



have been possible in the '60s. The reactor, a high-temperature helium-cooled type, would send heat through heat exchange coils surrounding the turbine shaft. That would help compress intake air to turn the jet's turbine fans.

### Return of the P-51



No belly scoop, but still a familiar sight.

Although it lacks the original's distinctive belly scoop, the plane you see above is almost a direct copy of the famous P-51 Mustang fighter of World War II. Called the Piper Enforcer, it's designed as a low-cost companion to the much more expensive tank-busting A-10 dive bomber.

Why build a new ground-attack aircraft based on a 40-year-old design? The answer: proven capability at a bargain price. Enforcers cost about \$3 million apiece, compared to as much as \$18 million for the A-10.

The 2,445-hp turboprop plane carries assorted cannons, missiles and bombs and can do 403 mph—making it actually a tad slower than its illustrious ancestor.

### Poor man's AWACS



Bargain AWACS: Tiny blimp with big eyes.

Flying radar stations like the AWACS and Hawkeye can be an effective war deterrent, but are too costly for use by many friendly nations of the Third World.

Now, however, the U.S. Air Force thinks it may have found a simple, low-cost substitute that anyone can afford—a small blimp fitted out to carry sensitive radar detection gear in an underbelly pod.

The 250,000-cubic-foot, helium-filled airship, currently being tested at Homestead AFB in Florida, is 175 feet long, operates at altitudes up to 12,000 feet and can be remotely controlled from the ground with no crew aboard—just in case some "unfriendly" takes potshots at it.



4. Safe in sling, Aquila is gently lowered.





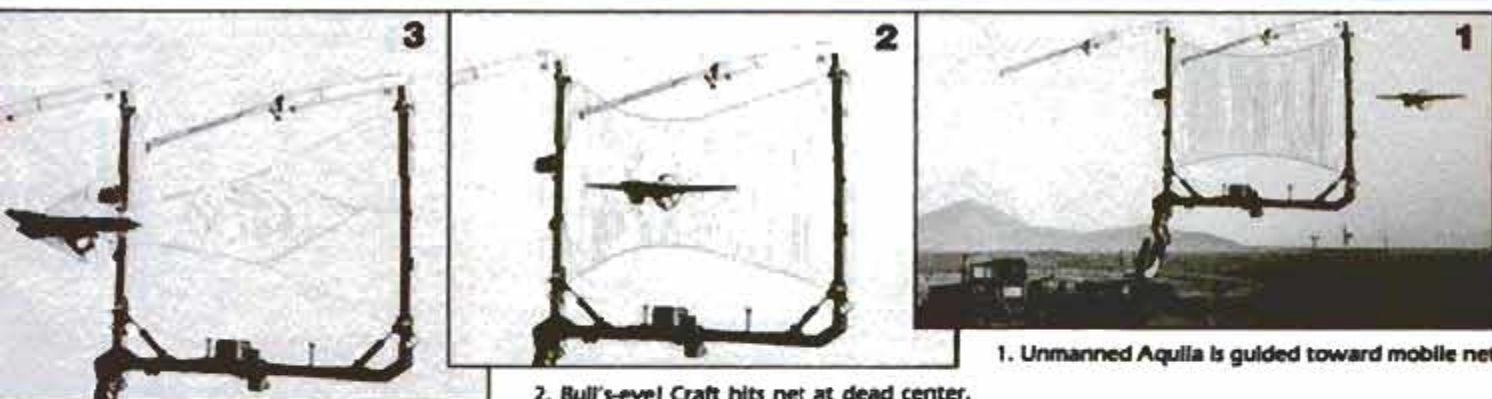
## Far-out flying machines for the 21st century

When not building airplanes for the present, engineers at the Lockheed-Georgia Co. like to dream about futuristic concepts for the next century. Some of the far-out ideas they come up with are dillies. Imagine an antisubmarine patrol craft able to remain at sea for days at a time without returning to base. In between reconnaissance missions, the huge amphibious Sea Loiter (upper left) would just park in the water, becoming a floating outpost ready to take to the air at a moment's notice.

The Delta-Wing Spanloader (upper right) is a giant, all-wing cargo transport designed to eliminate the weight and drag of a conventional fuselage. Its airfoil shape, thick

enough to accommodate boxcar-size loads, converts the entire structure into a lifting surface, enabling it to haul 400-ton payloads more than 4,000 miles.

Or take the Flatbed Freighter (lower right). It would carry containerized cargo on its open spine, making loading and unloading much faster and easier than in a cabin plane. Perhaps the strangest concept of all is the Ground-Effect Transport (lower left). A flying boat with cupped wings, it would fly across the ocean only a few feet above the surface without ever getting out of ground effect. Riding a cushion of air, the 238-foot-long water skimmer could carry 220-ton payloads at better than 300 mph.



3. Net stretches to absorb the impact.

2. Bull's-eye Craft hits net at dead center.

1. Unmanned Aquila is guided toward mobile net.

## Gotcha! New aerial snatch saves spy planes

Launching an RPV (Remotely Piloted Vehicle) is easy, but getting it safely back down is another matter. It has no wheels and can't be landed like a conventional airplane. Until recently, such unmanned observation craft were recovered by parachute—a slow method that subjects them to enemy fire and ground impact damage.

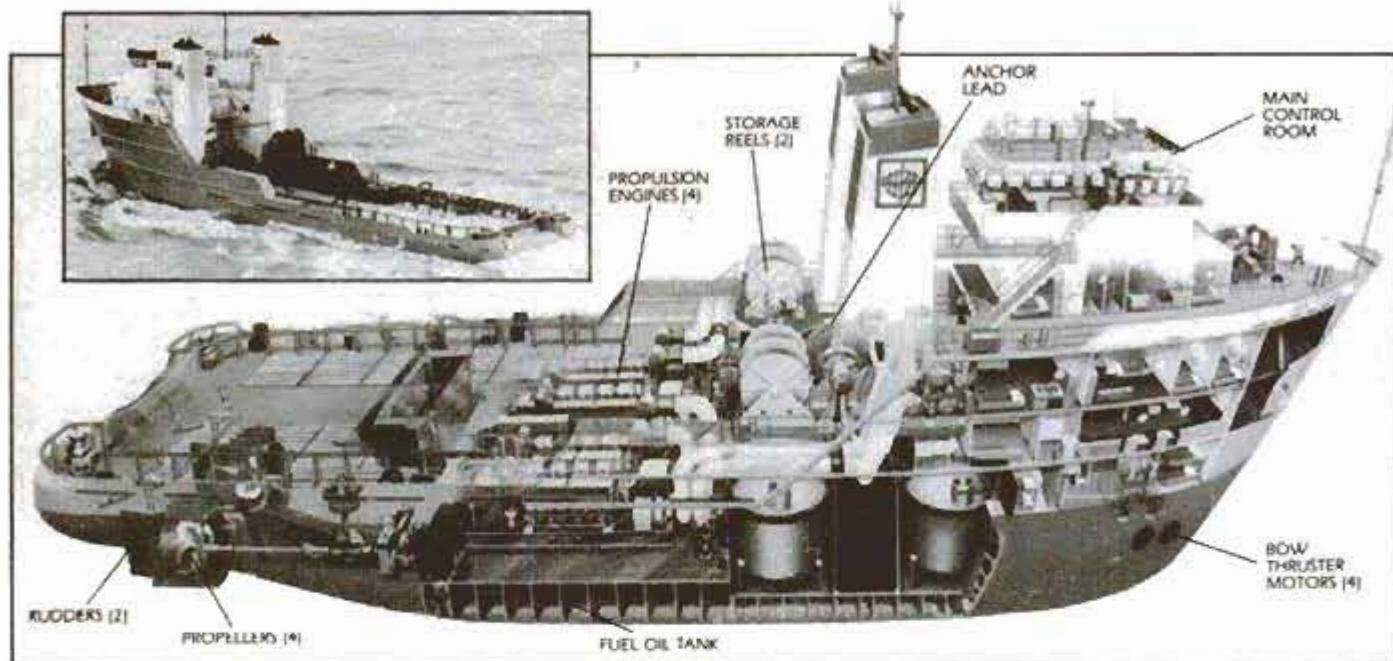
The U.S. Army's newest RPV spy plane, the Lockheed-developed Aquila, has no such problems—it's snatched right out of the air on the fly, as shown in the photo sequence above. After a reconnaissance mission, it's guided back to the launch site and flown into a mobile capture rig that looks like a place kicker's net stretched between

football goal posts. The net is designed to give way progressively, slowing the craft and forming a U-shaped sling to cradle it. The sling is then lowered to the ground.

The retractable capture rig, which mounts on a standard five-ton Army truck, can be moved quickly to any location and set up in minutes. The Aquila RPV, fitted with TV cameras and sophisticated surveillance gear, will give the Army a new set of long-range electronic eyes for peering deep into enemy territory.

Editor: Dennis Eskow  
Contributors: Sheldon M. Gallager, Jack Hammond,  
Michael A. Filton, Phyllis Wolfman, John Ginsberg

## MARINE



### This Kodiak is a bear

**S**he's 500 gross tons of steel, composites and wood. Named Kodiak I, this bear is the first Sea Titan-class tug, a supertug designed to pull supertankers and other massive or difficult loads. The Kodiak I's four diesel-electric engines produce a combined 12,280 hp.

For long-distance towing of semisubmersible oil rigs, the supertug has two chain storage wheels with a combined pull of 500 tons. Pulling a full load, the Kodiak I can move at 16 knots. It has a pair of twin bow thruster motors driven by

Reliance 750-hp DC engines to add to the vessel's maneuverability. Well-protected fuel-oil tanks feed the diesel engines a maximum 800 gallons per minute of oil.

The main control room is totally computerized and the crew monitors radar, sonar and the well-being of the ship's hull with TV cameras. The Kodiak I carries a crew of 27 in heated and air-conditioned staterooms located close to midships. The ship also has its own sewage treatment plant, permitting safe dumping of waste.

## ALTERNATIVES



### Earthquake-resistant building

**C**onstruction is under way in San Bernardino County, Calif., on America's first earthquake-resistant building. It's a four-story office building located near the San Andreas Fault, a crack in the earth from which comes most of California's quakes. The building sits atop 90 "elastometric bearings" made of synthetic materials with the consistency of rubber. The bearings were each subjected to stress tests (above, inset) which indicate that they will be able to absorb most of the shock from a strong quake.

## INVENTIONS



### TIME-RELEASED PILLS

When did you take your last dosage of penicillin? If you're sick, you may not remember. Now, Bart Zoltan, an American Cyanamid engineer, has invented a medicine bottle that records the date and time (a.m. or p.m.) when it was last opened. CAP, as the bottle is called, is expected to be on the market next year.

### SPRINGY CEMENT

Cement is very strong, but until recently, its use has been limited by its lack of elasticity. In England, University of Oxford researcher David Double combined a polymer and additional water with ordinary Portland cement. The result is a very hard, but resilient, substance that has been made into a spring.



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## DRIVING ISUZU IMPULSE

(Continued from page 67)

master of car design, Giorgetto Giugiaro, the same man who did the Lotus Esprit, the VW Rabbit and Scirocco, the De Lorean, the Maserati Bora, Merak, Quattroporte and others. The basic Impulse design first showed up at the 1979 Geneva salon called the Ace of Clubs.

Isuzu said from the start that they intended to produce the car. It was never just a styling exercise. And the Japanese have translated Giugiaro's lines very faithfully into metal.

### What's it made of?

The body not only looks good, but most panel seams run along natural parting lines. The hood cut, for example, follows the coupe's beltline groove. All glass fits flush, and the radio antenna rests inside the left windshield pillar. Doors lap up into the roof for easier entry, with hidden drip channels above them. And lift-up eyelids above the headlights cover part of the halogen quad lamps to give not only slightly better aerodynamics, but to impart a more cunning expression to the car's face.

The Impulse was introduced in Japan in late 1981 as the Isuzu Piazza. The Piazza was powered by a 135-hp, twin-cam version of the same 90-hp, sohc engine we get here. But the Japanese car comes with 13-inch tires and wheels; we get 60-series 14-inchers.

Mechanically, the Impulse borrows its unitized floorpan, suspension, five-speed manual and overdrive automatic transmissions from the Isuzu I-Mark sedan. The Impulse engine has the same internal dimensions as the P'up half-ton pickup.

The Impulse, like other Isuzus, sticks with rear drive and front engine placement.

It's all relatively simple, low-tech engineering. But we don't say that in a derogatory way. It's trendy nowadays to go with front-wheel drive and independent rear suspensions, but sporty vehicles have tended to stick with rear-wheel drive and the Camaro and Firebird don't have independent rear suspension. Low-tech engineering results in lower selling prices and, often, high reliability.

Front suspension echoes GM's traditional coils sandwiched between double wishbones, but adds high-mounted gas shocks. There's a three-link live axle around back, again with coils. Acceleration and braking reaction is taken through a torque tube that is carried in a heavily bushed crossmember. Both ends of the car have stabilizer bars.

The engine's fuel-injection system

uses a hot-wire sensor inside an intake passage that reads airflow temperature and air density. An on-board computer adjusts the fuel/air ratio to compensate for extremes of cold, heat and barometric pressure or altitude. In other words, if you're driving up Pike's Peak in wintertime, the engine *should* deliver the same power, torque and flexibility as it would if you were crossing Death Valley in July.

Engine mounts use hydraulic fluid inside a double-chambered rubber container. The fluid moves back and forth between the two chambers, much as in a conventional shock absorber. At idle or low vibration frequencies, you can see the gearshift lever shaking like crazy, but you can't feel engine pulses at all in the floor, steering column, or any



Pods on each side of the wheel give fingertip control of lights, wipers, A/C, vents.

part of the passenger compartment. It's really something, although not an original idea. The Porsche 944 and Mazda 626 had it first.

### Versatile steering

The steering is interesting, too, in that it uses a variable-ratio rack and pinion, whose power boost decreases with road speed. During straightline driving, the steering ratio is 16.6:1. But this changes to 20.0:1 by about the time you've got 180° of wheel lock. The idea is to give the driver three things: 1, quick steering response for high maneuverability; 2, good road feedback at cruising speeds and during normal handling maneuvers; and 3, greater boost for parking.

The Impulse performs capably, but not outstandingly well. It's a good road car, but not a great road car.

It is, however, a great-looking car, and that counts for a great deal in today's style-conscious world. **PM**

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	PRICE: DELIVERED TO YOUR DOOR	FACTORY PICK-UP
30-Gal. - Bottom	\$30.94	\$26.94
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Top Kit fits both	20.93	17.92

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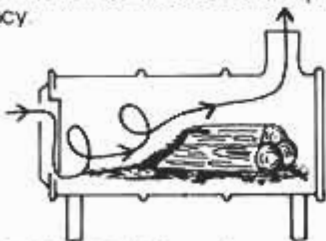
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**SPECIFICATIONS:** Door, door frame, flue collar, draft control, internal draft channel of 13 ga. steel legs, 1/8 in. steel hinges, latch, catch of 3/16 in. steel nuts and bolts. Top Drum, Connector flanges, pipe assembly, 4 nesting brackets, nuts and bolts



OUR 27th YEAR

Patented INTERNAL DRAFT CHANNEL-Air entering top draft control is preheated as it is drawn down inside of door and is sucked into bottom of heater with a turbulent action, mixing with the wood gases. This makes the Sotz stove tops in efficiency.



**SPARK-PROOF DESIGN**... Because of our internal draft channel, hot sparks cannot jump out of heater as in others with draft straight open to fire.

**\$34.92** 55-Gal. bottom kit factory pick-up

**\$26.94** 30 Gal. bottom kit factory pick-up

Kit converts 55 gal., or 30 to 15 gal., drum (not supplied) into high capacity stoves.

You've seen our ads and read unsolicited testimonials from folks just like you for many years. Before you spend \$400 to \$500 on a wood heater, try a **SOTZ HEATER** kit. If (within one year) you don't agree it outperforms any wood heater money can buy or (within 10 years), if the kit cracks, warps or burns up, your money will be refunded, including shipping charges.

Use of draft control allows you to heat large or small areas. Basement installation heats your entire home. Great for your garage, workshop, or cabin. Top drum squeezes 60% more BTU's from heat normally lost up the chimney. Heavy steel kit bolts together quick and easy.

• ALL MODELS SAFETY TESTED TO UNDERWRITERS LAB. SPECS. BY GEISSER ENGRS.

## THE ONLY KIT SOLD

- With enough nuts and bolts to complete stove.
- Sotz Top Drum Kits include connector pipe, others don't.
- 55 Gal. Stove has king size 15 1/2" diagonal fuel door. Less wood splitting, easier fire tending.
- 30 Gal. Sotz has bigger opening (9 1/4" rd.) than other brands' 55 gal. kits.

**FREE INFO:** Add even more efficiency to the already super efficient Sotz Stove with a genuine Corning Brand Catalytic Combustor, easily fits existing Sotz 2-Drum Heaters. Learn about heating water, drying wood, fireplace-to-woodstove.

Sotz Inc., 13643 Station Rd., Columbia Station, OH 44028

## "THE COMEDIAN"

I knew there was a catch to the stove kit and Monster Maul. For the past 3 years I've read your ads and successfully resisted. Finally I weakened and bought both the maul and kit for the 2 Barrel stove and as I suspected, there had to be a catch. It does heat a basement and upper floor of a 25'x40' building. I'll admit that it does hold the fire for 16-18 hours effortlessly. Sure there are not hot spots or sparks. And maybe the ease of assembly does impress me. Some of my neighbors even agree that the maul is better than a 6-pak of wedges and axes. But: If this whole set-up is so all fired great, efficient, convenient, dependable, clean, and low cost, why won't my wife volunteer to cut the wood?

Dr. Larry Vickrey, Louisiana, MO

## I CAN'T BELIEVE

I got my 2 drum heater working like you said it would, I built mine with a 30 H

kit, I put a 35 gal. on top of a 40 gal. ... works better than my neighbor's \$500 heater with less fuel. I have had people see this in operation they say "I can't believe it." I am ordering a 55HDD kit today. Well pleased with this unit and can't say enough for it and your service.

Jay E. Neal, Strattanville, PA

## "DISREGARD THE DIEHARDS"

I have used the Sotz double drum stove for 8 years now. It completely heats 3000 sq. ft. of my residence. My Sotz kit has cut wood consumption in half and requires much less attention feeding the stove. After seeing my stove and the results it gives, several friends have ordered one like it. Of course, there are those diehards who aren't satisfied unless they can spend \$600-\$800 for a heating unit. We Sotz users just smile and mentally count our blessings! My son is 13 years old now, and I believe the two of us can make a

few extra bucks by selling our surplus wood.

Russell McGuire, Glasgow, KY

## WHY BOTHER?

Please send me the Sotz wood stove as shown in the Mother Earth News Magazine. My parents have one in their house and it works great. It heats their 7 room house easily. My uncle has one in his house also. I don't know why you bother giving a guarantee on such an indestructible product.

David Mundy, St. Ann, MO

## "DOWN ON THE FARM"

We have one of your double barrel heaters in our shop on the farm. We are very pleased with it because it does an excellent job of heating the shop which is 36'x48' with a 14' ceiling. We also have a gas ceiling heater to supplement the wood heater which we have found that we never have to use since the wood heater does so well.

Jim Lyons, Plainwell, MI

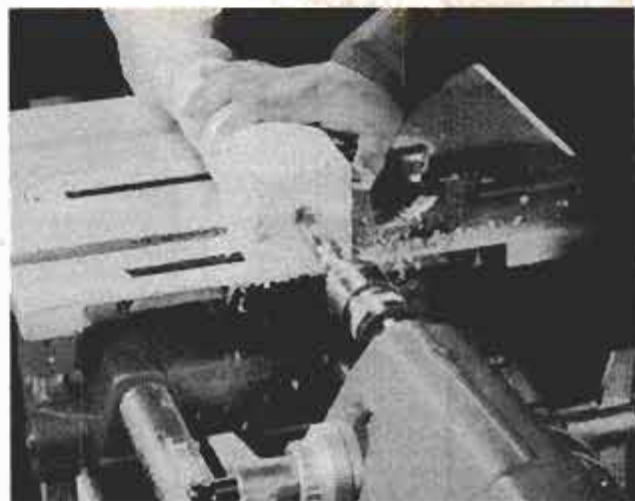


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Item #1013	137
16GPM, use with 8 HP Item #1015	157
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Ball-in-reel valve. 1/2" in-out ports. 1/2" cylinder ports. Item #2010 \$43.75  
Has pressure sensitive detent, hands free on return stroke. Item #2020 \$55

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Tie Rod*	3 1/2x24	1 1/2	50	909324	\$108
Tie Rod*	4x24	1 1/2	74	909424	133
Tie Rod	5x24	2	100	909524	210

\*These can be shipped U.P.S.

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Tecumseh	5	1/2"	Recoil	6053	40	144
Briggs	8	1"	Recoil, M 190432	6080	50	204
Tecumseh	8	1"	Recoil, cast ir. sl.	6081	50	183
Tecumseh	10	1"	Recoil, cast ir. sl.	6010	50	224
VERTICAL						
Briggs	5	7/8"	Recoil, hd fly-wh	7050	45	148
Briggs	6	1"	Recoil	7080	49	212
Tecumseh	8	1"	Recoil, m VM80	7082	50	198
Tecumseh	8	1"	Elec/Recoil 12 v	7083	55	243
Tecumseh	10	1"	Electric start	70101	49	283

3 1/2" 20HP available in horizontal & vertical

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#15924	W280	Recond.	\$139.95	\$82.95
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#15926	50	Recond.	\$59.95	\$28.95

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#17261	11000 BTU	\$58.95	\$ 38.75
#1727	24000 BTU	\$167.00	\$118.00

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Rot proof Poly tarpaulin with brass plated holes every 1 ft. on edge

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## OWNERS REPORT: CORVETTE

(Continued from page 134)

huge price in the car's rough ride." There was lots of agreement on that point. An Alabama engineering manager suggested, "It's the Z-51 handling package and the stiff Goodyear Eagle GT tires that cause the rough ride."

A Texas postal clerk said, "I don't believe the Z-51 handling package is desirable for anyone who's not going to actually race the car. The standard suspension system gives outstanding handling for the average owner while still providing a comfortable ride."

A doctor from Ohio: "Handling is sensational! Seats offer excellent lateral and lumbar support." In all, two-thirds of our respondents bought cars with the Z-51 handling package and a third had the sport-seat option.

One thing the sports seats tend to do is make entry and exit rather tricky. A Missouri engineer said, "Entry into this vehicle is extremely difficult." And a Wisconsin navigator explained, "The high rocker sills and seat wings make you learn to shoehorn yourself in and out."

There weren't many comments about the digital LCD instrumentation. A few owners mentioned that the displays wash out in bright sunlight, but no one seemed unduly annoyed.

We did register many comments about the Delco-Bose sound system, both pro and con. An Illinois butcher admitted, "Initially, I didn't think the Delco-Bose stereo was worth \$895, but I had to take it to get the car. I've since changed my mind. It is worth it!" But a Texas banker said, "The Delco-Bose is capable of deafening you without any distortion, but I think it's overrated and not worth the money."

### Transmission checks out okay

One word, too, about transmissions. At the time of our survey, the manual seven-speed Doug Nash overdrive transmission hadn't been released. Early Vettes came only with the Turbo Hydramatic 700-R4. This automatic has nonadjustable, computer-controlled shift points and an overdrive (.70:1 ratio) FOURTH. Comments about the THM 700-R4 transmission were generally favorable, although some owners felt that it shifted into the upper ranges too quickly. The idea here is to give better fuel economy. Other drivers mentioned that they left the selector in D3 around town to keep it from shifting back and forth between THIRD and HIGH.

The quality of the new Vettes received mixed reviews, with many owners saying the car has a terrific body but so-so mechanicals. Just over 70 percent of our owners rated the new

Corvette's surface smoothness excellent. Most also raved about paintwork and general finish.

But owners weren't too happy about the way some of their cars' mechanical parts were put together. They talked about just the little things—accessories and the like—not engine or drive train. On these more minor items, only 51.8 percent gave workmanship a mark of excellent, while 15.1 percent graded it average to poor.

A majority of the owners said they had mechanical problems. But more also fixed those problems themselves (17.7 percent) than for any car on which we've ever run a survey. This means a lot of the repairs were minor—things like regluing trim to the rear security shade or tightening screws.

### Brake squeal

Not counting recalls for the smog pump and replacement bolts for the front brake calipers, the biggest single mechanical gripe was brake squeal. The Vette's superlight, Australian-sourced Girlock binders apparently sing louder than most.

Nor was the one-piece, lift-off roof panel the handiest. For one thing, it tended to rattle. For another, since it uses four bolts to hold it in place, this targa top proved a pain to remove and install.

The power window regulators, too, had a way of going out. The electric motors either quit completely or, in some instances, raised and lowered the glass so sluggishly that it amounted to a defect.

Another mechanical problem was the tendency of the electric outside rear-view mirrors to come out of adjustment, either when the door slammed or when the car ran over rough surfaces.

A GM auto-design group leader—one of those insiders we happened to snag in our survey—had an interesting comment, though, about the Corvette's mechanical repair costs. "Chevrolet parts are so much cheaper than for other sports cars that this becomes a big plus in the Corvette's favor. I've had to buy parts for imports and know what they cost. Porsche parts are out of this world."

Corvette owners tend to be much more critical of their cars than most drivers, but in the final analysis, the vast majority wouldn't trade their Vettes for anything else on the road. Only 7.8 percent said they definitely wouldn't buy a Corvette again, which means that, despite all those early bobbles and some dealer gouging, most owners had no regrets.

As a Maryland warehouse manager put it, "After all, how many people can get excited about driving to work in the morning?"

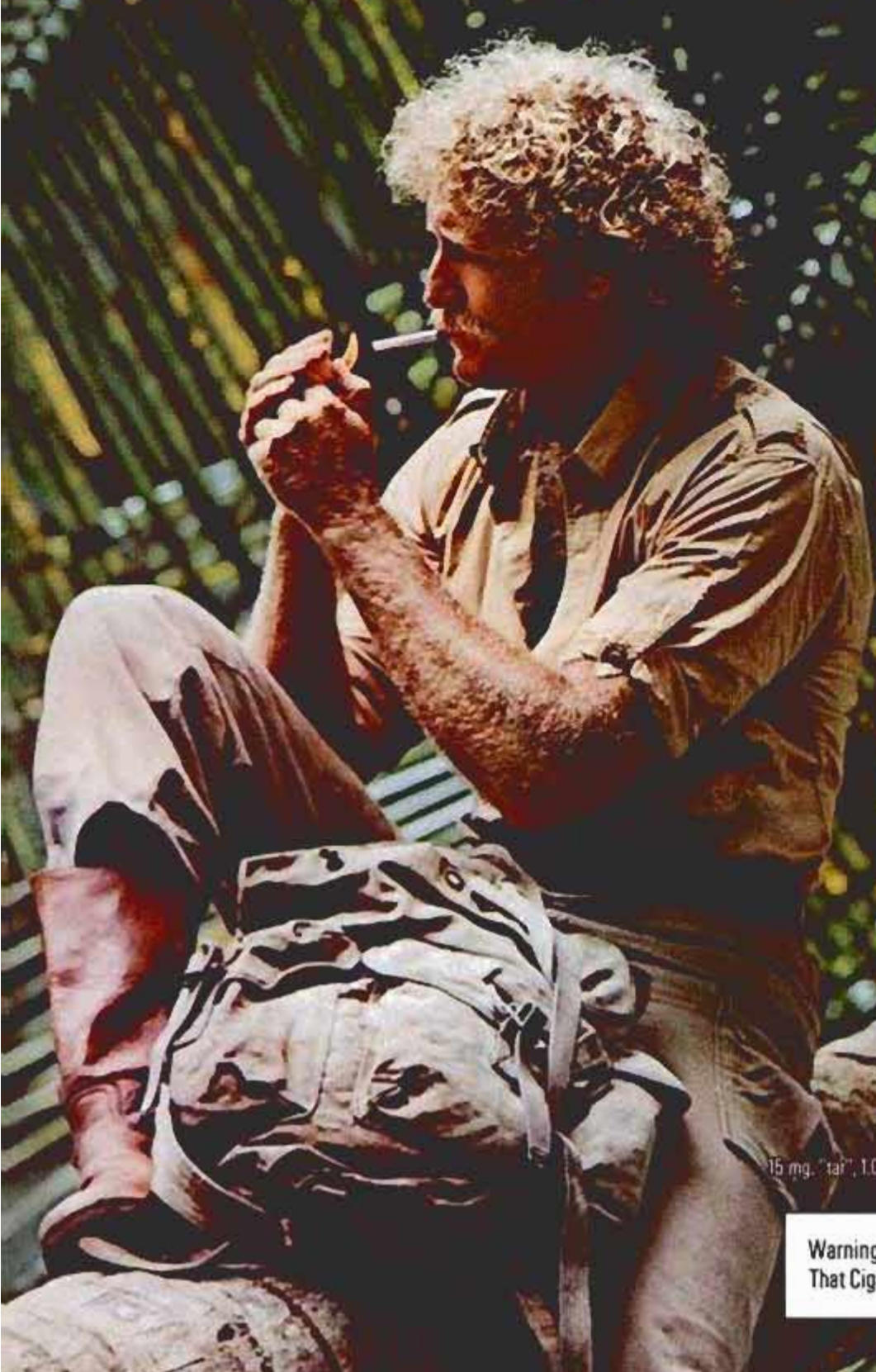
PM



# CAMEL

## FILTERS

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Experience  
the Camel taste in  
Camel Filters.

15 mg. "tar", 1.0 mg. nicotine av. per cigarette, FTC Report MAR '83.

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

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# Move into more wagon. New Chevrolet Celebrity.

**More cargo space, more passenger room, more engine than any front-drive wagon before.** That's a lot in one wagon. But then there's never been a wagon like our new Chevrolet Celebrity Wagon.

Nine cubic feet more total room than Chrysler K-Wagons. Comfortable full-width seating for six. Plus a three-seat model with room for eight.

Standard power rack-and-pinion steering. Power brakes. Side window defoggers. And even the under-

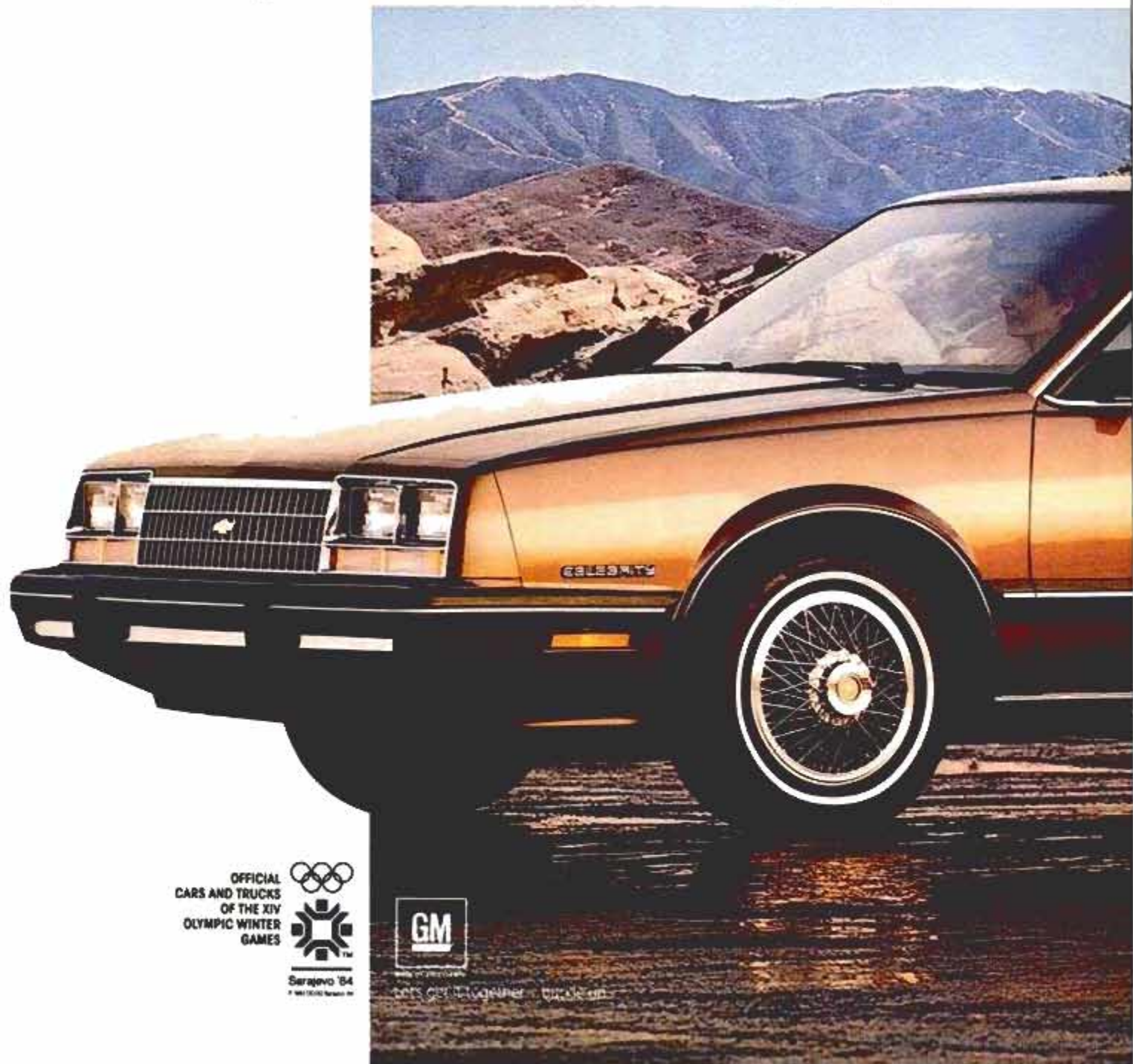
floor cargo compartment is carpeted.

All moved by a bigger standard engine than in any front-drive wagon before.

**More mileage than many smaller cars.**

39 Est. Hwy., [25] EPA Est. MPG\* from a standard electronically fuel-injected engine so advanced it's fine-tuned by computer as you drive.

Performance aided and abetted by the surefooted traction of front-drive. In a wagon so easy to drive, you'll forget there's all that wagon behind you.



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**No other front-drive wagon has this much room at a lower sticker price.** You've squeezed into small wagons. Now move into more wagon.

Try to find any front-drive wagon that gives you more, for less, than the new Celebrity Wagon.

Today's Chevrolet, bringing you the cars and trucks you want and need today—that's what Taking Charge is all about.

\*With available automatic transmission. Use estimated MPG for comparisons. Your mileage may differ depending on speed, distance, weather. Actual highway mileage lower. Some Chevrolets are equipped with engines produced by other GM divisions, subsidiaries, or affiliated companies worldwide. See your dealer for details.



**CHEVROLET**

taking charge



# How To Get The Most

Here are video cassette recorder add-ons that will really make your picture shine.



BY DAWN GORDON

Ever since the first Betamax video cassette recorder (VCR) appeared in '75, the video accessory market has been close behind. Accessories come in all shapes and sizes, from simple video head-cleaning cassettes to expensive and complex color processors. It's all there waiting for you, but be careful. You might just get carried away and end up spending more on accessories than you did on your VCR.

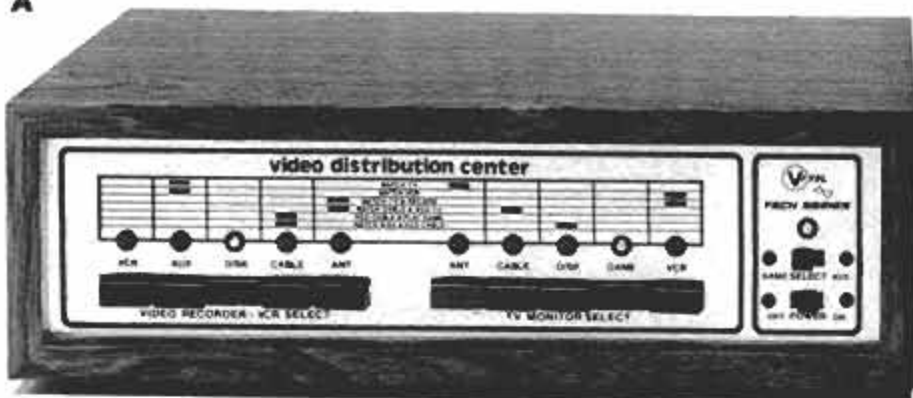
Probably the most interesting and popular black box is the video stabilizer (\$80 to \$175). All prerecorded videotapes incorporate a copyguard signal that causes the picture to roll when a video dub is attempted with another VCR. Because the vertical synch is weakened, video dubs are prevented and so is piracy of copyrighted material. Well, maybe. A stabilizer, when connected between two VCRs, will correct the problem and allow taping to take place. Of course, it is illegal to tape copyrighted programming, but it is legal for you to purchase the stabilizer because it can be used to dub homemade movies, and to correct picture roll and jitter on too-sensitive TV receivers.

Image enhancers (\$150 to \$300) are used to increase image clarity, brighten faded colors and eliminate white haze, all unfortunate symptoms of tape dubbing. Enhancers can also improve any poor recording and sharpen video camera images even while shooting is in progress.

What can you do to get rid of commercials when you tape a TV program automatically? You can buy what is known as a commercial killer. The commercial killer

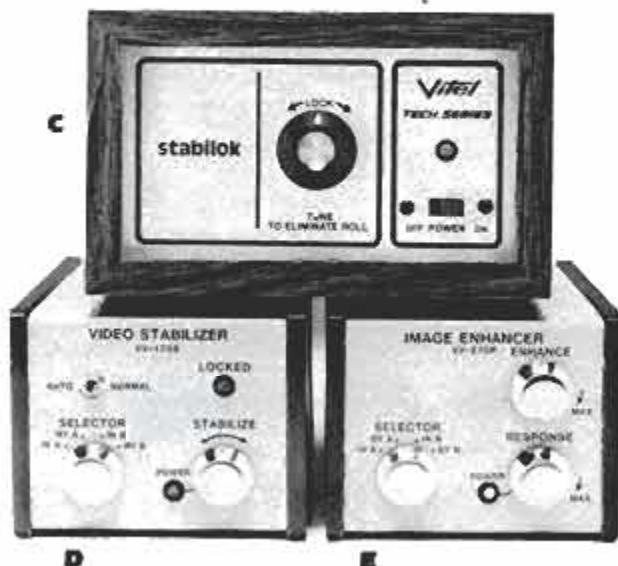


A



B

Recording between two VCRs, such as the Zenith model VR9800 and the VR1200 above, can be improved greatly with accessories such as these. **A.** Is a video processor from Vitel which enhances clarity and picture color. **B.** Is an RF switcher from Vitel which can direct five video sources between a TV and VCR, and **C.** is Vitel's stabilizer, used if copyguard picture rolling is a problem. **D.** and **E.** show how to get separate stabilizing and enhancing power (Showtime). All these units may be interconnected to best serve in your situation.



D

E

# From Your VCR



(\$150 to \$350) automatically removes commercials during VCR timer operation. Killers work in various ways. Some simply sense the fade-out that occurs when a commercial is about to begin, while others work only with black and white programming, sensing the commercial's color signal and stopping the VCR. Almost all of these devices take a few seconds to stop and start the recorder, so there is a certain amount of lag time involved and some of the program may be lost.

Color Processors (\$200 to \$500) work just as their names suggest. They process color images in any way imaginable. One control found on most units varies the color intensity, while another knob (the color phase control) adjusts tint for effects such as green hair and yellow eyes. Yet another feature (burst control) on some units varies the frequencies responsible for flesh-tone reproduction. Color processors are quite useful for dubbing, as well as for playback enhancement.

Other assorted black boxes worth noting are: noise-reduction systems, which subdue some of the hiss associated with videotape; stereo simulators that recreate the real thing from a mono source, such as a VCR or early CED videodisc player; and Dolby extraction units that decode the rear channel still intact on most stereo tapes and discs for a spectacular surround experience. Some units are single function. Others provide multifunction convenience, such as a combination image enhancer/color processor.

This next video accessory is the most useful one. It doesn't

*(Please turn to page 156)*

Showtime's audio/visual processor (F.) allows you to adjust the audio level of all signals. G. is a color processor from Showtime. The system switcher (H.), also from Showtime, lets you feed and process up to four signals to separate TVs. RF switches (I. from MTI, J. from Winegard and K. from Total Video) mean further customization.



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## VCR ACCESSORIES

(Continued from page 155)

take up much space and its cost is fairly low (\$30 to \$175). The RF switcher is a device that conveniently switches between inputs and outputs, and makes it easy to select the input of a VCR, video-disc player, antenna, cable converter, video game or computer. It eliminates the rat's nest of wires that often accompanies video gear and, at the same time, allows different sources to be routed to different TV sets. Most switchers will produce a small degree of line loss (3 to 7 decibels) because they do split the signal, but the majority of homes with a strong signal shouldn't be affected. In residences with a weak signal, switchers will tend to increase the snow level. To prevent this, and also to boost any weak signal, a signal amplifier (\$25) is the answer. This unit is sometimes called a mini-amp, and it boosts signal strength by about 10 decibels. This will generally get rid of snow, and afford a better picture overall.

One unfortunate fact of VCR life is that cable TV converters prevent you from watching one channel while taping another. The converters disable a VCR's programmable timer and leave a TV receiver's remote control totally useless. While these problems may seem unsolvable, there is a light at the end of the tunnel, and it's called the up-converter. This unit (\$30 to \$75), sometimes called a block-converter, relocates all VHF and cable channels to UHF frequencies, which the VCR tuner can pick up easily.

### Maintenance accessories

The next set of accessories to look for is designed to extend the life of your VCR and keep everything in good running order. A bulk eraser (\$50), for instance, is a convenient item that will erase an entire tape in seconds, and can provide a cleaner tape than a VCR's erase head.

Video head cleaners should definitely be included on your shopping list. They come in all sizes and shapes, and are usually marked as to what VCR models they will work on. Other cleaners are in cassette form with specially treated tape or cloth, and some manufacturers use a wet solution. A new idea comes from the Koss Corp., whose VIP cleaning system features a replaceable premoistened cleaning cartridge that's thrown out after it's used.

Videophiles want their video libraries protected from humidity and dust. Manufacturers offer an assortment of dust covers, storage holders and cases. Many firms produce custom VCR covers designed specifically for machines of varying sizes, so be sure to specify your model number when ordering

them. As for cassette storage cases, buy only those that store the cassette on its edge.

Some cables are prepackaged with F-connectors at each end, and this makes them easy to use. However, you can buy cables and connectors separately for longer runs when needed. One interesting prepackaged cable set is called Interlink II from Monster Cable, and it comes complete with heavy-duty shielding terminated in twin 24-karat gold-plated connectors designed for direct audio and video inputs. The company also offers special 18-karat plated adapters in F-connector and UHF configurations that fit over the RCA phono pins for even more flexibility.

Splitters let you divide any video signal for routing to another source. Some are better than others, and the better splitters will have a smaller line loss (measured in decibels). Specifications should be listed on the package.

Finally, when you're shopping for video accessories, you might be surprised to find that most discount houses either don't have them or aren't very knowledgeable in that area. For the more expensive items, such as signal processors, it's best to go to the local video specialty store. As for cables and the like, the neighborhood electronics store will do fine.

PM

## VCR Maintenance

**L**ike the average Buick, your VCR needs attention and care if it is to last many years. The average life span of video heads is 2,000 hours, but that figure can be extended if you keep them clean.

The first thing to do is make sure that your VCR is placed in an area where there's adequate ventilation. Do not position the machine near any heat sources such as a radiator, large amplifier or very hot TV. If possible, buy a dust cover or make one yourself. Also, occasionally wipe off the outside of the machine with a damp cloth to keep it dust-free.

Some people clean video heads every 25 to 30 hours (this includes both playback and recording time). Others prefer to wait until the picture shows actual degradation in the form of snow and white streaks. A good compromise is a cleaning once every 100 hours or so. If you have trouble keeping track of hours, clean the heads once a month if you are a heavy user and once every three months if you are a light user.

Choosing a cleaning system is a personal matter. The wet systems are less abrasive than the dry ones and sometimes afford better cleaning because their solutions dislodge dirt from the heads. However, many dry systems are quite good, especially those made by Fuji and Sony. Wet system manufacturers to take note of are Koss and Nortronics. As good as cleaning

cassettes are, they cannot clean everything perfectly. They should be used on a regular basis, but once a year you should send the machine out for a \$125 cleaning.

If you are very careful, you can purchase a VCR cleaning kit and do the job yourself. Of course, this type of procedure will invalidate your warranty. Cleaning kits generally come with detailed instructions (important to read), special Q-Tip-type cleaning instruments (do not use regular Q-Tips) and a special cleaning solution using a chemical called Freon TF (Trichlorotrifluoroethane). Make sure that only this solution is used, and that there are no other additives such as any type of alcohol.

Following the detailed directions, open the machine and clean the video heads gently, using a horizontal stroke from right to left in the direction that the tape travels across the heads. Then gently clean the tape guides and their corners. Next, clean the rollers and the stationary erase, audio and control track heads. When you are finished, close the machine tightly. Sometimes, it's best to let an experienced person take you through it the first time.

Finally, the most important measure that you can take in the step toward perfect maintenance is to use the highest quality tape. Cheap, off-brand tape will tend to shed and clog up your heads, causing more wear.—D.G.

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# Protect And Preserve Your Family Movies

Don't let those memories grow brittle or fade. Here's how to keep your home movies in the family for a long time.

BY CLIFF GROMER



They are the treasures and memories of a lifetime—otherwise known as home movies. Stored away and forgotten, countless reels silently decay in the back of hot closets and in dark, dank basements. But the destructive process may not need years to occur. Given the right conditions, a reel of home movies can be ruined in minutes.

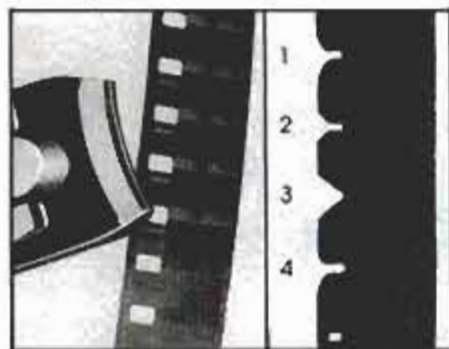
Damaged movie film often can be saved by a professional lab that special-

## Storage Damage



Film can get brittle, then decay and mildew while being stored. Here is a severe case.

## Fix Sprocket Holes



Use a nail clipper (left) to fix a torn sprocket. Area 1 (right) shows clipper's cut. Areas 2 and 3 were made with scissors. Area 4 was made with a commercial notcher.

izes in this type of work (a fact that most home movie buffs and even camera store personnel are not usually aware of). There are even some measures you can take to save damaged film. But there's a great deal you can do through a program of film and projector maintenance—to prevent damage from occurring in the first place.

Most home moviemakers believe that once a roll of movie film is processed and put away in the can or box, that's it. The film is good for life. No so. Movie film is perishable. Made of an acetate base that is coated with a gelatin emulsion, film can dry out, become brittle and shrink when exposed to high heat and low humidity conditions, or when left neglected over a period of years. It can become a victim of mildew when it is stored in a high moisture environment such as a damp cellar.

Ideally, film should be stored at 50° F. or lower and 50 percent relative humidity. Temperatures above 75° F. will start drying out the film. When film becomes dry and brittle, it will snap or tear when run through a projector. Often, just taking film stored on the top shelf of a closet, where heat collects, and placing it on the closet floor or on a lower shelf, where the temperature is cooler, will enable you to save it.

Movie film can be scratched, torn or crumpled in its initial screening if it is threaded improperly or run through a dirty projector. Film

threaded upside down in the projector will have the sprocket holes on the wrong side. The projector sprockets then punch holes into the picture area, or in the case of a sound film, punch out the sound track.

Auto threaders are a wonderful invention, but they sometimes act as auto shredders. If you use an auto threader, take off the projector cover, if

(Please turn to page 160)

## Test For Brittleness



Twist a length of film to see if it's too dry. The film should curl smoothly without cracking or snapping.

## Use A Film Editor



## Bent Reels



Also called a viewer, the film editor will let you examine brittle film carefully, as well as let you preview film lengths for splicing.

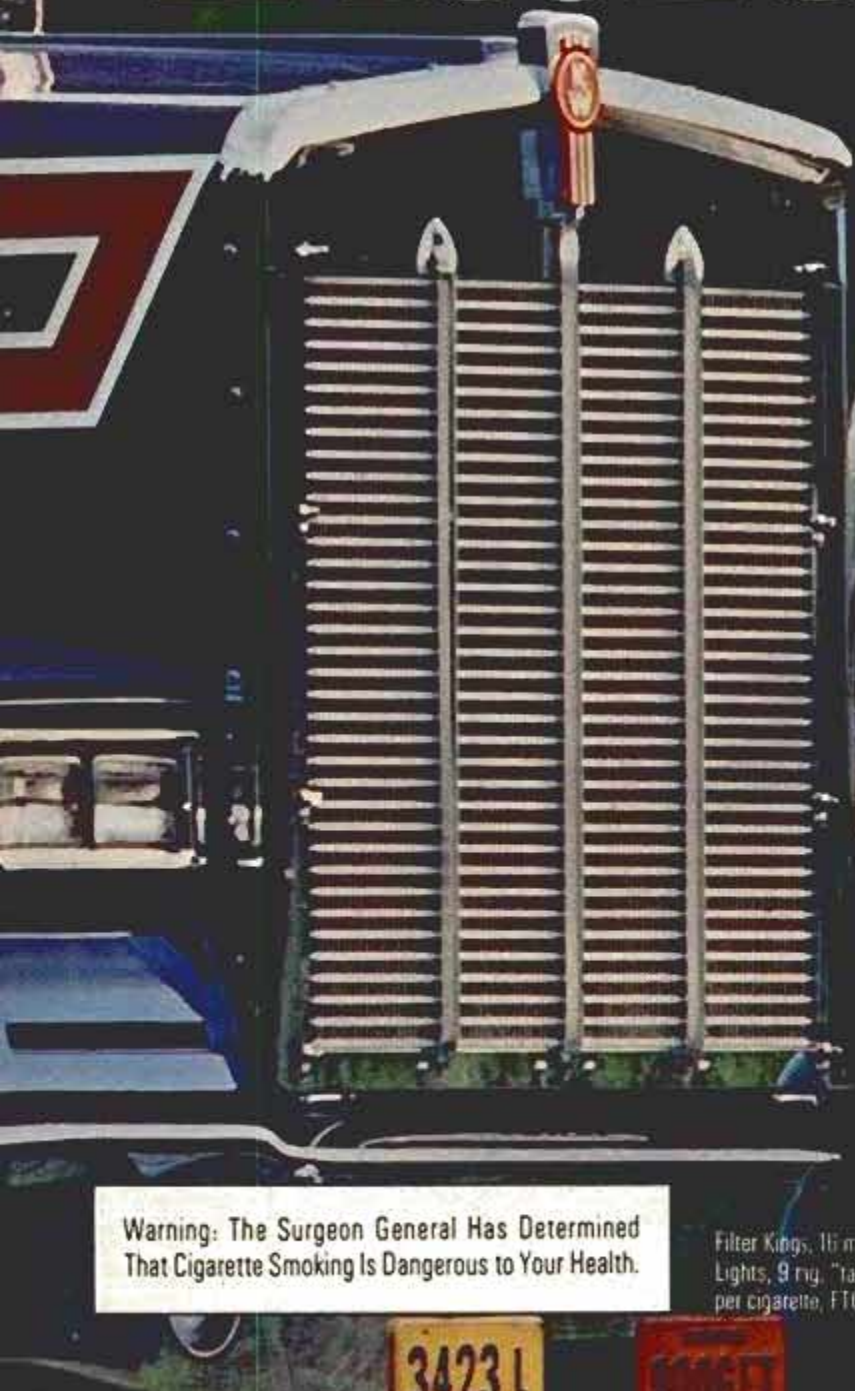
Using bent reels can cause uneven film winding. This can lead to creasing, as well as scraping the film while the projector is being operated.



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## Cleaning Film



Wet-cleaning film with a commercial film cleaner removes dirt and mildew. But more importantly, it adds moisture to the film and prevents it from drying out.

## PRESERVE YOUR MOVIES

*(Continued from page 158)*

possible, so you can see the film as it is being threaded. Splicing a long leader on your film also offers insurance against threading damage. If a problem occurs, it will be the leader rather than your pictures that gets sacrificed. Damaged leader can be cut off and new leader spliced on.

If you thread your projector manually, use the manual operation knob (most projectors have them) to check that the film is engaged properly before switching on the power.

A clattering noise when the projector is running, usually accompanied by a fluttering picture, is a sign of a film—not a projector—problem. The cause may be a torn sprocket hole or a torn frame. It's important to repair the film as soon as possible. Running a film with torn sprocket holes will lead to more torn holes. Small tears lead to big tears.

Damaged frames should be cut out and the film spliced with a film splicer (available for \$6 to \$10) and cement. Splicing tape, while faster and simpler to use, isn't as good because the adhesive tends to ooze, causing film layers to stick together.

Torn sprocket holes can catch on the sprocket teeth, causing the film to tear. This problem can be fixed in several ways. The frame with the damaged sprocket hole can be cut out and the film spliced. Sprocket repair tape is a quick fix for a series of torn sprocket holes. It reinforces the area much like loose-leaf paper hole reinforcements. But the adhesive on this tape also can ooze. Using too much of this tape will build up the sprocket side of the film

and cause uneven winding on the reel, which can crease the film.

If one or two sprocket holes are torn in one area, cut the outside edges of the hole to keep it from catching and tearing in the projector. Use small nail clippers. Don't use scissors because they leave sharp edges that can get caught. A commercial notcher makes round edges, but leaves no square area for the sprocket to grab. Sprocket holes that are elongated, but not torn, should be left alone if there is no picture flutter.

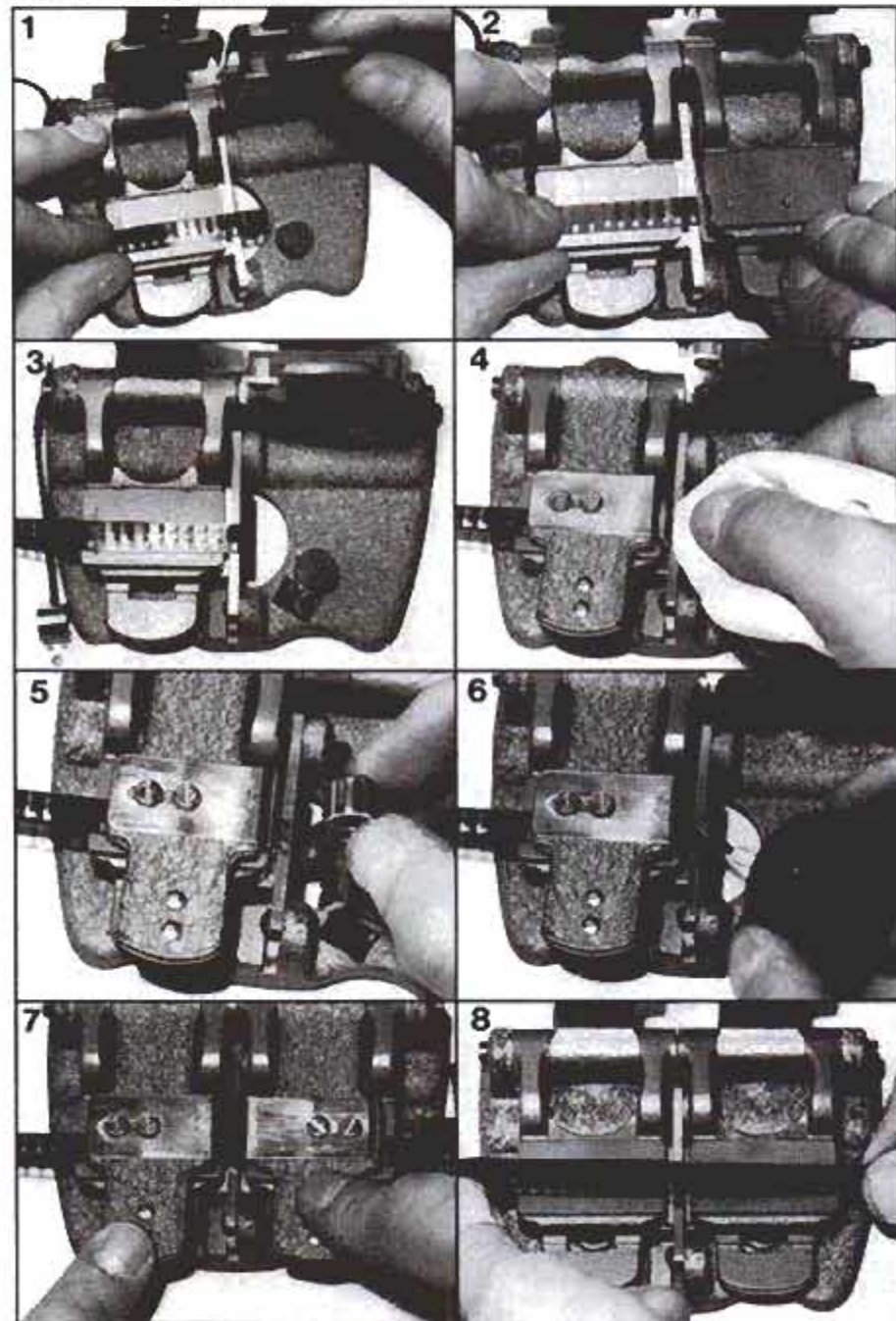
If the film does become creased,

either by a threading problem or by uneven winding, it can be straightened to some extent. Lay the film on an ironing board, cover it with a towel and press carefully with a steam iron.

Movie film often is ruined by running it through a dirty projector. Dust and dirt, especially in the film gate area, are abrasive and scratch the emulsion. This shows up on the screen as flicks and specks. The damage progresses with subsequent viewings. Dirt gets wound up on the film reel and creates bigger

*(Please turn to page 162)*

## How To Splice Your Film



Lay film emulsion side (dull side) up in splicer's top, left-hand section (1). Trim excess film with splicer's cutter (2). Lay length of film to be attached in right-hand splicer section (3). Lift up the right-hand section and moisten exposed film to soften the emulsion

(4). Scrape off the emulsion, but be careful not to damage film base (5). Apply splicing cement to the film base (6). Close and press down on the right-hand section of splicer to join film (7). When splice is complete, wipe away excess cement with acetone (8).

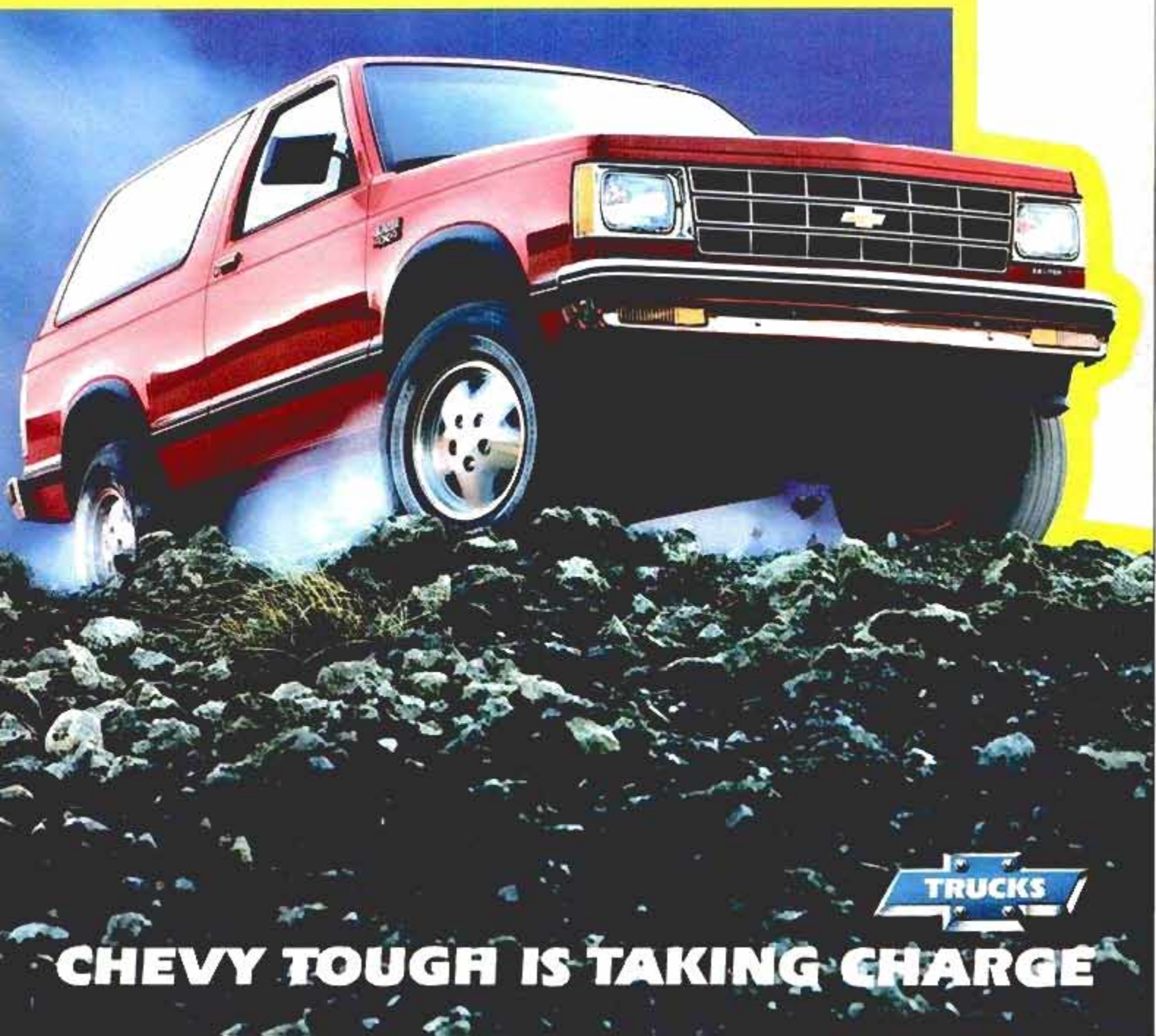
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scratches that show up as running lines and "rain" on the screen. Sound tracks can also become damaged by dirt and sound scratchy.

Trying to blow away that "dancing hair" while the projector is running is not an effective cleaning method. Take out the film gate and clean the aperture with a small brush or alcohol-dampened cotton swab. Of course, running old, dusty film through your projector means the unit is now loaded with dirt again, so be prepared to reclean your projector.

Just about all modern projectors are lubricated for life at the factory. Older models require periodic lubrication and have oiling holes for this purpose. Failure to lube the machine causes it to run unevenly. This puts a lot of strain on the film and often elongates or tears sprocket holes.

Don't make the mistake of thinking you can squirt oil on the film while it is running. The oil simply will mix with any dirt in the machine, creating an

abrasive sludge which is disaster for your film.

Another source of film damage is a bent reel or a metal reel that has a burr. These scrape and gouge away at your film. Trying to bend a reel back into shape usually makes the problem worse and causes the film to wind unevenly. While plastic reels aren't subject to burrs, they tend to be weak and can close in at the top, rubbing against the film as it unwinds. New reels are inexpensive insurance.

One of the fastest ways to damage film is to grab the end of a loosely wound reel and pull to tighten it up. The action of the film tightening against itself can cause cinch marks throughout the entire roll. If your film is rewinding loose, hold back the reel with your hand to create more tension.

The best thing you can do for your home movies is to run the film into another reel and then back onto the original reel, and wet clean it with a commercial film cleaning solution

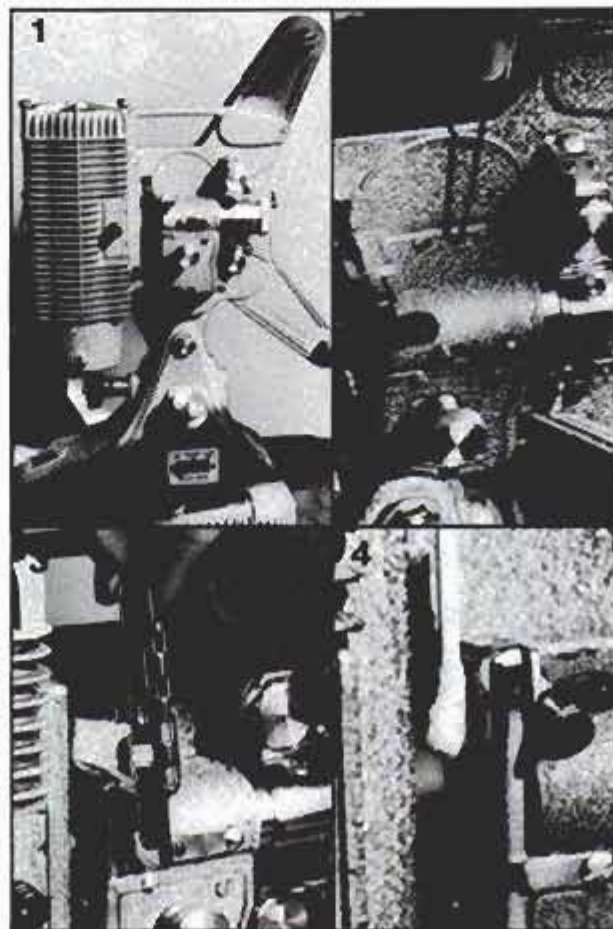
(available at any camera store). This procedure, done at least once a year, aerates the entire length of film. This prevents the emulsion from sticking to the layer of film above it on the reel. The film cleaner, in addition to cleaning, adds moisture to the emulsion and protects the film from drying out.

When cleaning the film, use a fold of lint-free ribbon or velvet dampened with cleaning solution. Do not use silicon cloth. It is not antistatic and will "magnetize" the film, making it attract dust in the air. Also, when handling film, it's a good idea to wear inspection gloves. These are just soft white cotton gloves that protect the film from finger marks. In addition, as you're running the film from one reel to the other, the gloves will pick up problems such as torn sprocket holes and poor splices.

You can wind the film back and forth by using your projector rewind, a film viewer or a set of hand film winders mounted about 3 feet

(Please turn to page 164)

### Projector Maintenance



While new projectors are lubricated for life at the factory, older models may require you to do regular oiling (1), in order to get at dust and dirt in film aperture, remove the film gate (2). Once the cover is off the film gate, the gate should slide free. Note its position for proper reinstallation (3). Once the gate is out, it's an easy job to clean the film aperture with an alcohol-dampened cotton swab (4).

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### PRESERVE YOUR MOVIES

(Continued from page 162)

apart on a board. You can even support the reels with pencils as a last resort.

When cleaning the film, create an apex of a triangle between the two reels with the cleaning cloth. Allow sufficient distance between the apex and the takeup reel so the film will dry before being wound. If the film is wound wet, it will stick to the layer above and the emulsion will crack.

If you find home movies that have been stored untouched for a long time, inspect the film for brittleness. Make a finger-size loop in the film and rub the ends together lightly. Brittle film will snap. A second test is to twist a length of film to see if it can curl over on itself without snapping. Brittle film may be moisturized to some extent with film-cleaning solution. But this remedy will be temporary at best. Once dried out, film requires the services of a professional for lasting results.

If the film is coated with a white powder, it's a sign of dried mildew caused by excessive moisture. Film cleaner should remove this powder, but mildew sometimes can cause stains to be cast right into the frame. Here again, see a pro.

### Moisturizing helps

Film that appears wavy on the reel is dry and most likely brittle. Sometimes, the film is so brittle that you can't even unwind it from the reel without it snapping. The only thing to do in this case is to moisturize the film temporarily so you can see what's on it (sometimes you can run it through a viewer), and decide if it's worth the money for professional rejuvenation. Moisturize the film by putting it in a plastic bag and then creating a water vapor atmosphere in the bag with a home vaporizer or steam iron. Be careful—too much moisture can cause the emulsion to float right off the film base.

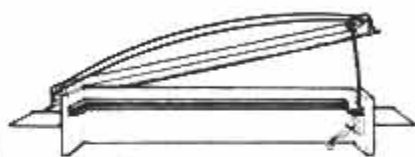
Film that's dried out usually has shrunk, which means the sprocket holes in the film no longer line up with the teeth on your projector. Use a viewer, not your projector, to view dry film.

Of course, careful film handling and good maintenance are of no value if you rest a reel of film on a hot radiator while setting up your projector or transport the film in the hot trunk of your car.

If you decide to have your home movies rejuvenated, you can send them to a specialized lab such as Film-life Inc. (Film-life Building, Moonachie, N.J. 07074; 201-440-8500). This is what major movie studios, like Walt Disney, do to renew features that they re-release periodically. Film-life has special equipment to clean film thoroughly

(Please turn to page 167)

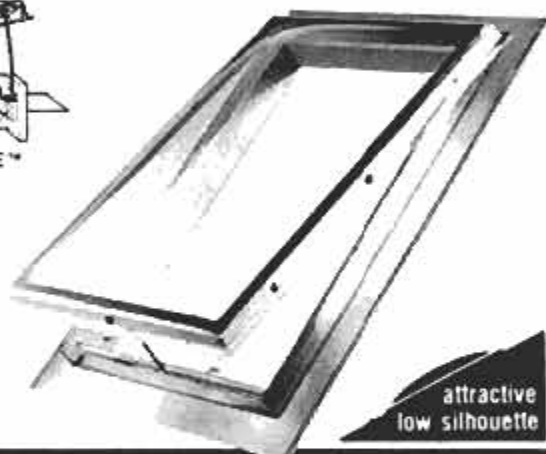
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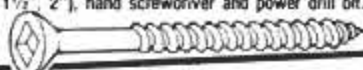
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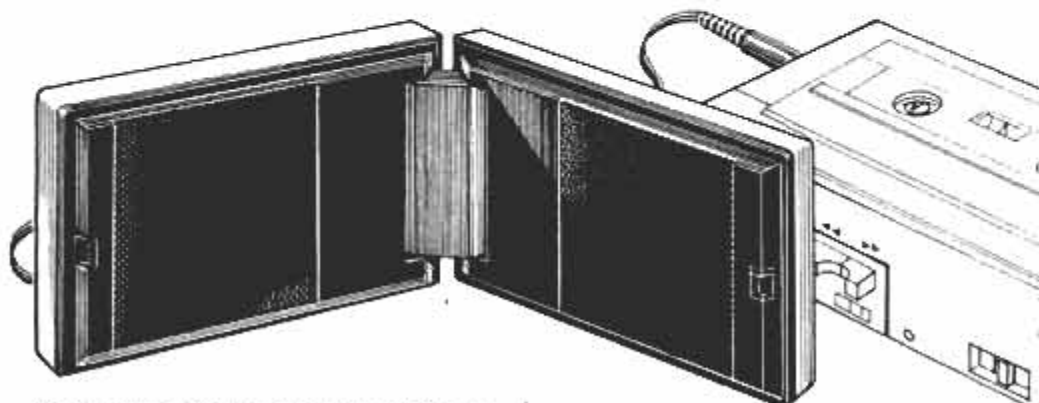


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## PRESERVE YOUR MOVIES

(Continued from page 164)

and get the dirt out of the scratches.

Scratch marks, seen as running black lines on the screen, are removed by an interesting process. Using a combination of chemicals and heat, the process swells up the emulsion and then melts it down several times. This softening permits the gelatin of the emulsion to be absorbed and blended into the grooves of the scratches. The process does not affect picture sharpness. It works only if the scratch hasn't penetrated down to the clear film base in black and white film, or penetrated beyond one color layer in the emulsion of color film. The process does not rely on a surface coating of any kind.

Brittle and shrunken film is re-moisturized (a process that can take up to 72 hours) and then stretched. The stretching is only temporary, but it allows enough time for another copy to be made. Film-life also can copy shrunken film by using a special printer that has adjustable sprocket teeth.

One last note. If your home movies should become damaged by water, don't try to handle the situation yourself. If you let the film dry on the reel, it will harden and be beyond rescue. Unwinding and cleaning the film also can endanger it. Keep film damp by putting it into a plastic bag and get it to a professional as rapidly as possible.

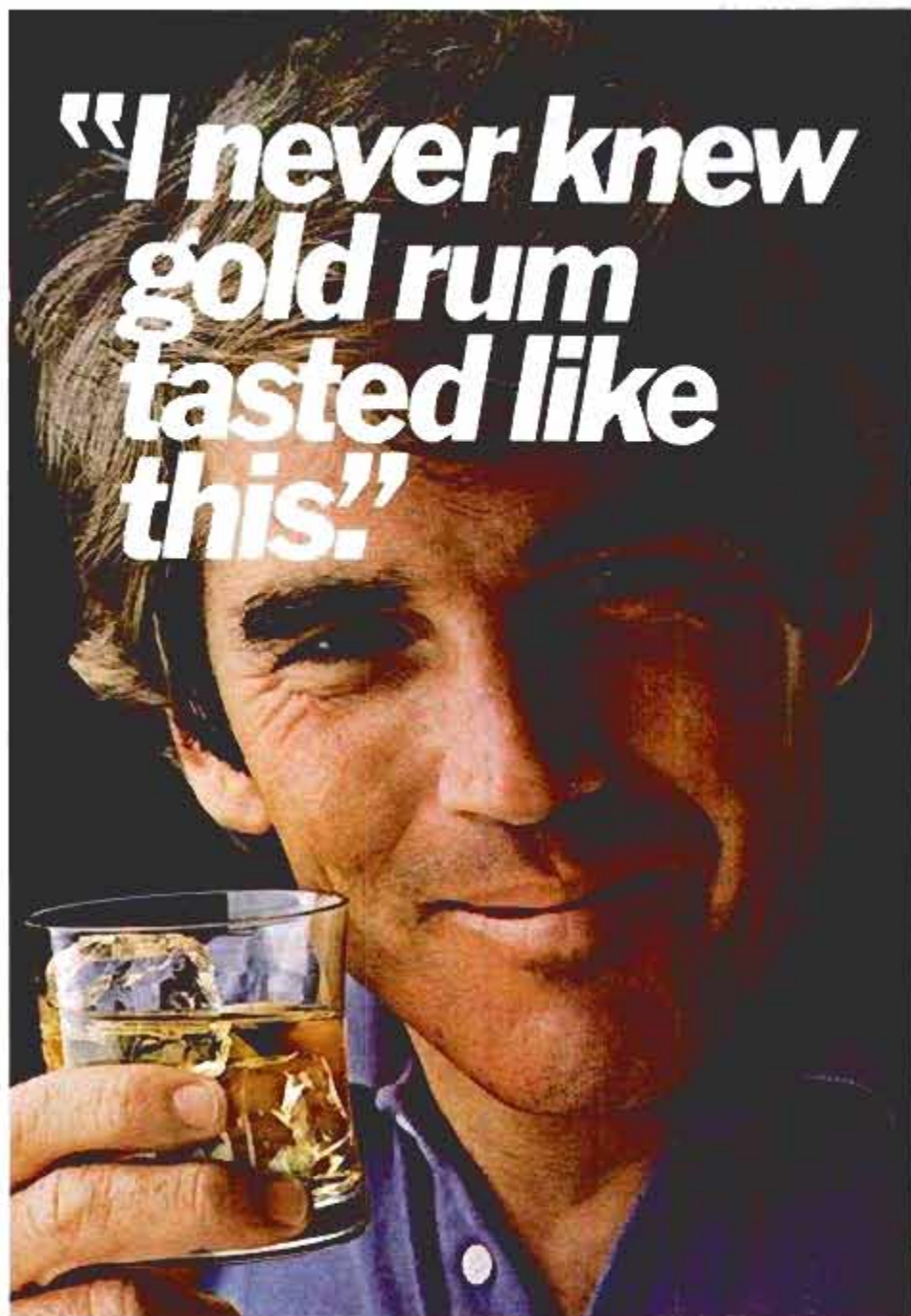
Film-life charges \$15 per 50 feet of black and white and \$18.50 per 50 feet of color film for its rejuvenation service. It's a lot cheaper to maintain your projector and films. And it's the best form of health insurance for your home movie family. **PM**

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More people than ever own video cassette recorders, and home movies are beginning to make a transition from film to video. For the past few years, the Fotomat people have been transferring both home movies and slides to videotape. By transferring to video film which is beginning to show signs of damage, you ensure its survival. We tried it with our own home movies and noted no loss of quality. Indeed, Fotomat was even able to compensate for a minute or so of overexposed frames.

Movies are transferred directly. You just number the reels in the order you want them placed on the videotape. Slides can be transferred with a variable delay between each one.

If you buy the video cassette at the same time as the transfer, prices are about \$40 for the first half hour. If you supply a cassette, the cost is lower. Exact prices vary from region to region.—N.S.



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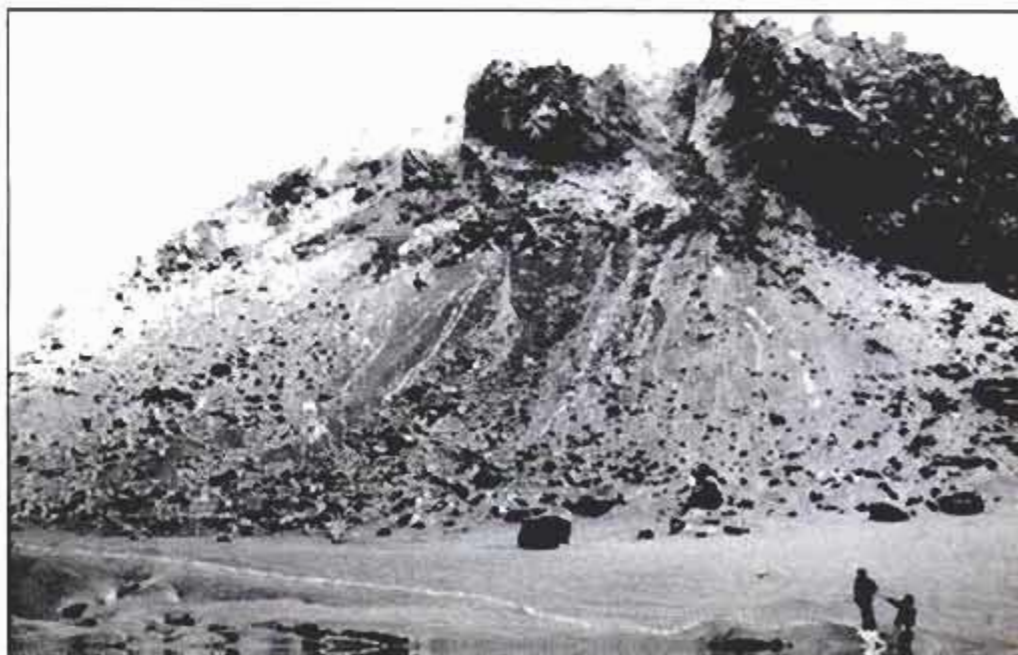
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Bell Helicopter (facing page) took us inside the cone, which was covered with ash-laden snow (above). Once inside, we faced the volcano's shield (right)—that mountain of dried lava that plugs up the volcanic vent. Lava building up pressure under the shield will eventually blow it out like the cork in a champagne bottle. Science Editor Dennis Eskow looks on (far right) as U.S. Geological Survey scientist Don Swanson uses a laser distance meter to help measure the growth of the volcano's shield.



# INSIDE MOUNT ST. HELEN'S

We helicoptered inside the cone of a volcano that has taken at least 23 lives and given us new insights into geology.

BY DENNIS ESKOW, Science Editor



**T**he Bell Jet helicopter shuddered against the cold wind as we skimmed the treetops. Little ponds of blue and green water broke the verdant carpet every few yards, a familiar aerial view. But just ahead of us, inside the top of snow-capped Mount St. Helen's, awaited a scene from another planet. The pilot, a Vietnam vet who also had seen action in rescues after the mighty volcano exploded in 1980, slowly took the bird 10,000 feet up the mountainside. Our first look inside the crater of Mount St. Helen's was sudden and shocking.

"My God, how are we going to put down in that?" I asked through our headset communications system. The crater, as deep as a football field and about twice as wide, was covered with cinder-laden snow and pyroclastic rock. There wasn't a sign of life below us as steam vents sent clouds of sulfur and water billowing from what could easily pass for a lunar landscape. The land below looked soft with gray volcanic ash. Here and there we could see deep fissures in the earth, ominous holes that could swallow a man. As Warren Fortier set the chopper down gently inside Mount St. Helen's, we saw a thin white trail zigging and zagging across the crater

*(Please turn to page 172)*



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## INSIDE MOUNT ST. HELEN'S

(Continued from page 169)

and a tiny white "X" that marked our landing strip.

"When we put down, you guys run out in front of the chopper. The geologists will meet you," Fortier said, even as the bubble pitched forward less than 100 feet above the "X."

"Why don't you just cut off the engines?" I shouted above the mounting engine noise. "We're only staying a half hour or so."

Fortier's good-natured smile showed as he turned to me and said, "I don't stay here." Photographer Vic Huber and I quickly discovered why. As we were greeted by U.S. Geological Survey scientists who had landed moments before us, a distant crackle—much like a sustained barrage of firecrackers—gave both of us rookies pause. Was the mountain exploding again?

"Oh, no. Nothing like that. It's just a rock slide," said geologist Christina Heliker, one of those brave souls who spends most of every daylight hour inside Mount St. Helen's. "Look up. You'll see a rock slide," she said. And there it was. All around us rocks tumbled from ledges along the rim of the volcano. The air-filled balls of silicon, iron and quick-dried lava cascaded down the walls of the volcano, falling less than 100 feet away.

### Lava shield growing

Heliker had been working with geologist Don Swanson inside the crater all that week. They and other USGS scientists have been watching Mount St. Helen's expectantly as the shield of dried lava in the center of the volcano's dome grows about 1.5 centimeters a day. American geologists are determined to improve the accuracy of their eruption forecasts.

When Mount St. Helen's exploded on May 18, 1980, geologists were far from surprised. Daily earthquakes and other signs had alerted them that the volcano was about to spit hot lava. But they were astounded at the eruption's force and at the fact that the cone of the mountain exploded outward and not upward. That helped contribute to the deaths of at least 23 people. Another 52 are missing and presumed dead.

While much about the way volcanoes evolve remains a mystery, some important facts have been well established by the studies of Mount St. Helen's and other volcanoes. Recent studies indicate that a buildup of silicon in the steam coming out of the mountain is an indicator of an approaching explosion. The silicon apparently comes from sand that falls into the boiling magma (molten earth) lake beneath a volcano.

(Please turn to page 174)

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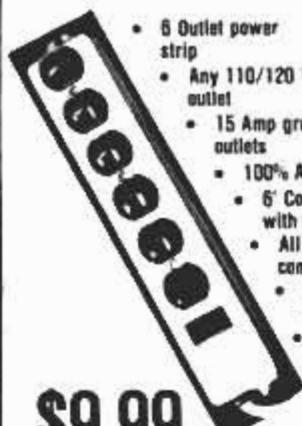
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## INSIDE MOUNT ST. HELEN'S

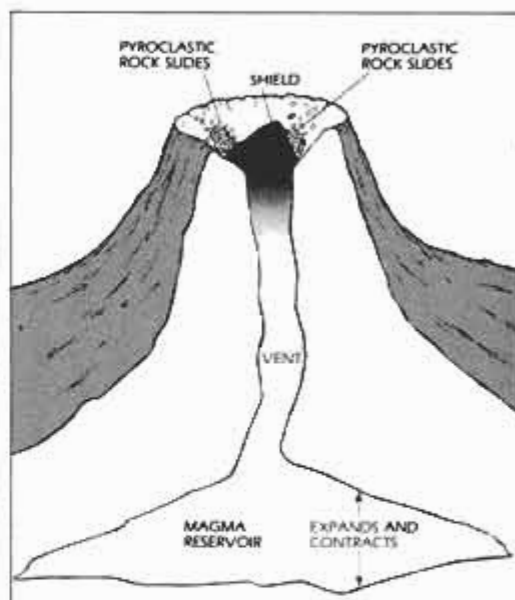
(Continued from page 172)

As the silicon builds up, it traps the gases needed to fuel a massive eruption. As the gases collect, the magma reservoir expands, pushing lava up a vent in the mountain cone. At the top of the vent, lava that has time to cool forms a shield that plugs up the vent. Eventually, the pressure becomes so great that the shield is blown out like the cork from a champagne bottle.

Mount St. Helen's is a "composite" volcano. It erupts every couple of centuries, blowing away its top. When the volcanic ash settles down, the original mountain is buried and the new site is far higher and broader-based. Other types of volcanoes include cinder cones,

killing hundreds and sending out a plume of ash so thick that meteorologists believe the upper atmosphere may have been covered with a thin film that has helped contribute to a slight decrease in the Earth's temperature.

There is an average of two earthquakes a day inside Mount St. Helen's, according to Wayne George, an observer for the Cowlitz County sheriff's office. George and his wife live in a cliffside trailer less than three miles from Mount St. Helen's. Their job is to watch the tiny rivers that meander out of Spirit Lake. In the 1980 blast, the lake was so filled with lava that it could no longer contain hundreds of thousands of gallons of water. The outrushing water formed new rivers and cut sudden valleys in the soft volcanic rock.



El Chichon (above, left) killed hundreds in Mexico and may have altered the Earth's weather. Mauna Loa (left) erupted earlier this year. Diagram shows the structure of a volcano. When magma expands and pushes up vent, the shield explodes, sending pyroclastic rock all around the volcano lip.


composed of very loosely packed ash, and shield volcanoes, such as Hawaii's Mauna Loa. The latter are made up entirely of steadily flowing lava. A fourth class of volcano—the lava dome—is a cooler mountain from which very thick lava flows.

Besides Mount St. Helen's, the most notable activity in North America has come from El Chichon in Mexico. The composite volcano erupted in late 1982,

Today, dried lava in the lake hangs on tenuously to millions of gallons of water that could burst through and flood nearby villages. To lower the pressure, the U.S. Army Corps of Engineers pumps the lake 24 hours a day.

"If the lake ever goes, I'm here to warn the county that the river's coming," Wayne George says. "It might give folks a few hours' head start to get out of the way."



A man is shown from the waist up, wearing a dark leather jacket and blue denim jeans. He is holding a pair of tan work gloves in his hands. The background is a solid blue color.

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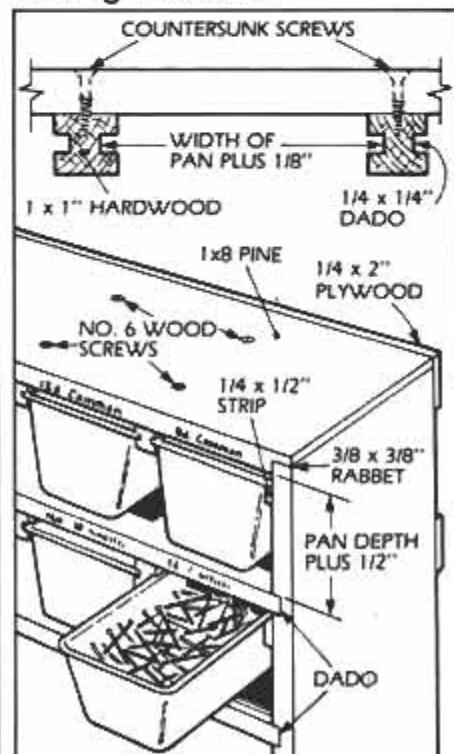
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## HINTS FROM READERS

### Storing fasteners



You can make an excellent storage system for nails and screws with bread loaf pans from thrift shops and a few scraps of wood to serve as supporting shelves. Cut as many shelves out of a 1x8 as needed. Several stacked shelves generally work better than one long one.

To determine the height of the shelf sides, add 1/2 in. to the pan heights of each row plus the shelf thicknesses. Rabbet the top shelf and dado the sides to receive shelves. Make pan rails by ripping a 1x1-in. strip of hardwood. Dado the strip on both sides and cut it into rails the depth of the shelf. Also cut end strips.

Assemble by setting one rail the width of the pan plus 3/8 in. from the shelf end. Check that the rail is perpendicular to the shelf, then glue and tack it in place. Use a pan as a guide in spacing. Locate the last rail, test-position the end strip and trim the shelf length as needed. Bore and countersink the top to attach runners with No. 6 flat-head screws. Glue and screw the shelves into the sides. Attach a 1/4 x 2-in. plywood strip behind each shelf to serve as a stop.—*Glenn D'Onofrio*

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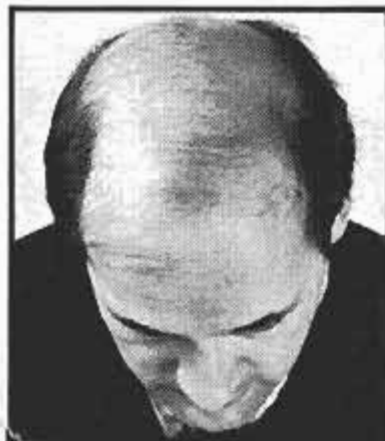
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"simplicity itself", the biological mechanisms involved are too complex to be adequately explained in this limited space. I have therefore authorized a detailed, step-by-step, photo-illustrated report, titled **BALDNESS CONQUERED, on the HAIR SUPPLANTATION PROGRAM** and the research effort for **AN ANSWER TO THE PROBLEM OF BALDNESS**, now available to those who wish to see the **POSITIVE PROOF** in the privacy and comfort of their homes . . . without the expense of traveling to New York for a private consultation.

everything **TO GROW NEW HAIR** . . . every pill and lotion on the market. Many were completely bald. Others found that day by day, strand by strand they were losing their hair . . . and nothing seemed to help. Yet today, almost every single one of these men enjoys **A FULL HEAD OF HAIR**. They include:

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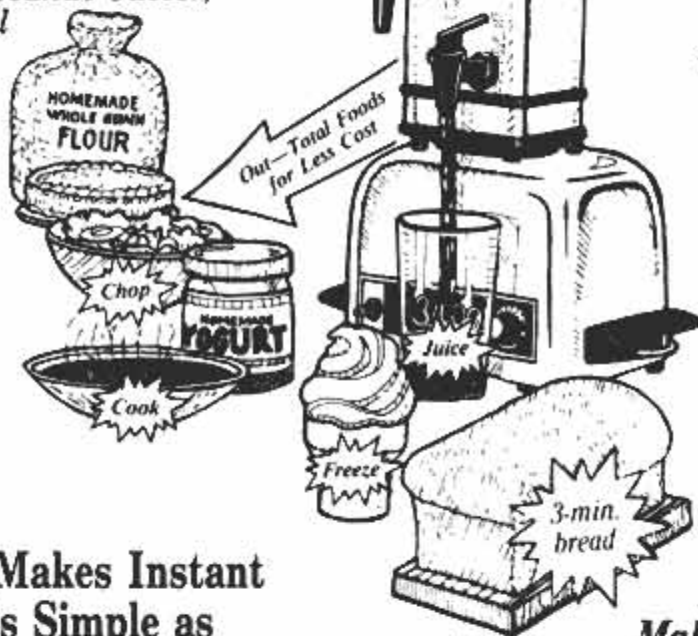
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# WORKSHOP MINICOURSE



## Power planes pay off

Virtually everyone making a living in woodworking knows what a power plane is—and how effective a good one can be. However, most do-it-yourselfers I come in contact with (in my adult education woodworking class, for example), do not know that such a tool even exists.

Basically, a power plane does everything a hand plane does. The difference is that the planing job becomes effortless because the tool does all the work. You simply guide it. The power plane, depending upon its maker, will have a spinning blade with one or more cutting edges, located about one-third of the way to halfway back from the leading edge of the tool. To obtain depth-of-cut, the front shoe adjusts up or down (in the same fashion that a stationary shop jointer does). Because the entire cutter on the bottom is exposed when the tool is in use, it should be used with extreme caution. Every manufacturer I know includes a thorough manual with its tool. Read it through—especially the section dealing with safety. No matter which brand you buy, you'll find that handles and gripping portions of the tool are well away from the blade while the tool is in use. *Make certain you grip the tool as the manufacturer specifies.*

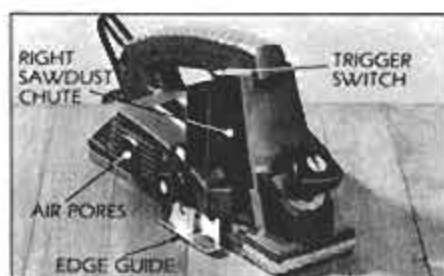
I am not aware of any "cheap" power planes. Since they are designed for lots of use, most can withstand the punishment that constant usage and toting to jobs imposes. I have a pair of them in my workshop: the comfortable-to-grip Black & Decker Industrial shown here (which has just about eliminated the jack plane from home carpentry tasks) and a smaller version by Rockwell, which does those tasks I would normally use a block plane for.

If you're contemplating a plane purchase, rent one for a weekend the next time you plan to do a lot of planing. Heft the tool about and use it on practice cuts. Once you've mastered the art of getting the spinning cutter on and off the edge to be cut without making a dip—thus a gouge—you'll want your own.

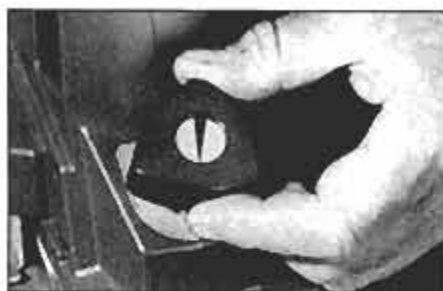
We'll discuss power planes some more next month. **FM**



Once you have shaved an edge with a power plane, you'll wonder how you got along without it. Here, Black & Decker's Industrial plane powers its way down a pine plank.



Here are left and right side views of the planer that we used for these photos. This rugged model is particularly outstanding when you have extensive planing sessions.



The depth-of-cut knob is rotated in order to achieve the particular cut that you want. The arrow on the knob serves as the pointer for aligning with index.



Before starting a cut, the shoe should be checked with a straightedge. When both plates are in the same plane, the depth-of-cut knob should be aligned at 0 mark.



Good design feature: Sawdust chute can be moved to either left or right side of machine to direct sawdust away from user.

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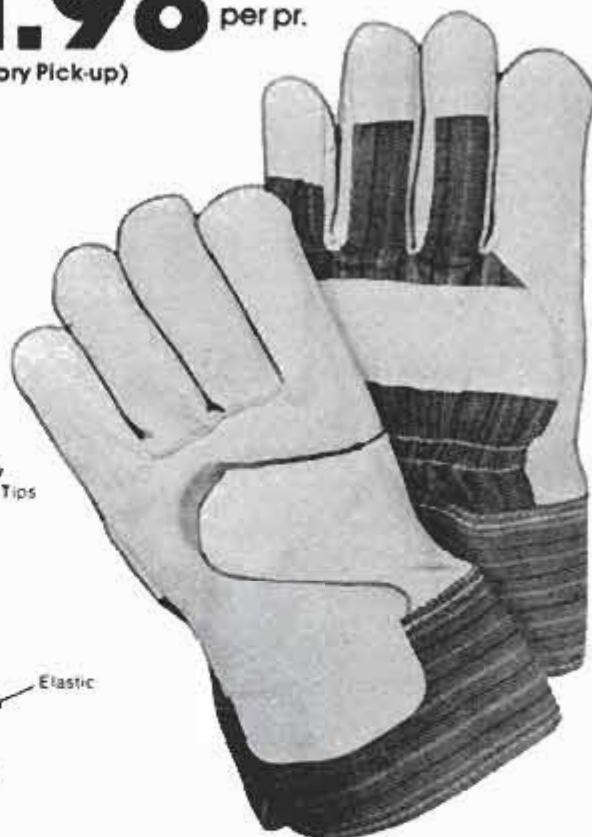
(Shown)

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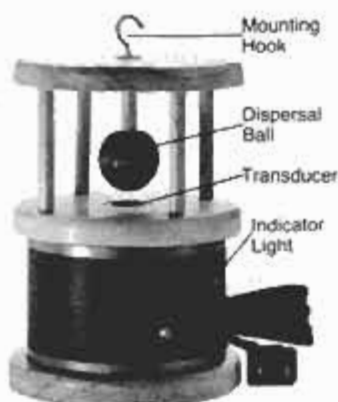
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Jan. 1982 (Wash., D.C.) — Justice Department and AT&T settle their law suit and agree to restructure the phone company. After January 1983, Bell System companies can no longer buy and resell or lease telephones and any peripheral equipment to their customers.

### News Item

Jan. 1982 (Portland, OR) — As a result of AT&T settlement with Justice Dept., Bell System companies can no longer buy Code-A-Phone telephone answering machines for leasing to businesses. Code-A-Phone's manufacturer is left "stranded" with over 10,000 units!

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Aug. 1983 (Minneapolis, MN) — The C.O.M.B. Co., Inc., the nation's largest authorized liquidator, acquires 10,000 Code-A-Phone machines for liquidation to the public at far below the Bell System's cost!

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Math Reimer, Long Lake, MN

### DOCTOR REPORTS!

I recently purchased your "Monster Maul". It is gratifying to find a mail order item that is exactly as advertised. I split knotty, live oak with little difficulty. The most amazing thing to me is that compared to all the other systems, I have ever used, the Monster never gets stuck. Also, the newspaper that accompanies the maul is full of useful information. Being on the receiving end of many work-related injuries, I appreciate the emphasis on safety as well.

Ira B. Fishman, M.D., King City, CA

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Rabbi Israel Stock, Trumbull, CT

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I'm writing to tell you how much I like the Monster Maul, I used the maul for two hours on Thanksgiving Day, and one hour the following Saturday. In that time, I think I cut more wood than I would have in 30 hours with a sledge and wedges. I brought my next door neighbor over, and he was skeptical as I, at first. Then he quickly became a believer. He said he won't use anything else to split with now. What amazes me the most is that every extravagant claim you made for the maul is true. Believe it or not, I felt really good that a company can promise so much and then actually deliver it. I have become a self-appointed good will ambassador for the maul, and have told everyone I know who splits wood about it. I've been extremely pleased, and wanted you to know it. Keep up the outstanding work, and if I can sell some for you, I will. It sure works like hell.

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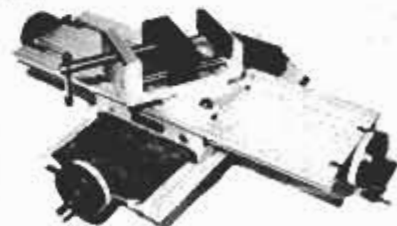
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# UNITED STATES TREASURY MINTING ERROR\*

## Creates Rare Collecting Opportunity



Actual Size of  
Susan B. Anthony \$1 Coin

**THE FIRST SUCH OPPORTUNITY  
IN OVER 100 YEARS!**



AN OPPORTUNITY LIKE THIS MAY NEVER OCCUR AGAIN IN YOUR LIFETIME! It's the result of a most unpredictable turn of events. When the United States Mint first issued the Susan B. Anthony \$1 coins in 1979, they never intended them to become coins for astute collectors or investors. But, since they stopped minting them in 1981, this is how it seems to be turning out.

Here is the story that makes the Susan B. Anthony coin a rarity. In 1979, the United States Mint produced millions of SBA coins for general circulation, and then found that no one wanted to use them. In 1980, they drastically curtailed the minting and in 1981, they did not mint any at all for general circulation.

**What's so remarkable about this set?**

**Consider these facts:**

- These are most likely the last one dollar circulating coins the United States will ever issue.
- For every 75 Susan B. Anthony coins struck in 1979, the first year of minting, *only one* was minted in 1981, the third and final year of minting.
- This final 1981 minting was *never released* through banks to the public.
- Congress has debated whether they should order the U.S. Mint to melt down the remaining Susan B. Anthony coins.
- This may be the only complete "closed" coin issue you will ever be able to buy in your lifetime at this price.
- Susan B. Anthonys are undoubtedly one of the shortest lived American dollar coins ever minted.

### LIMITED AVAILABILITY

The Columbia Mint has acquired a limited quantity of Susan B. Anthony United States Mint coins in Brilliant Uncirculated condition and assembled them into complete nine-coin collections, consisting of one coin for each of the three years they were minted (1979, 1980, 1981) and from each of the only three U.S. Mints (San Francisco, Denver and Philadelphia) that minted them. Each coin bears the individual mintmark S, D, or P of the mint that produced it. This unique collection is

housed in a specially designed custom case. The case protects their value and provides an attractive display showcase as well as convenience for your safe-deposit box.

When our supply of the Brilliant Uncirculated nine-coin collector sets is depleted, this offer will automatically expire and any unfilled orders and remittances will be returned. We urge you to place your order immediately. We regret that we must restrict each individual order to a limit of three collections. This limit applies whether you are a collector or a professional dealer, ensuring the same opportunity for all. Do not delay, order today.

**SIMILAR COIN  
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The last time there was a similar coin was more than 100 years ago when 20-cent coins were minted in 1875, 1876, 1877 and 1878. The similarities between that 20-cent coin and the Susan B. Anthony coins are astounding. The old 20-cent piece was about the same size as a quarter just like the Susan B. Anthony. Consequently, the people rejected it—just like the Susan B. Anthony. Circulation quantities of the old 20-center were struck—just like the Susan B. Anthony. Believe it or not, 1875 20-cent pieces in Uncirculated Condition—the same condition as the Susan B. Anthony's in this collection—100 years after they were minted, are worth as much as \$1,200.00 today. What are the possibilities for the 1981 Susan B. Anthony's 100 years from now?

Not only will these SBAs enrich your own collection, but they should become family heirlooms to be passed along to your children and your grandchildren.

Again, we must emphasize that our nine-coin collector sets are severely limited. These coins will never be minted again. We challenge you to try to assemble this complete nine-coin set yourself. Go to any bank and ask for a

**WILL HISTORY  
REPEAT ITSELF??**

### MINTING ERROR

\*The error that makes this a rarity? Take a quarter and lay it on the Susan B. Anthony pictured above. Note the similarity in size that turned out to be its problem. People refused to use it—perhaps you were one of

them. When the U.S. Government became aware of this public rejection, they recognized that there had been an error in judgment. Susan B. Anthony coin minting ceased, destining the coins to collector status.\*

**ACT TODAY!**

Brilliant Uncirculated Susan B. Anthony dollar from just one of the three years of minting and you will then quickly realize the opportunity you have. We strongly suggest—to avoid disappointment—that you not delay in ordering.

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If for any reason you are not completely satisfied with your Brilliant Uncirculated nine-coin Susan B. Anthony Collector Set, you may return it within thirty (30) days for a full refund.

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# SAVING ONE LEG WITH THE OTHER

Surgeons can now mend a patient's chronically broken leg with a graft from the healthy limb. The procedure, also used to repair fractured arms, has saved dozens of people from amputation.

**B**roken legs that refuse to mend can force patients to undergo treatments that are seemingly endless and often ineffective. The usual alternative? Amputation. But a new procedure now avoids the issue by transplanting "spare parts" from the patient's healthy leg.

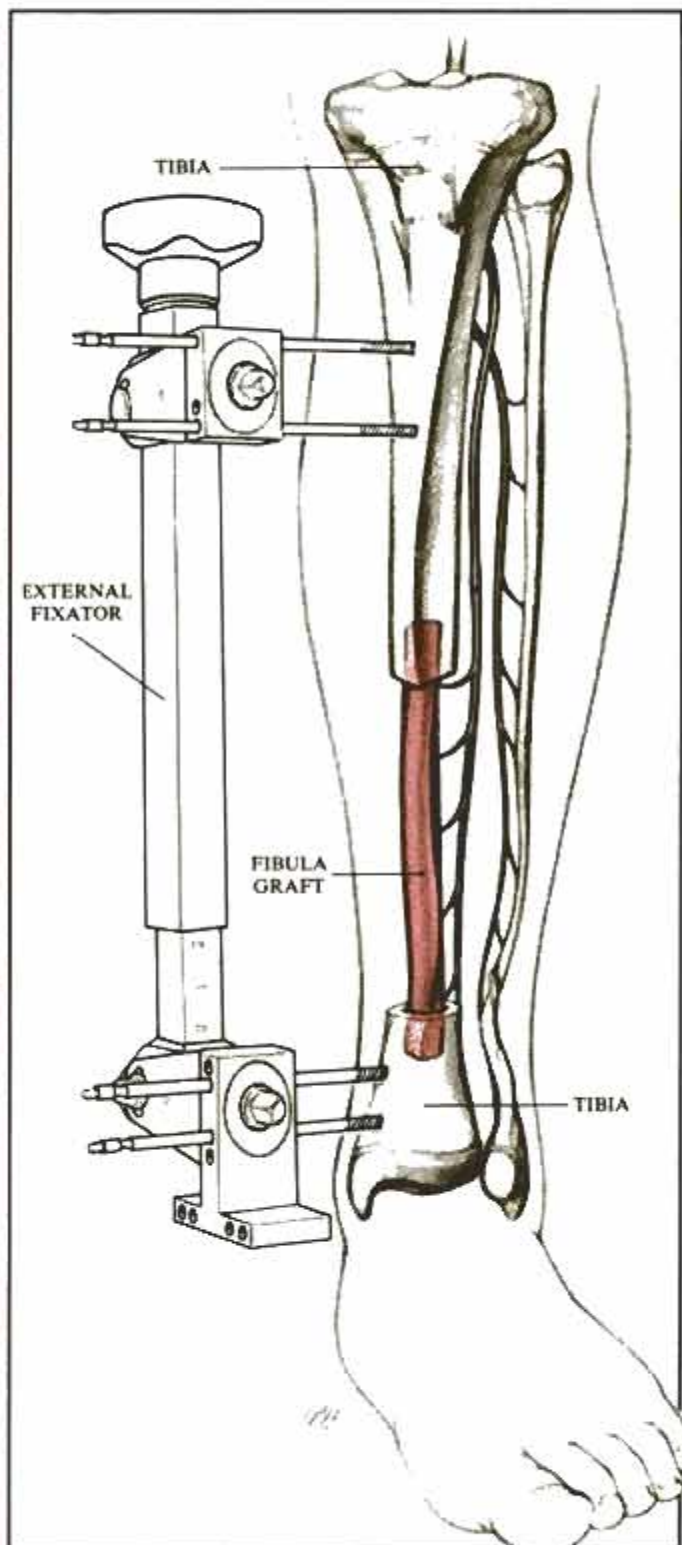
Normal healing takes place in the vast majority of fractures. The blood clot that forms at the break is penetrated by capillaries and by fibroblasts, cells that give rise to connective tissue. Within 48 hours of the break, the fibroblasts differentiate into osteoblasts, specialized cells that form new bone tissue.

In some cases, though, poor blood supply in the fracture area, or other complications, may prevent healing. These patients may suffer from pseudarthrosis, an often painful false joint caused by the unmended break. Most of them undergo conventional grafting procedures to transplant bone chips from their hip. And many also receive therapy utilizing electric current to stimulate new bone growth.

Since 1979, orthopedic surgeons at Columbia-Presbyterian Medical Center in New York City, led by Harold Dick, have performed successful transplants on 31 of 35 such sufferers with a fractured tibia, the thick, weight-bearing shinbone. The patients, many of whom are children, usually had broken the leg several years earlier; some had had fractures since birth or shortly thereafter. Others were operated on for bone cancer or had tissue removed because infections didn't respond to antibiotics. One four-year-old girl was operated on three times and had two and a half years of electrostimulation before her transplant. "These are usually desperate people for whom nothing else has worked," Dick says. "They're up against the possibility of amputation."

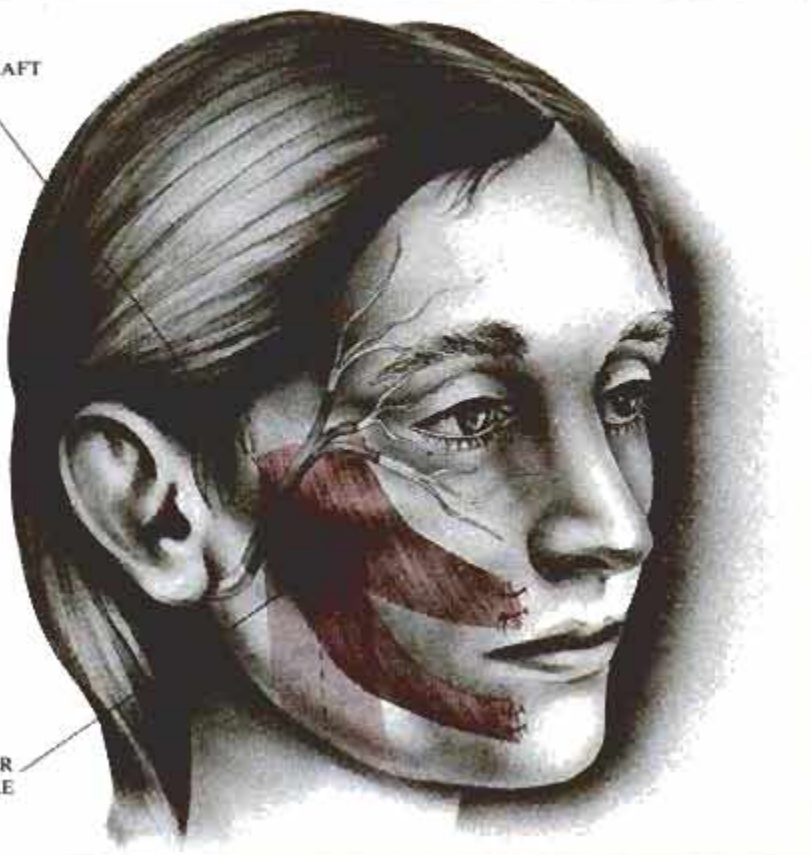
**R**ather than take that drastic measure, Dick cuts from the opposite, healthy leg two to eight inches of fibula—the thin bone in the lower leg—along with the surrounding muscles and blood vessels. "The fibula is a leftover from the time when we walked on hands and knees," explains Dick. "We can remove it and still get full function from the donor leg." After excising the damaged part of the tibia, Dick grafts the fibula section into the gap. An external fixator is then screwed into both ends of the tibia to keep the new bone in position until it begins to knit. After six to eight weeks, this bar is replaced by a cast and, later, a brace. The procedure, which often takes eight hours in the operating room and can involve six surgeons, six nurses and three anesthetists, costs between \$5,000 and \$10,000.

As the patient gradually puts weight on the limb, three to six months after the operation, the grafted fibula section grows thicker and stronger. "By the time the bone is healed," says Dick, "it has grown fat like the one it replaced. It's a spectacular phenomenon. Most people end up with a normal walking leg."



A section of fibula inserted into a damaged tibia bridges its severed ends. Anchored temporarily by an external bar, the transplant begins to knit. Then, with activity, the graft will thicken until it's indistinguishable from the original bone.

NERVE GRAFT

MASSETER  
MUSCLE

## SURGEONS FREE UP FROZEN FACES

Plastic surgeons are literally putting a smile back on the faces of patients suffering from facial paralysis.

This condition, which afflicts thousands of Americans each year, occurs when one of the facial nerves is injured or partially removed during surgery. The standard surgical method to correct the paralysis can restore movement, but it does not allow the patient proper control of his facial muscles.

Michael Sachs, director of plastic and reconstructive surgery at the New York Eye and Ear Infirmary, explains that the facial nerves are connected to several different muscle groups. "A normal person can move his eyes and mouth separately," he says. "When he blinks, his mouth doesn't go up and down. When he smiles, his eyes don't close." But this is exactly what has been happening in cases of facial paralysis, because traditional reconstructive surgery is not very precise.

By treating the upper and lower zones of the face separately, Sachs, along with John Conley of the Columbia-Presbyterian Medical Center, has been helping paralysis patients regain a more natural fa-

*Paralysis patients regain facial control when surgeons reconnect the facial nerve with a graft and shift the chewing muscle from the cheek area to around the mouth.*

cial expression and more coordinated movements. First, a graft taken from a nerve in the neck is used to reconnect the facial nerve to muscles around the eye. To restore lower-face movement, Sachs takes the masseter muscle, which runs from the cheekbone to the lower jaw and is used for chewing, and divides it into two parts. One part, with its accompanying nerves, is positioned above the mouth; the other, below.

The masseter muscle can function almost immediately after the operation. The only trouble is that when the patient wants to chew, he moves the masseter, which is now around the mouth, and may involuntarily begin to smile instead. Eventually the brain will "realize" that the chewing muscle is in a new location and allow the patient to smile or chew at will. When the nerve graft heals and the eye muscles can be moved, the patient must learn to coordinate his facial movements. Peak performance, says Sachs, takes about two years.

Although the operation does not entirely restore normal movements, most patients should be able to derive some benefit from it. Also, the procedure can be performed even years after the onset of the paralysis.

## WHY MEN DON'T SPEAK THEIR MINDS

We all know the scene. John Wayne is off to fight some war or other. His wife begs him not to go. Sobbing, she cries, "John, I love you so much."

"Sorry," says John. "I've got a job to do." He may have strong emotions, but he won't express them. It isn't manly.

Actually, the truth may be that John can't talk about what he's feeling. There is evidence that men's brains are put together in a way that keeps them from putting emotions into words. Martin Safer, a psychologist at the Catholic University of America, thinks the problem may be that the brain's two halves, or hemispheres, don't talk to each other as easily in men as they do in women.

The brain's hemispheres, though interdependent, have different specialties. The right hemisphere controls nonverbal activity and spatial perception; the left is in charge of language and speech. Both halves process emotions, but the right handles perception, while the left describes them with words.

Safer did an experiment to see whether emotional information entering just the right brain would make it over to the left. First, he showed test subjects a slide depicting an emotion-laden face. Then he flashed another, but directed this one only to the right brain.

To understand how he did this, look straight at a vertical line—the place where two walls meet is a good one. Anything you see to the left of the line is entering your right brain. Things on the right enter the left brain.

Safer found that when the second slide was projected toward the right brain, women were much better than men at telling whether or not it matched the emotion seen on the first. The implication: Emotional data that enter the right hemisphere of a man's brain seem to stay there. In women the information travels more easily over to the left side, where it can find expression.

Is this because women's brains are physically different? "Maybe," says Safer, "or maybe it's cultural. Culture might even determine neural development." ■

**IF YOU MUST BE BITTEN** by a black widow spider, do so in early summer. The venom can be 10 times as potent at other times of year.

## CIGARETTE PAPER MENDS EARS

Torn eardrums are being patched with an unlikely Band-Aid—plain old cigarette paper.

Why such an odd medium? Physician Nancy Snyderman of the University of Arkansas Medical School answers: "It's cheap, reliable, easy to handle—and it works."

To understand the logic behind the paper patch, it's necessary to know a bit of ear biology. The ear is divided into three regions: outer, middle and inner. The eardrum, a thin, flexible membrane, separates the outer from the middle ear and vibrates in response to sound waves. These vibrations are ultimately converted by the inner ear into nerve impulses that the brain interprets as sound.

Extending downward from the middle ear is the auditory, or eustachian, tube, which equalizes the air pressure between the middle ear and the world outside. At one end of the tube is a valve that opens into the upper nasal cavity. Generally the valve remains closed, but when there is an imbalance, the valve opens and air moves either in or out of the tube to equalize the pressure.

Yawning or swallowing will also open the valve. This is why chewing gum while on a plane helps a traveler adjust to changes in air pressure. When the ear "pops," the pressure has been equalized. If the imbalance is more than momentary, however, or if it becomes too great too fast, as in an underwater diving acci-

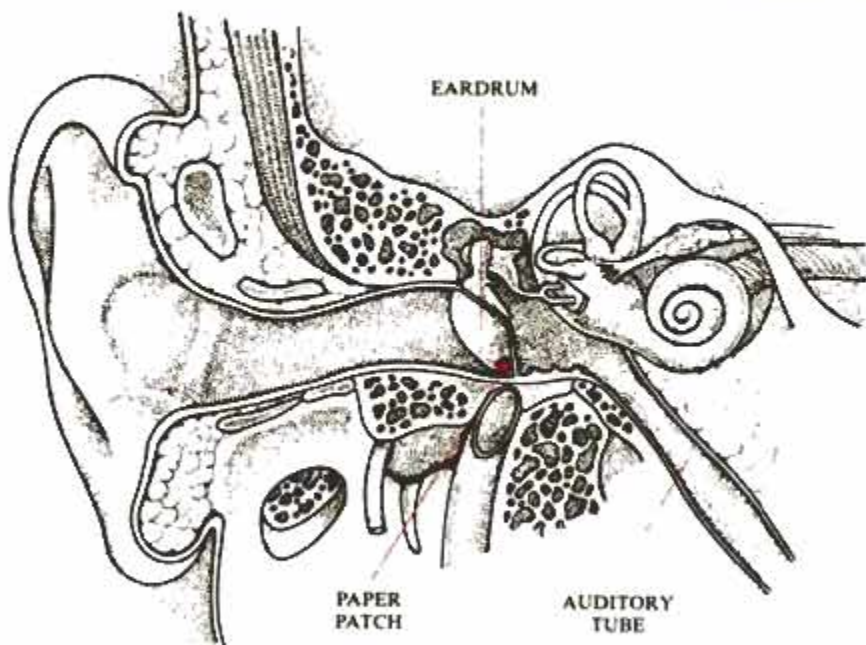
dent, the eardrum can rupture.

This is where cigarette paper can help. Explains Snyderman, "The eardrum heals in an unusual way. If I were to put a bit of paper on the eardrum and film what happened over several weeks, I would see the paper move and eventually slough off into the outer ear. This is because the eardrum is always in flux, making new cells and regenerating itself. It mends as it builds new cells against the buttress of the paper. Without the patch," she says, "the eardrum would probably still heal, but with it, healing happens quicker and more evenly."

The simple office procedure has already resulted in the successful paper-patching of more than 4,000 ears. ■

**THE EAR IS A versatile sensor. Not only can it hear a plane taking off, it can also hear the sound of breathing—10 billion times less intense.**

**TO TEST a woman for pregnancy, ancient Egyptians added her urine to barley. If the seed grew, the test was said to be positive. Hormones in a pregnant woman's urine do, in fact, encourage plant growth.**



*Sometimes there's no need for expensive medical materials. Doctors are finding out that a simple piece of cigarette paper works fine as a bandage for torn eardrums.*

Illustration by Robert Frank

## "FAKE" BLOOD FROM REUSED RED CELLS

Microscopic bubbles of fat filled with hemoglobin are showing promise as a temporary stand-in for blood.

Blood banks and hospitals often run short of blood for transfusions. The red cells, which contain the oxygen-toting hemoglobin molecules, begin to break down after just 21 days in the refrigerator and less than 24 hours on the shelf. And certain blood types are hard to come by, yet the donor's blood must be meticulously matched to the recipient's.

Pharmaceutical chemists C. Anthony Hunt, of the University of California, San Francisco, and Ronald Burnette, now at the University of Wisconsin, Madison, have devised a simple process that yields universally transfusable pseudo red blood cells called neohemocytes.

"When enzymes break down the red cells in stored blood," Hunt explains, "the hemoglobin is still good, even if the system isn't." Then why not use hemoglobin alone in transfusions? Because, Hunt explains, its molecules disintegrate easily and are readily excreted. So, to delay degradation and hide the foreign hemoglobin from the body's defense system, the researchers developed a fatty coating similar to a red blood cell's membrane. Outdated blood provides the hemoglobin. Eventually, animal hemoglobin may be used for the neohemocytes, creating a virtually endless supply.

Tests of the cells on rats have been encouraging. Even rats with 50 percent of their blood replaced by neohemocytes show few adverse effects. And half of the animals survive until their body restores the lost cells. Human trials should begin in several years.

The cell substitutes can now be stored for two months, but Hunt and Burnette are aiming for six—and two weeks without refrigeration.

Neohemocytes are free of blood-borne diseases. "It's conceivable that we could take hepatitis- or AIDS-contaminated blood and use its hemoglobin," Hunt notes. And the spheres, which are much tinier than red cells, can slip past clots and constrictions.

Another "artificial blood," a petroleum-based white liquid called Fluosol that was developed by other researchers, is now being tested in humans. But it must be administered while the patient is in an oxygen tent. And, Hunt says, it's disconcerting to watch a person being transfused lose all his color. ■

## THROAT SOUNDS FAKE ASTHMA

An impostor has been unmasked, and for nine people who thought they had severe asthma, it's almost a miracle.

A group of researchers recently discovered that in a handful of patients they examined, a vocal-cord disorder had been disguising itself as asthma. The ailment causes such asthmalike symptoms in its victims as episodes of wheezing, extremely labored breathing and a sensation of suffocating.

Pulmonary researcher Kent Christopher, of the National Jewish Hospital in Denver, and colleagues suspected that a vocal-cord problem might be the true culprit because the patients had not responded to traditional asthma therapy. "Things just didn't look right, so I pursued it," says Christopher. "The patients' breathing difficulty seemed to be coming from the throat, not from the lungs." True asthmatics suffer from constricted air passageways in the lungs.

The researchers were able to confirm their suspicions by looking at the patients' vocal cords with a fiber-optic scope during an attack. What they saw was that the vocal cords were behaving abnormally—they came together in such a way that only a small opening was left through which air could pass. Normally the cords do not close to this degree.

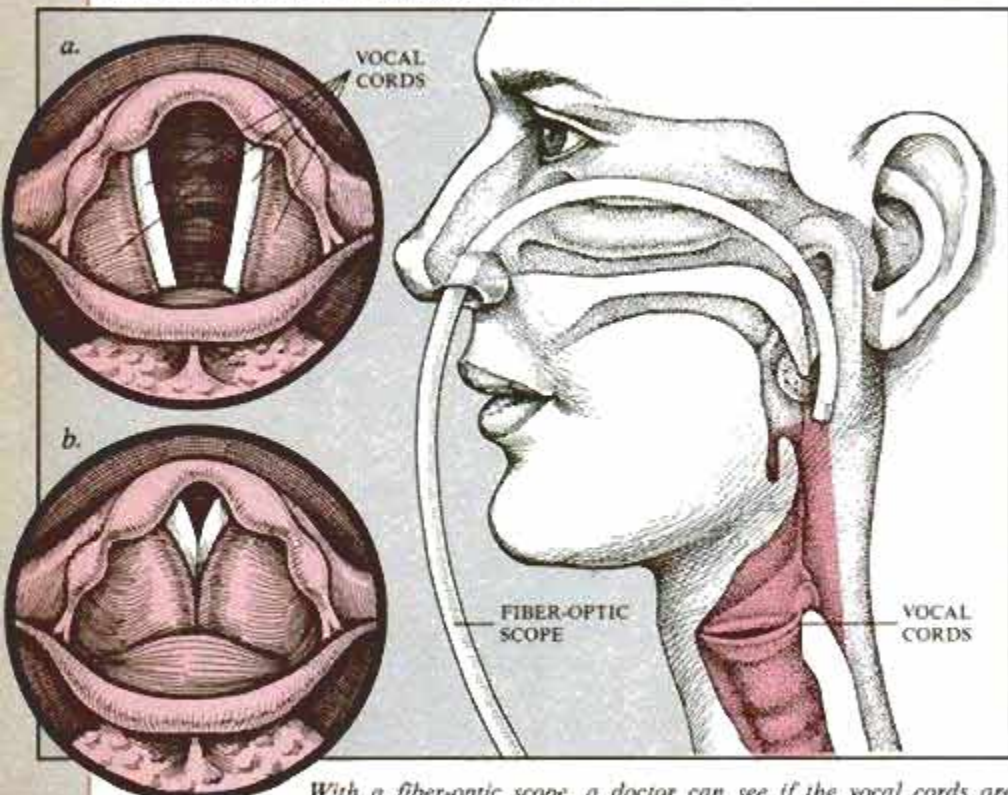
The cause of the disorder is not known, but the researchers have developed tech-

niques that allow patients to breathe through an attack. Initially, they are asked to inhale a combination of helium and oxygen, a light mixture that easily passes through the constricted area. Over time, and with speech therapy, they can learn how to relax their vocal cords.

One 32-year-old patient, a former nurse, suffered through eight years of what she was told was severe asthma before her vocal-cord problem was identified and treated. Besides being subjected to a continuous regimen of medication, she had undergone eight tracheotomies, a surgical procedure in which a tube is inserted through the neck into the windpipe to facilitate breathing.

No one knows for sure how many of the millions of Americans who have been diagnosed as suffering from asthma actually have the vocal-cord malfunction. Although Christopher says he suspects the number is not large, he strongly recommends that any asthma patient concerned about the possibility of having the disorder consult a physician.

**TO CUT through tooth enamel, the body's hardest substance, a dentist's drill whirs at half a million revolutions a minute.**



With a fiber-optic scope, a doctor can see if the vocal cords are normal (a) or abnormal (b). In the latter case, there's only a tiny hole for breathing.

## HEALTH FOOD STORES GIVE BAD R<sub>x</sub>

If you go to a health-food store for health advice, you could be asking for trouble. That's the conclusion of a recent study by the nonprofit American Council on Science and Health (ACSH).

The ACSH sent researchers into stores in the New York area to find out how managers and clerks reacted to customers complaining of serious symptoms.

One investigator, for example, visited 24 stores and said his mother had an eye problem. He described symptoms of acute glaucoma, a serious ailment that can cause blindness if not treated. To their credit, six employees recommended seeing a doctor immediately. Of the rest, though, 12 offered their own diagnoses, without even seeing the patient. Their wrong guesses ranged from allergies to fatigue to emotional stress. And several others prescribed various vitamins and minerals—some in risky doses and all worthless in treating glaucoma.

Another health detective phoned 17 stores complaining of a recent drastic, unexplainable weight loss—among other things, a warning sign for cancer. Again, fewer than half the stores suggested a visit to a doctor, several made diagnoses over the phone, and more than half tried to sell the caller a remedy. These included the predictable vitamins and minerals, as well as high-calorie weight-gain products that would not address an underlying medical problem at all.

In another part of the survey that dealt with products, a woman called 10 stores and said she was pregnant. She asked about bone meal and dolomite, two sources of the calcium she'd heard she needed. She didn't mention that both had been cited by the Food and Drug Administration as having levels of lead contamination that could be dangerous to unborn babies. In most cases, the stores didn't mention it either, and recommended both supplements.

Some stores were even willing to sell items that have been expressly banned by the FDA. Seven out of ten asked still carried starch blockers, diet aids taken off the market over a year ago.

"These people can cause a lot of harm," says Victor Herbert, head of the Hematology and Nutrition Lab at the Bronx Veterans Administration Medical Center and an advisor to the ACSH. Besides, he adds, "There's no such thing as health foods. All foods are healthy in moderation."

## FINGERPRINTS A CLUE TO SENILITY

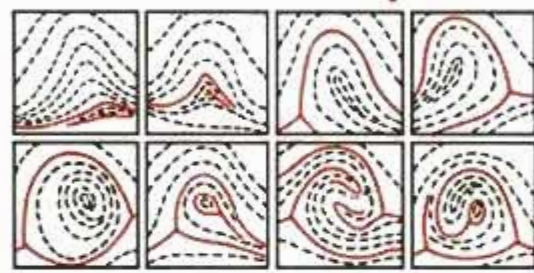
Your fingerprints may be able to predict whether you will one day develop Alzheimer's disease, the number-one cause of senility.

The evidence comes from research at New York University, where a certain fingerprint pattern was found to occur three times as often in Alzheimer's patients as in nonsufferers.

Herman Weinreb, the neurologist who did the study, was led to look at fingerprints because of a known connection between Alzheimer's and Down's syndrome, a form of congenital mental retardation. "Virtually everyone who has Down's syndrome and lives beyond the age of thirty gets Alzheimer's disease," he says.

One well-known feature of Down's syndrome is a greater than average frequency of a fingerprint pattern called an ulnar loop. Weinreb reasoned that the pattern might also be common among Alzheimer's patients. He compared prints of 50 presumed Alzheimer's sufferers with those of 50 normals ("presumed" because a confirmed diagnosis of the disease can be made only in an autopsy; these patients, though, had enough symptoms to be good bets).

When Weinreb looked for patients who had ulnar loops on at least 8 out of 10 fingertips, 72 percent of the Alzheimer's group qualified, compared with 26 percent for the control group. Of those with



*Of the eight standard types of fingerprint pattern, the ulnar loop (\*) shows up with unusual frequency in people who suffer from the sort of senility called Alzheimer's disease. There appears to be a connection between it and Down's syndrome, a form of inborn mental deficiency.*

ulnar loops on all 10 fingers, 14 were Alzheimer's patients, but only 4 of the other group had the pattern.

"This is a statistical finding only," cautions Weinreb. "It certainly does not mean that anyone with the ulnar loop on eight fingers will necessarily get Alzheimer's disease."

He now plans to use fingerprints as a confirming test for senile patients whose specific diagnosis is uncertain. Senility is caused by several different diseases, says

Weinreb, and is not an inevitable consequence of aging. It is important to find a way to distinguish true Alzheimer's sufferers from those with other diseases, he explains, so that scientists can isolate its cause and eventually learn to treat it.

For those tempted to look at their own fingers for a preview of their mental health in old age, Weinreb says, "Don't." It's easy to misidentify your print patterns, he adds; only someone who has been trained can be sure.

## CONTACT LENS "CURE" STIRS CONTROVERSY

When Robert Buffington forgot to wear his contact lenses one day, he realized that his unaided vision was better than it had been in years. Upon having his eyes examined, he found that they had changed in a way that improved his nearsightedness. He had another pair of lenses prescribed, this time with a slightly different curvature. Six months—and four pairs of lenses—later, his unaided vision was perfect, he claims.

Buffington, an optometrist in Sacramento, California, is a subscriber to a procedure called orthokeratology. This controversial technique involves using a series of progressively modified contact lenses as tiny braces to adjust the shape of

the cornea, the dome of transparent tissue that covers the front of the eye. By changing the cornea's shape, the eye's focal length is altered. In nearsightedness, for example, images focus in front of the light-sensitive retina—instead of on it—because the distance from the cornea to the retina is too long. By flattening the cornea, that distance is shortened.

The philosophy behind the treatment is to correct the vision problem, not simply accommodate it, as glasses do. "Orthokeratology is for people who are tired of just treating symptoms and want to treat the cause of the problem instead," says Buffington.

The idea isn't new. By one account, the early Chinese placed tiny sandbags on their eyelids while they slept in order to improve their vision. The modern-day form requires a substantial investment of time and money, and even after treatment, patients must wear prescriptionless "retainer" lenses to keep the eye in shape.

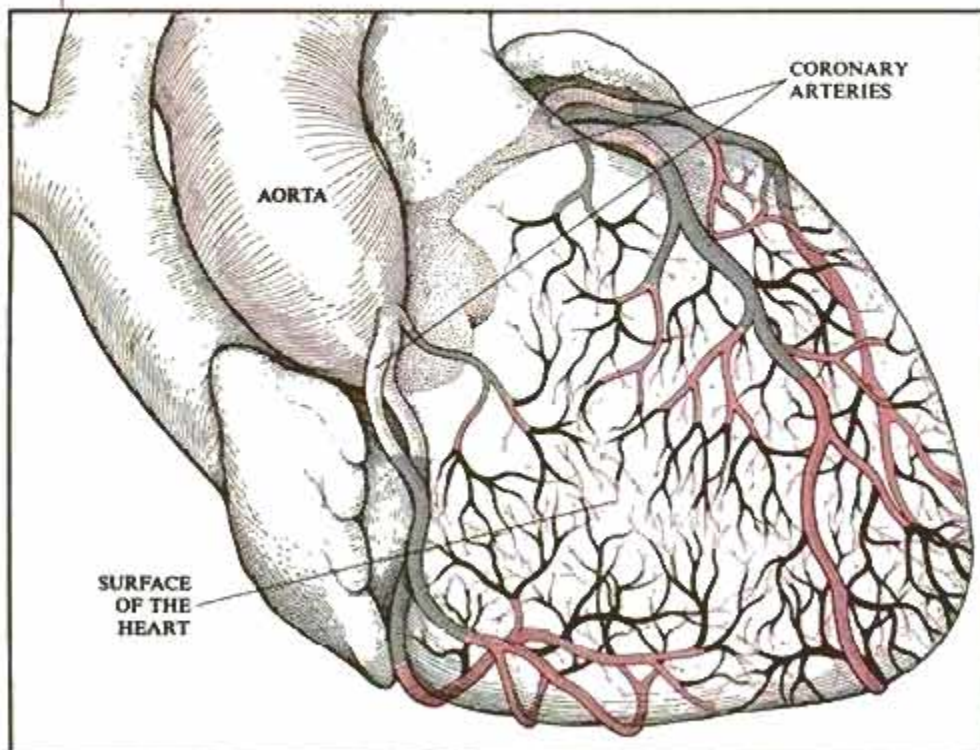
The procedure has been practiced since the 1960s, but many experts still question its effectiveness and safety. Ophthalmologist Alexander Traykovski, of the Manhattan Eye, Ear and Throat Hospital, warns that forcing the eye to adjust to a flat lens can do damage to the cornea. "We've seen some pretty bad corneal scratches," he observes.

But Buffington argues that orthokeratology does not use brute force to correct vision. A properly fitted lens, he says, is not flat. It parallels the cornea and passively changes its shape, though exactly how this happens, he admits, is not known.

**THE HUMAN EYE is continuously but imperceptibly moving. Muscle contractions cause it to quiver 30 to 60 times per second.**

## WATCHING THE BLOOD FLOW BY

## IN BRIEF



Doctors can now observe the rate and quantity of flow as blood feeds the organs. Computer-processed X-rays are projected on a video screen in a five-beat sequence.

Creative use of a computer has given doctors a powerful tool in the diagnosis of heart disease. For the first time, they can see the pulse-by-pulse flow of blood as it moves through the vessels that feed a patient's heart. They can even watch blood penetrating the heart muscle itself.

"With these measurements, we can tailor therapy to each patient based on the condition of his arteries," says Robert Vogel, head of the team that developed the technique at the Ann Arbor, Michigan, Veterans Administration Hospital. Vogel estimates that 25 percent of the 100,000 coronary bypass operations done last year, for example, could have been replaced by less dangerous treatments.

The new imaging system is based on an established procedure called digital subtraction angiography (DSA). In DSA, blood is dyed with a substance that shows up on an X-ray. Pictures are taken before and after introduction of the dye and are then converted into digital data. A computer subtracts one set of data from the other. Since the only difference is the dye's presence, the resulting image shows just the dye—and, therefore, the shape of the artery it is flowing through.

The new process takes DSA five steps further. Instead of simple before-and-after pictures, the computer compares undyed blood with a series of five pictures taken after the dye is introduced.

Five beats of the heart are seen in succession; the distance the blood advances with each beat appears in a different color on a video screen. The spreading color shows not only where blockages are but how they affect blood flow. The computer can then zoom in for a close-up, revealing flow dynamics in extreme detail.

By testing patients both at rest and after exercise, doctors can see if the heart is getting adequate nourishment when it is under stress.

Ordinarily, the heart's constant motions would be a problem for DSA; image subtraction only works when tissues surrounding the dye remain in the same position. The computer program takes this into account by ensuring superimposable pictures. It instructs the X-ray to flash at the same point during the heartbeat every time.

According to Vogel, the system could be used throughout the body. "I see no reason why we couldn't use it to look at how blood feeds the muscles, or even the brain," he says.

**NEVER TRIFLE with a bluefish!**  
This vicious animal often kills 10 times as many fish as it can eat, for no apparent reason.

**If you're overweight, don't bother controlling your sweet tooth.** Control your fat tooth instead.

Scientists already know that, contrary to what one might expect, fat people tend to be turned off by large amounts of sugar in food. In a recent experiment, though, it was discovered that the obese like fat—the more the better. Pudgy test subjects preferred cream to milk and liked heavy cream laced with safflower oil best of all. A small amount of added sugar made the effect even more pronounced, but it was the presence of fat that made the real difference. Most responsive of all to fatter food were those testees who were formerly fat.

**Eat like a bird; it could keep you from getting cancer,** says a professor of medicine at New York University.

Walter Troll says that enzymes found in all seeds—including corn, beans and rice—can prevent the spread of melanoma in mice injected with that virulent form of skin cancer. They also seem to stop the development of cancers of the liver, colon and breast. That could explain, says Troll, why human populations whose diets are rich in these "seed foods" have lower rates of similar cancers.

The enzymes, dubbed protease inhibitors, combine with protein-digesting enzymes in the stomachs of the mice. They then pass through and out of the digestive system. No one is sure why that should prevent cancer, and it seems unlikely that the answer will be found soon; there hasn't been much interest in funding the research, Troll reports.

**The catalog of vitamin C's benefits is expanding:** The substance that prevents colds (maybe) and apparently prevents some cancer seems also to be effective in treating a form of male infertility.

In short, the vitamin unglues sticky sperm. When more than 20 percent of a man's sperm cells clump together—a condition called nonspecific sperm agglutination—he is infertile. Researchers at the University of Texas Medical Branch at Galveston have found that these men also have a borderline vitamin C deficiency.

Experiments with supplements have yielded dramatic results: In just one week, the average number of sticky sperm in test subjects dropped to 14 percent; in three weeks the number was down to 11 percent. Not only were sperm less sticky, but they were also more motile and longer lived.



# HOW DOES THE KIDNEY WORK?

**More than 40 miles of tubes running through the kidneys cleanse all of the body's blood supply many times each hour. Of the 500 gallons processed daily, only a quart is considered waste.**

Every minute, a fourth of the body's supply of blood—nearly one and a half quarts—passes through two remarkable organs on either side of the spine: the kidneys. Only four inches long and five ounces in weight, these organs dispose of the body's metabolic wastes and excess water, excreting them as urine. Some 190 quarts of fluid pass from the blood into the kidneys daily, yet all but a single quart is recycled.

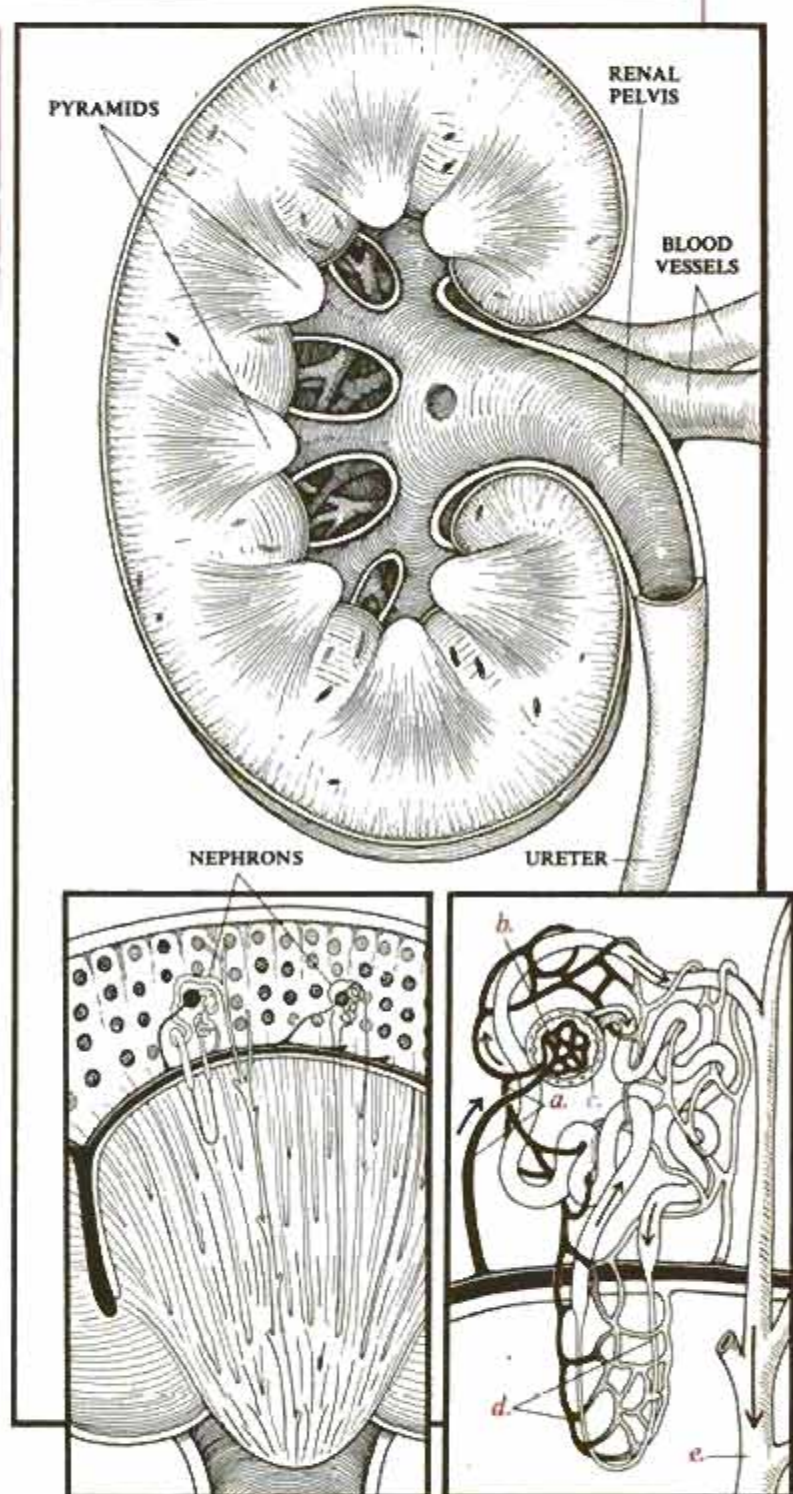
How can the kidney work so efficiently? The answer lies in a million or so tiny, tightly packed structures that act as a highly sophisticated sieve. Called nephrons, they filter a constant stream of blood, reabsorbing nutrients and water vital to the body and secreting urine.

Blood coursing into the kidney first flows into one of many glomeruli, each a tight bundle of capillaries that marks the beginning of a nephron. There, rising pressure forces water, salts and small molecules out of the blood into Bowman's capsule, a cuplike structure surrounding the glomerulus. The larger protein molecules and whole blood cells remain behind in the bloodstream. From Bowman's capsule, the filtrate enters a series of twisted tubes, where various essential nutrients—glucose, amino acids (the building blocks of proteins), ions and minerals—are extracted and returned to the bloodstream. Nearly 99 percent of the water passing through the nephron is also reabsorbed, and of the 2.5 pounds of salt processed daily by the kidneys, only one-third of an ounce is disposed of in the urine.

From the nephrons, the remaining material drains into collecting ducts that transport it to the center of the kidney (the renal pelvis) and on to the ureter, which delivers it to the bladder.

In addition to filtering the blood, the kidneys help regulate the body's internal environment—fluid volume, blood composition and blood pressure. Kidneys produce the enzyme renin, for example, which adjusts the blood pressure so the nephrons' filtration rate is nearly constant, regardless of the amount of water ingested and expelled. This, in turn, ensures that the blood's volume, salinity and acidity remain within a fairly narrow range. And if the kidney runs short of oxygen, another enzyme stimulates the formation of red cells, the blood's oxygen porters.

What happens when the kidneys fail? If one goes out of commission, the other enlarges and picks up its load. In fact, we have so much extra kidney tissue that only a third of the nephrons are needed to filter blood normally; a scant 10 percent can still sustain life. Researchers have yet to perfect a portable artificial kidney. And since successful kidney transplants are still few and far between, for most people with acute kidney disease there is only a tedious and expensive solution. They must be hooked up to a machine the size of a file cabinet for several hours every few days to have their blood cleansed.



Pyramid-shaped units (left) in the kidney contain the tangled nephrons (right) that cleanse the blood. Vessels (a) carry blood to and from the glomerulus (b), where water and other molecules are drawn into Bowman's capsule (c) and through tubules linked by the loop of Henle (d). Most of the fluid reenters the blood; the remainder goes into a collecting duct (e) and is excreted.

## WHY DOES FRUIT RIPEN?

Growing old is a fate most of us dread: Aging all too often means a loss of strength, vigor and attractiveness. But in the world of peaches, papayas and other fruits, things are different. There, old age turns a mouth-puckering persimmon into a juicy delight, a hard, tasteless avocado into soft nutty butter.

What's behind the ripeness process? On one level the answer is simple: A single chemical called ethylene, a gas produced by the fruit itself, choreographs the dramatic changes a fruit undergoes as it grows older and better.

Fruits don't all follow the same path as they grow old. Some ripen best on the vine or tree; others, such as avocados, don't ripen until they fall. (The avocado's

stem is like the pin on a hand grenade: As long as it is attached, the fruit will not ripen.) Most fruits soften as they get ripe; a few, though, including coconuts, become harder.

Ripening is heralded in many fruits by a marked increase in ethylene production. This seems to affect the fruit's physiology. It begins to respire, to "breathe" oxygen, a process that raises its internal temperature slightly.

Respiration can increase three-, four-, or even five-fold, providing extra energy for the work ahead: Chlorophyll is broken down and the fruit loses its green, unripe color. Stored starch is converted to sugar. Acids (and thus sourness) decrease. The pectin that cements cell walls together begins to disintegrate, softening the fruit. A corky layer may form at the base of the fruit's stalk, causing it to fall. Finally, many fruits produce aromatic chemicals that impart to them an enticing

aroma.

But why? Why do so many plants expend so much energy and effort surrounding their seeds with tasty fruit, only to have it fall to the ground and rot or be carried away by bird, beast or man?

The key seems to be dispersal. Plants, forever rooted in one spot, take advantage of the mobility of animals. Fruit is bait, dangled temptingly for all to see. Once "taken" by some hungry forager, the seeds within the edible exterior pass unscathed through the digestive tract and are deposited far from the plant that produced them. ■

**NINE-EYED, blue-blooded and helmet-shaped, the horseshoe crab is not a crab at all but, rather, a close relative of the spider.**

## WHY ARE EVERGREENS EVER GREEN?

Why don't evergreen plants lose their leaves? The answer is, they do.

We are duped into thinking they don't because, unlike deciduous plants, which lose all their leaves in the fall and replace them in the spring, evergreens lose leaves while adding on new ones.

This is not to say the leaves don't live a long time. They do. The longest-lived evergreen leaves are the needles of the bristlecone pine, which last an impressive 30 years before they self-destruct.

Besides the conifers, many shrubs and other trees, such as those that live in the tropics, are green year-round. And some trees, like the red maple, are deciduous when growing in New England but evergreen when basking in the Florida sun.

Why aren't evergreen leaves everlasting? "Nothing lives forever," says plant ecologist Brian Chabot of Cornell University. "We don't really know why any organism has a programmed life span."

But evergreen and deciduous leaves also differ in their construction. "Deciduous leaves are designed to be discarded," says Chabot. On the other hand, the tougher evergreen leaves are built to last. They have a double epidermis—the superficial layer of cells covering leaves and other plant parts—and a thicker cuticle, the waxy outer covering. In addition, ev-

ergreen leaves are stuffed with supporting cells, called sclereids, and they're chock full of noxious chemicals to deter nasty bugs.

Considering the time and energy an evergreen puts into growing its complex leaves, it makes sense for it to keep them a long time. "The longer the leaf lives," says Chabot, "the greater the plant's return on its investment." That is, a leaf that lives five years will make more food for the plant than one that lives only a few months.

The argument seems to run in circles: Evergreen leaves need to live longer because their sophisticated structure is more expensive to make; they need a sophisticated structure in order to be hardy and live longer. But Chabot says he prefers to view this as a positive feedback loop that is advantageous to certain plants in certain environments. ■

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*The evergreen leaf is tailor-made for a long life. It has a thick cuticle, or outer covering, and a double layer of epidermal cells to make it hardy.*

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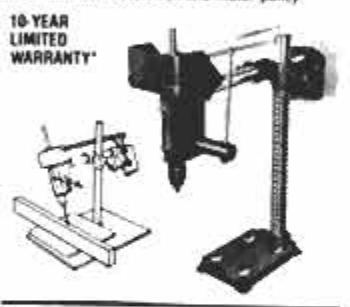
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To Celebrate Our 10 Millionth Sale!  
**CALCULATOR/WATCHES**  
**ONLY \$10**  
**WITH THIS AD**  
This is *NOT* a Misprint.

*This special offer is being made to celebrate the 10 millionth sale of the famous New York jewelry firm of Abernathy & Closther and is open to every person who mails this ad to the company address (below) before Midnight, December 31, 1983.*

**NOTE: This original printed ad must accompany your request. Copies or photostats are not acceptable.**

To celebrate its 10 millionth sale, the famous New York jewelry firm of Abernathy & Closther will distribute one million of the new "ultra-slim" LCD Quartz Calculator/Watches for only \$10 apiece to the first one million people who mail this ad to the company address before Midnight, December 31, 1983.

These are the same nationally advertised Calculator/Watches to be featured in leading media, with digital display of the year, month, date, day, hour, minute and second. Its "built-in" alarm wakes you in the morning, reminds you of appointments during the day, and even tells you when its time to put another coin in the parking meter. (It also chimes on the hour.)

The calculator will add, subtract, multiply, divide, do percents, square roots, etc. It will even balance your checkbook.

These famous Quartz Calculator/



Watches will not be sold at this price by the company in any store. To obtain one at this price, mail *this original printed ad* to the company address (below) before Midnight, December 31, 1983.

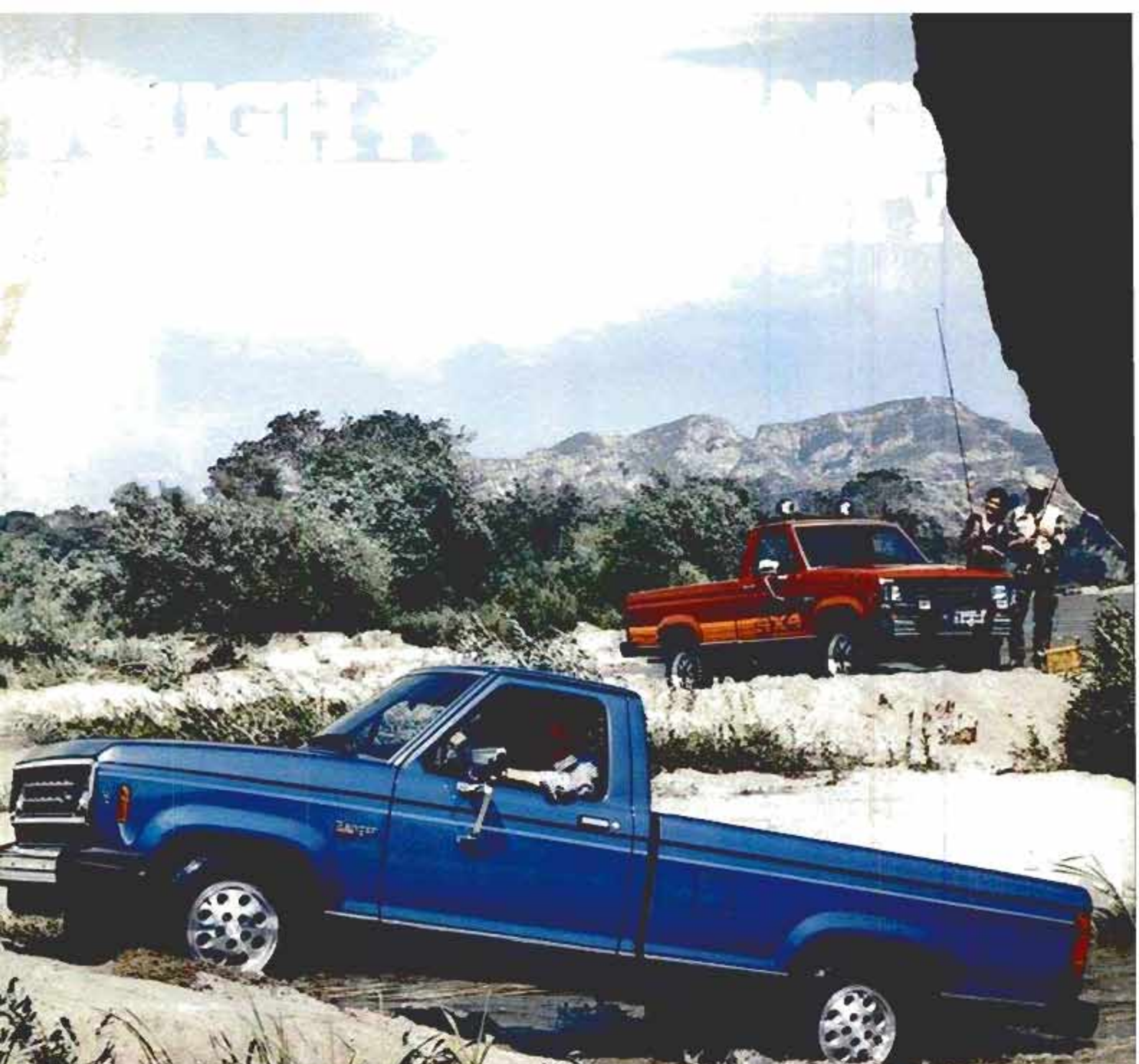
Each Calculator/Watch carries a full money-back guarantee and will be replaced by the company, free of charge, if it ever fails to function.

There is a limit of two (2) watches per address at this price, but requests which are mailed early enough (before Dec. 25) may order up to 5.

To obtain your Calculator/Watch, mail *this original printed ad* together with your name and address and \$10 for each watch. Add \$2 shipping and handling for each watch you are requesting. Mail to: **Abernathy & Closther, Computer Watch, Dept. 114-11, Box 1735, Hicksville, New York 11802.**

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(A22460)



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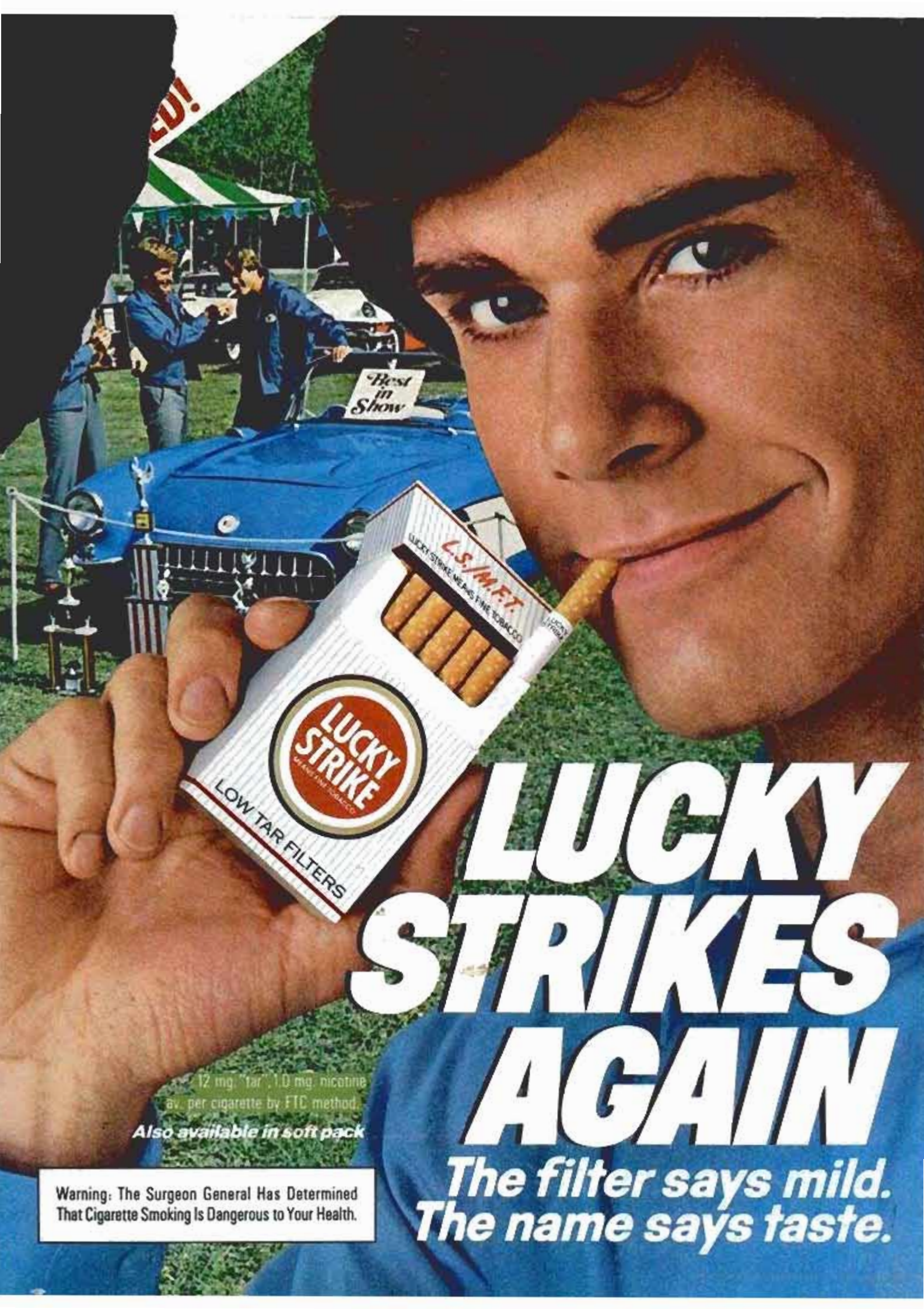
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