

OCTOBER 1976 75 CENTS

# Popular Mechanics

**'77 CARS**  
23 experts  
tell what's  
really new

**AT LAST! Safe  
hands-off blind  
landings for jets**

**Exciting new  
games you play  
on your home TV**

**Build PM's lighted  
INDOOR PLANTERS**

**21 secrets  
of lower  
heating costs**

**NEW TELE LENSES:  
Shorter barrels  
& greater power!**

**VANS: 30 great  
new add-ons**

**PM PICKS 16  
DREAM TOOLS  
FOR THE MASTER  
CRAFTSMAN**



Does your cigarette  
fall short on taste?

Come all the way  
up to the "extra"  
extra coolness of  
KOOL Super Longs.



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

17 mg. "tar," 1.2 mg. nicotine, av. per cigarette, FTC Report Apr. '76

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# Our Tune-up Kit can end those "58-Chevy-points-won't-fit-my-'65-Vette-going-back-to-the-parts-store" blues.



You know the lyrics. Some of them are probably X-rated . . . and for good reason. Picking up the wrong parts for your tune-up can shoot half the day. But there's no more kicking yourself or the guy you bought them from.

Thanks to the AC-Delco Tune-up Kit.

## The AC-Delco Tune-up Kit. A matched set to end mix-ups.

It contains everything you need for a reliable tune-up. A matched set of AC Fire-Ring Spark Plugs and Delco-Remy Ignition Parts.

We probably don't have to tell you what a tune-up can do for

you if your spark plugs are worn and misfiring . . . but we will.

## Help improve your car's economy and performance.

Under these circumstances, a good healthy tune-up can help your engine operate cleanly, with fast, reliable starts and improved acceleration. Our tune-up team helps your gasoline economy and helps you get the performance you expect.

And oh, yes! A kind of comforting assurance as you head home to do the job. The AC-Delco Tune-up Kit helps end mix-ups. The application is clearly marked right on top of the box.

So next time you're ready to tune up your car, don't start singing "the blues." Pick up the red, white and blue box, instead . . . the AC-Delco Tune-up Kit.

Fits 8 Cyl. 398-05  
General Motors Products

### Tune Up Kit A Matched Set



Go  
with the names  
you know.



AC-DELCO DIVISION OF GENERAL MOTORS CORPORATION

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OCTOBER 1970

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# Popular Mechanics

OCTOBER 1976 • Vol. 146 No. 4

INTERNATIONAL EDITIONS: Australia, Caribbean, Mexico, Southern Hemisphere

## SPECIAL FEATURES:

**'77 Cars: 23 experts tell what's really new.** You get insiders' information from some of Detroit's most knowledgeable engineers. Page 90.

**At last! Safe, hands-off, blind landings for jets.** Details of how an amazing new system will take the danger out of airplane landings. Page 82.

**Build PM's lighted, indoor planters** explains how easily you can put together two attractive grow shelves for inside gardens. Page 116.

**Vans: 30 great new add-ons.** Sensational new gadgets and devices are now available for those who are into sport vans. Page 86.

**PM picks 16 dream tools for the master craftsman.** All these tools are not only works of art, but they are fun to use. Page 72.

**21 secrets of lower heating costs** will help you cut skyrocketing fuel bills this winter. Page 112.

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## ON THE COVER

Great hand tools are the "jewels" of a master craftsman's home shop. For PM's 16 dream tools, see page 72. Photo: George Rátkai

**POPULAR MECHANICS IS PUBLISHED MONTHLY** by the Hearst Corporation, 224 West 57th Street, New York, N.Y. 10019, U.S.A. Single copy for the United States, 75 cents; for Canada, 95 cents. Subscription prices: United States and Possessions, \$7.00 for one year; \$13.00 for two years; \$18.00 for three years. Canada, add \$3.00 for each year. All other countries, add \$5.00 for each year, second-class postage paid at New York, N.Y., and at additional mailing offices. Authorized as second-class mail by the Post Office Department, Ottawa, and for payment of postage in cash. Registered as second-class matter at the Post Office at Mexico D.F., Mexico, June 20, 1950. © 1976 by The Hearst Corporation. All rights reserved. Printed in U.S.A.

**POSTMASTER:** Please send Forms 3579 to *Popular Mechanics*, P.O. Box 10064, Des Moines, Iowa 50340.

NASCAR SUPERSTARS  
DRIVER DAVID PEARSON  
AND THE WOOD BROS.  
LEONARD AND GLEN

# See S-K® tools superiority

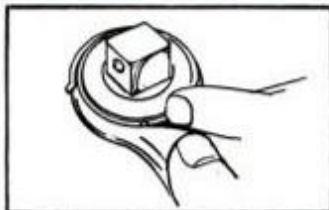
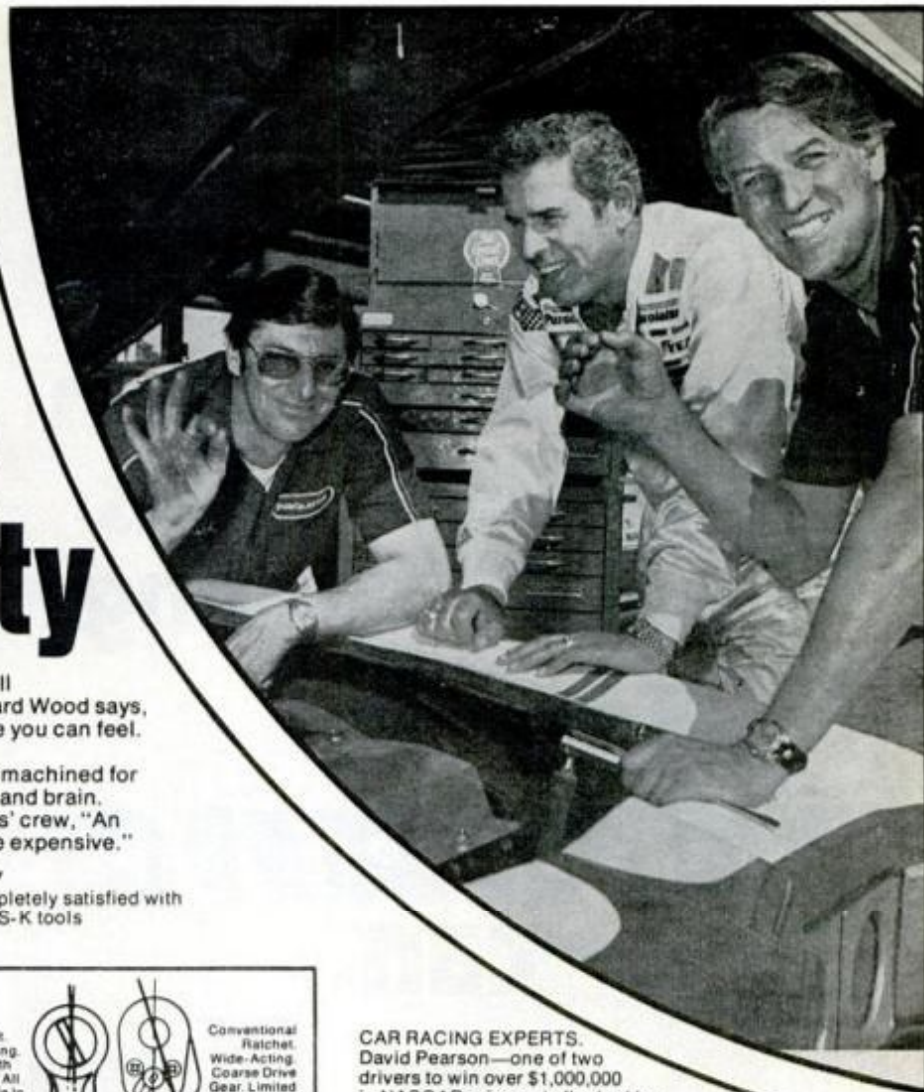
If you get grease under your finger nails, you'll understand when champion mechanic Leonard Wood says, "There's a difference in tools . . . a difference you can feel. Do a job with S-K tools and you'll see."

An S-K tool is polished to a high finish. It is machined for a balance that makes it an extension of hand and brain.

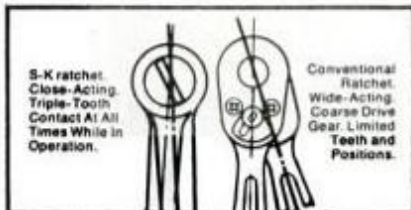
Says the famous chief of the Wood Brothers' crew, "An S-K tool is worth any price, yet many are more expensive."

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**SATISFACTION GUARANTEED.** If you are not completely satisfied with any S-K tool during its life, simply notify any place S-K tools are sold for a free exchange.



S-K ratchet wrench has a unique operating mechanism control for simplified cleaning and resultant longer life. Lets you easily remove mechanism.



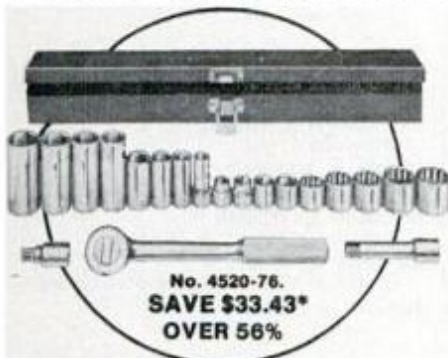
S-K ratchet.  
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Wide-Acting.  
Coarse Drive  
Gear. Limited  
Teeth and  
Positions.

S-K ratchet operates in 5.1° to 9° arc; little or no back movement—invaluable in tight work areas. Conventional ratchets make tight work tough: 10° to 20° arc, with 5° to 10° back movement.

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## Prices Equivalent To 1970 Prices—S-K Tools American Quality Specials



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**OVER 56%**

20 pc. 3/8" drive socket set with S-K ratchet. Top quality all-purpose set includes: 9 standard sockets, 3/8" thru 7/8"; 8 deep sockets, 3/8" thru 13/16"; 1-1/2" and 3" extensions; reversible ratchet. Metal box. **\$25.98**

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sugg. user price.



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13 pc. 3/8" drive Metric socket set. Fine quality set contains 13 metric 6 pt. sockets in sizes 7 mm thru 19 mm. Packed in sturdy flip-lock tray.

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Total regular value \$30.04\* **\$13.98**  
sugg. user price.

\*Prices and savings based on purchase of pieces separately at suggested user prices.  
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1/2" drive torque wrench. Professional quality speed and accuracy. 0-150 ft. lbs. capacity. Dual scale, English and Metric. Compare with torque wrenches selling for much more. **\$12.88**  
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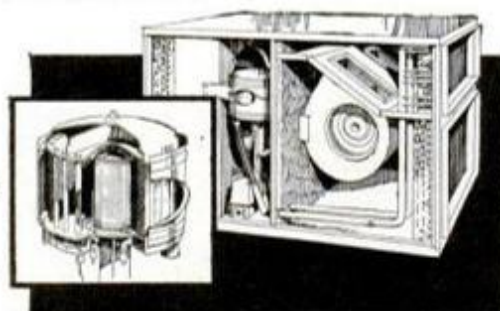
**Amana<sup>®</sup>  
can.**

If you want to save money on heating your home, look at the Amana Electric/Gas cooling-heating unit. The money savings comes from the unit's unique Heat Transfer Module, the first major breakthrough in heating technology in years. The HTM† is small enough to hold in your hands, yet powerful enough to heat an average size home. The HTM uses outdoor air for fuel combustion eliminating much up-the-chimney heat loss common to conventional gas furnaces. Amana uses electronic ignition to eliminate wasteful pilot lights and two-stage heating to keep the unit operating at maximum efficiency. In addition to saving money on heating, the same Electric/Gas unit gives you dependable central air conditioning, too, all from one compact comfort center.

Call your Amana home comfort dealer or write Dept. C-200, Amana, Iowa 52204 for more information on Amana Energy Savers.

\*Based on Institute of Gas Technology laboratory tests and projected performance for a northeastern Ohio city, compared to a conventional gas furnace. Savings will vary with climate and weather conditions.

†HTM is a registered trademark of the Raytheon Company.



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of tomorrow.**

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# Get your CB from a company you can depend on. Because someday you may have to depend on your CB.

Sure, CB is fun. But when you get a CB transceiver, make sure it won't break down when you need it most. Because helping you out of tight scrapes is really what CB is all about.

If your car gets stranded on a spooky mountain road. Or there's an emergency on the highway. Or when it's 1 AM and your tank reads "E." Or even when you're beginning to nod off and you need some conversation to

keep you awake. That's when you need a dependable CB transceiver as much as you need dependable brakes.

We've been making 2-way communications systems for years. Marine. Police. And HAM systems. And, like everything Panasonic, we build them as if our reputation depended on it.

And that's how we built our mobile transceiver, the RJ-3200. That, you can depend on.



**CB/PA Switch.** To turn your CB into a public address system (with optional external speaker).

**Noise Blanker/ANL Switch.** Silences background noise for clearer, quieter reception.

**Delta Tuning.** Pulls in off-center communications.

**"LED" On-Air Indicator.** Lights when the set is in the transmitting position.

**Lighted Channel Indicator.** To easily see any one of 23 channels.

**4 Watts of Power.** The legal maximum.

**Squelch Control.** For silencing interstation background noise.

**S/RF Power Meter.** Measures both transmitting and receiving signals.

**Quick-Release Bracket.** Lets you remove your CB so a thief can't.

**Modulation Indicator.** Lights up to indicate strength of transmitting signal.

**Detachable Mike.** For ease of storage.

**Panasonic 1-year parts and labor limited warranty.\*** Backed by a nationwide network of service centers.

\* For one year after purchase Panasonic will repair or replace parts of the RJ-3200 if purchased and retained in U.S.A. Customer must bring it to an authorized service center. Warranty does not cover damage in transit or damage from abuse, misuse or commercial use. Proof of purchase must be shown for in-warranty service.



**Panasonic**  
just slightly ahead of our time.

# LETTERS

## TO THE EDITOR

### How they watch us

I want to point out a mistake in your July '76 article, *How They're Watching Us* (page 48). It says that satellites have replaced the Distant Early Warning (DEW) Line and Ballistic Missile Early Warning Systems. This is not true.

Satellites are helping in the overall collection of data, but obviously are not as good as one may believe after reading your article. I am working on the DEW Line, and we're still going strong.

KARL H. BUB  
WINNIPEG, MAN.

Already (is it my imagination?) I'm hearing clicks on my telephone.

WILLIAM T. GODBEY  
WEST PALM BEACH, FLA.

### Still flabbergasted

I was delighted that your July *Owners Report* featured the 1976 Oldsmobile 98 (*Who Needs Cadillac? The Olds 98 Offers Just As Much With a Lower Sticker Price*, page 82). I took delivery on one in January and found the accolades and complaints as expected until I read the paragraph on seating comfort.

I have read and reread it, and I am still flabbergasted that 93.8 percent of the respondents rated the seats "very good-to-excellent."

My gleaming beauty is a sedan equipped with the 40/60 front seat configuration. There is no way even a preschooler can ride comfortably in the middle position for any length of time. The rear seat is but very little better in the center. What this amounts to is a 2½-ton, 20-foot 9-grand, overgrown behemoth that can only haul four in comfort.

Oh! To have my six-passenger, '71 Olds 88 back! And it didn't use oil, either—even with 100,000 miles on it.

M. K. GILMORE  
STARKVILLE, MISS.

### Frozen tennis balls

I've seen many ads for keeping the gas from leaking out of tennis balls after the pressurized can has been opened. Again, I see a new pump in your *New Outdoor Gear* story (page 108, May '76).

I seldom play tennis, but the balls I use still have good bounce after

two to three years of unpressurized storage. I store them in the freezer. The cold temperature reduces the pressure inside the balls so the gas doesn't escape. Within 15 minutes of putting the cold balls into room temperature, they're ready for action.

JOHN TRAUBE  
HARRISON, ARK.

### Some CB confusion

In the section *CB Lingo—It's English, Sort Of (How CB Can Make Your Vacation Better*, page 60, July '76), Ivan Berger made some mistakes.

He said that 10-10 means "negative"; it means "transmission complete, standing by." He also said that 10-34 means "correct time." It means "this station in trouble, needs help." And for the correct time, the 10-code number would be 10-36.

DEAN CRUSE  
EL PASO, TEX.

*We've seen several 10-codes. Most used is the Associated Public Safety Communications Officers, Inc. code, with designations from 10-1 to 10-34, including those in the article.*

You mentioned Form 555-B, saying it should be mailed in to get a temporary call sign. This form, which I obtained, says at the bottom:

"Do not mail this form; it is your temporary permit."

J. H. WORMAN  
MEMPHIS, TENN.

*You're right. Our story was written before the forms became available.*

### More CB installation tips

I have a couple of points to add to your article, *How to Find the Best Spot for Your Car's CB* (page 88, May '76).

As to the 12-volt source, a simple solution is to install a single-pole, double-throw switch on the dash and have either option (battery or key) at your fingertips. It leaves the set (and radio and tape outfit) under control of the key. If you want CB while the engine is off and the key is out, simply switch to direct battery.

Connect CB and radio to the center contact, a hot wire to an outer pole,

and a key-controlled hot wire to the other. A fuse should be in the center line to protect equipment.

In addition, while separate speakers improve listening, a simple solution is a roof mount. You can also use a dash mount, having the radio higher, in a near vertical position, with the speaker facing outward.

EDWARD W. HALL  
POWNA, VT.

### Don't burn out your motor

In regard to the "Improved Reversing Switch" (*Letters*, page 174 June '76), Harry Sinclair failed to mention one detail.

When using the unmodified DPDT switch to reverse your motor, always disconnect your motor beforehand. When the DPDT type switch is used, current flows through the field windings when the switch is between positions.

If the power is left on, and the DPDT switch is not completely thrown, there's a great possibility of burning up the motor. I have built the reversing switch both ways and found out the hazards by trial and error.

LEON HARRIS  
GOLD BEACH, ORE.

### An enjoyable project

I enjoyed building your *Pier Curio Shelf* (page 112, Jan. '75). Problem was it wasn't large enough, so I doubled the size and made a standing wall unit. I used one-inch oak for construction and used the storage drawer as additional display. I installed glass in the sides and a mirror in the back.

The design fits perfectly with our Spanish decor.

JOHN GLENN  
ANCHORAGE, ALASKA

### Home Care Guide available

In reading a back issue of PM, I noted an advertisement for the Master Home Care Guide. I would like to know if it still available and at what price.

DAVID LICKTEIG  
HANOVER, KANS.

*You can get your guide by sending a check or money order for \$4.49 to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10019.*



# If you're smart, you may never have to worry about life insurance again.



## *Here's why Allstate's Family Plan Package makes sense.*

**You're just starting out**—with a new baby, or a new home, and with a whole new future together—and you wonder how you can be sure you're buying life insurance wisely.

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**Allstate's Family Plan Package starts out the way you do:** On a budget. Yet the basic plan is big enough to cover you, your spouse, and your children until they reach age 22. And future children—15 days after arrival—at no extra cost. And more . . . but that's just for starters.

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The Family Plan Package described is Allstate's Two Parent Family Plan policy with optional benefits: Future Purchase Privilege, Additional Accidental Death Benefit and Family Income Insurance Benefit. A One Parent Family Plan policy is also available.

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HAVE TO WORK 2 JOBS  
JUST TO MAKE  
ENDS MEET.**



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You'll hardly ever see your family. You won't have time for friends or fun. Your wife will wonder what happened to the husband she used to have. You'll spend your days off sleeping.

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Since 1890, millions of men and women around the world have turned to ICS for career training.

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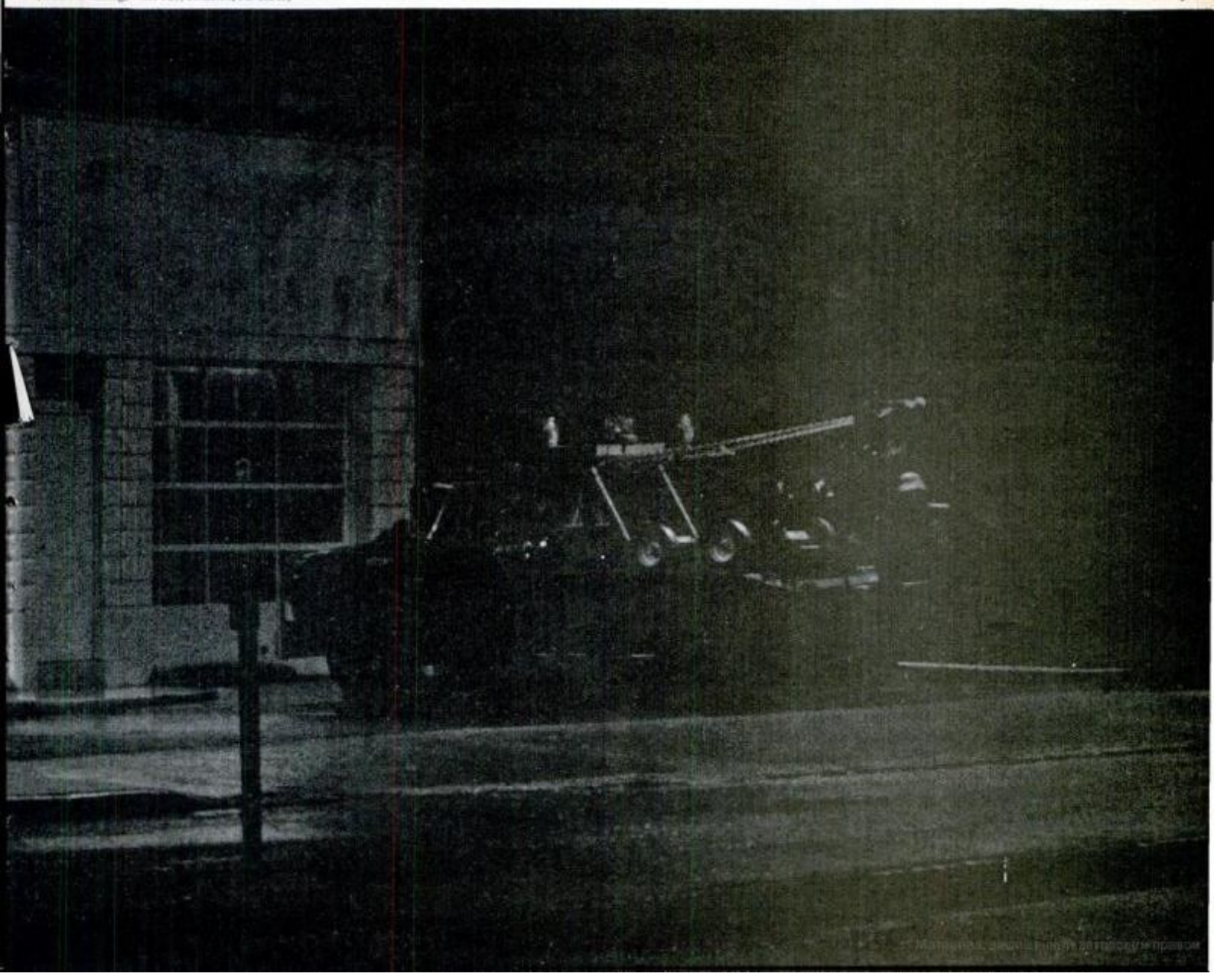
No one can promise success, but if you *want* more—more money, more security, more day-to-day satisfaction and more future—our free Career Booklet and free Demonstration Lesson can help you get started in the right direction. Just check the box next to the field that interests you most and mail the postpaid card today. There's no obligation.

Remember, it's your life. You might as well make the most of it.

**ICS**

International Correspondence Schools  
Scranton, Pa. 18515

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# Pentax . . . always easy to use.



## This new one is easy to own.

If you want better pictures than you've been getting with your pocket camera but not a lot of hassle getting them, now there's a camera for you.

Get your hands on a K-1000. It's the easy one.

### As easy as your pocket camera.

You can grab and shoot with a K-1000 just like you do with your pocket camera. The built-in light meter makes it certain you'll get beautiful color. And you'll get all the picture you see in the viewfinder because you look right through the lens.

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All you have to do is center a needle while you look through the viewfinder, focus and shoot.

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## Honeywell Photographic

## PHOTO HINTS

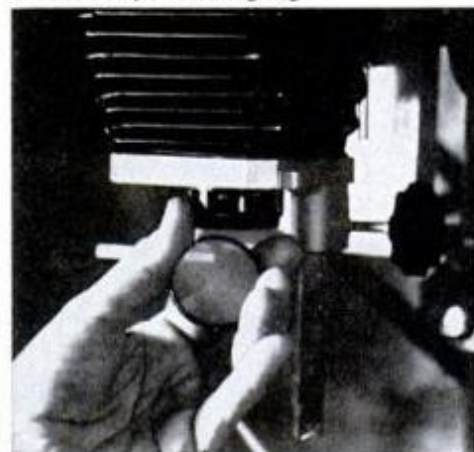
FROM READERS

### Battery reminder



You're not likely to neglect the batteries in a flash gun or camera if you put a dated reminder sticker on its body. Check it from time to time, and you'll avoid possible corrosion problems—from old leaking batteries—or the probability of having batteries go dead just when you need them.—*Robert Hertzberg*

### Filter helps enlarging



Some new enlarging papers are so fast that you can't stop down your enlarger lens far enough to get the exposure times you need in order to do burn-ins and dodging. If this happens to you, try a 4X neutral density filter over your enlarger lens or in the filter drawer under the lens. This colorless gray filter will multiply your exposure time by a factor of four.—*Robert O. Barnes*

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# ALL OUTDOORS

WITH BILL McKEOWN



## Cross-country comments

Self-containment—remember that term? Five years ago it was the claim of the fully self-sufficient recreational vehicle featuring its own beds, lights, water supply, kitchen, bathroom and holding tank. With this rig you were supposed to be able to pull off the road anywhere and live comfortably abroad.

Five years ago to test the theory I took a little Ford Minihome Econoline van conversion, got in it in Maine and drove to Mexico without getting out. The trip wasn't very exciting because nothing went wrong—no flat tires, no engine problems, no shortage of food and water or overflow of the holding tank. I couldn't take a real bath with the showerhead over the sink so I was glad when I reached the border in six days to check into a motel for a long soak, a bigger bed, and a meal not motor-home cooked.

But the drive proved you can live inside today's RVs for extended periods if you insist, and that a person who is elderly or crippled but able to drive, or who travels with someone who does, can certainly set out to see America's sights. My cross-country run also gave me a chance to study many states, plus a variety of campgrounds on the way back when I stopped and got out every chance I had.

So recently I drove 6000 Minihome miles again for an up-dated look at much of the same countryside. It was a chance to survey changes of the last five years and to check conditions that could have improved for the outdoorsman. The great sights, it turns out, still remain, and so do those scenery polluters—the utility poles—that stick up in front of so many good views, as my photographer pointed out.

## The new sports car

Remember the trend to midget motorcars? Across the country, I noted fewer two-seaters and performance compacts, foreign and domestic, than ever before. For each, in fact, I must have counted 50 or more trailers, motor homes, vans and cap or camper-topped pickups. The sports car of the near future, I pre-

dict, is going to not only seat but sleep two to four, have some cooking facilities and offer an optional toilet. My mobile crystal ball shows more four-wheel-drives, more small trucks that double as recreational transportation, more rigs offering privacy with curtains, panel sides or darkened one-way windows. Gas economy will be important, yes, and exorbitant pump prices will mean shorter trips and longer stops at campgrounds. But only a complete fuel turn-off should deprive us of our choice of one of these versatile vehicles. Full self-containment seems less important now, with most campgrounds offering adequate bathroom facilities.

Part of the appeal of sports cars, however, has been their handling, performance and slick good looks. They were designed by car creators, and I suspect the really successful RVs of the future will have to look better. A car or yacht may carry more when shaped like a barge or shoebox, but it will not excite buyers who appreciate something classy, when they see it. The rigs may expand, unfold, pop up or stretch out into a bungalow once they're parked, but we presently need designs that look less like lessons in wind resistance as they roll down the roads.

## Where to camp

It's getting easier to find campgrounds these days. Signs along major highways are giving loca-



Onshore offshore patrol is provided along Delaware coast with International Scout II's roof radar that locates fishing boats up to 12 miles out in the Atlantic.

tions. Good directories like Rand McNally's, A.A.A.'s, Woodall's and Wheelers' give detailed lists of facilities and often helpful directions for finding the locations. Some campgrounds monitor CB and you can call for routes and reservations.

Your printed guide may provide campsite ratings, but these often need interpretation: A lighted volleyball court plus recreation center with jukebox and pinball machines may not be your idea of five-star luxury if you don't have youngsters along. The cost of a full-facilities campground, however, may run only a dollar more than a less-developed site, and save 75 percent over a motel where you'll be eating in its restaurant as well. Total charge at the Ramada Camp Inn outside Indianapolis, the best example we came across, was only \$7 a night for our rig and included indoor and outdoor swimming pools, gravel parking spots next to lawn campsites, well-stocked store, landscaped restrooms and handy laundry machines. Golf, tennis, stocked trout pond for fishing and other sport activities were extra-charge options. Best of all, shaded picnic tables and adequate space between campsites were not an exception. A crowded unpleasant layout might have cost only \$2 or \$3 less.

## Sites for the future

On our survey, we found a trend toward campground specialization. Many private camps are now divided into sections for trailer, motor homes and tents, with some campgrounds for just one of these as is done in state and national parks.

In addition to more campgrounds and better reservation systems, we foresee a need for minimum-facility sites for overnighting. Right now you can get a few hours of sleep at a truck stop amid the rumbling diesels, and a few states allow overnight rest at rest stops—although most want your money for local motels. One answer could be separate coin-operated parking spots and hookups, without the complications of checking in, where the RV traveler could pull in and sleep, wash up, and be on his way. ★★

# When your taste grows up, so should your cigarette.

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

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

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



# THE PM GARAGE

## Wondrous oil gun



I might finally have found it—the perfect oil-change spout. Called the Trig-A-Flow Oil Gun, it's a combination funnel and punch. The punch pierces the bottom of a one-quart oil can while the funnel portion is already set into your engine's oil filler opening. So the Oil Gun eliminates a lot of the mess and drip that usually goes with changing oil. The unit is all metal and well put to-



gether. Costs \$2.98 plus 50 cents handling from A-G Marketing, Box 3842-PM, Amity Station, New Haven, Conn. 06525.—*M.L.*

## Inductive timing light

It'll just be a matter of time until all timing lights are using inductive pickup. Eliminating the muss and fuss of connecting into the No. 1 sparkplug makes an ignition timing check a snap for anyone with enough skill to use a clothes pin.

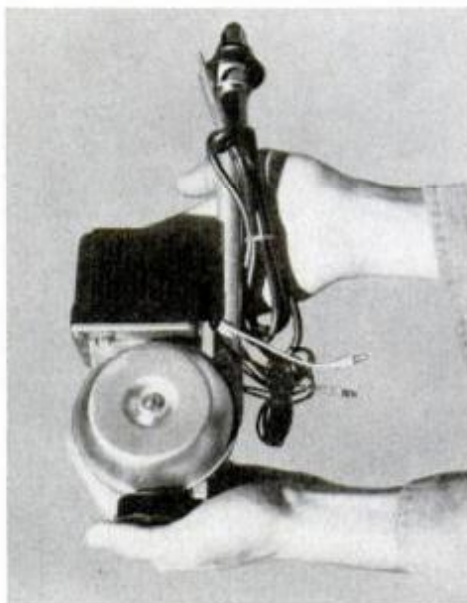
This inductive pickup is the one



used with Dixon's Model 418 d.c. power light. It's bright, easy to use and costs \$55. Dixon, Inc., Box 1449, Grand Junction, Colo. 81501.—*B.H.*

## Bulky power antenna

Cursed with a low garage entrance, I've long searched for an after-market power antenna for my 1967 Camaro. And I finally found one—paid \$23.95 and figured the installation would be simple. After 2½ hours of the purest frustration, though, I discovered that there is no way to fit this rather bulky an-



tenna into the front fender of my car. Nor would it fit my wife's 1972 Dodge wagon. So before you buy one of these, be sure that you check for space in your car.

The antenna itself seems to work just fine (I operated it outside the car), and this particular unit is the Afco Electronics Model HCA-300B. It's available at auto supply stores or direct from the distributor, Afco, 476 Roland Way, Oakland, Calif. 94621.—*M.L.*

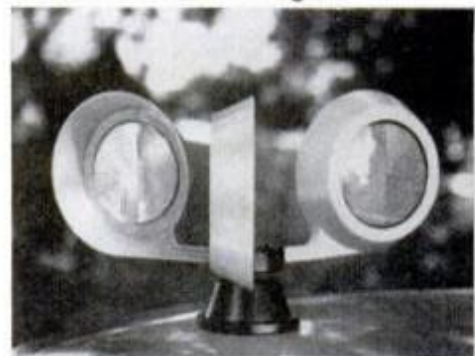
## Emergency patch

This stuff—actually a mineral rubber compound—will sit in ready on your workbench shelf forever. Imagine a package of paper-between-slices-of-cheese rolled up into a tube, and that's what you get when you open the box. The stuff is black, though, and it's ready to stop leaks



whether it's minus 65° F. or plus 180° F. Neat Seal Patch is \$3.95 for 216 sq. in. Woodhill Chemical, Cleveland, Ohio 44128.—*B.H.*

## Roadside distress signal



This clever gadget has three double-faced reflectors (red, amber and white). The reflectors rotate in even a mild breeze, and the magnetized base holds "Blinky" firmly to the roof or decklid of your car. It's \$10 plus 95 cents postage from Hoffritz, 20 Cooper Square, New York, N.Y. 10003.—*M. L.*

## Glue-on tire letters



They're just for fun. You get 64 raised white letters to trick up your tires. \$8.95 from Aljohn Car Service Corp., 195 Northern Blvd., Great Neck, N.Y. 11021.—*M.L.*



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Over the years, you've seen our TV commercials where a Marquis was always hard to beat when compared to some of the world's finest cars. Even a Buick Electra and Olds 98 when they were still full size. Now with their biggest cars scaled down, we think this year, more than ever, is the year you must compare.

**Compare ride.** This small plaque on Marquis' dash, "Ride-Engineered by Lincoln-Mercury," isn't something we just tacked on. We take pride in our hard earned reputation for riding excellence. But don't just take our word for it. Go out and pick a really bad road.



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which car holds more. And which car is easier to load.

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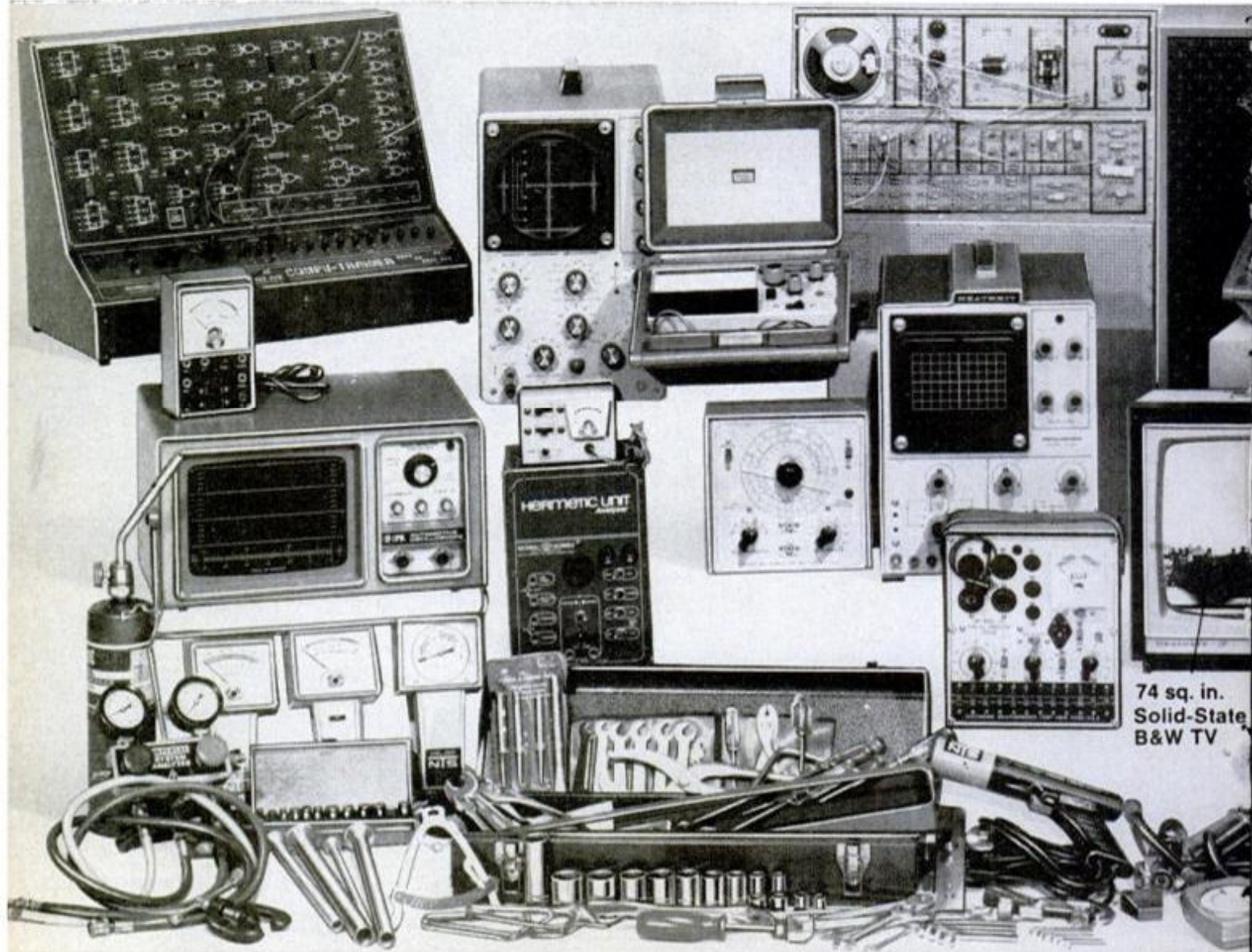
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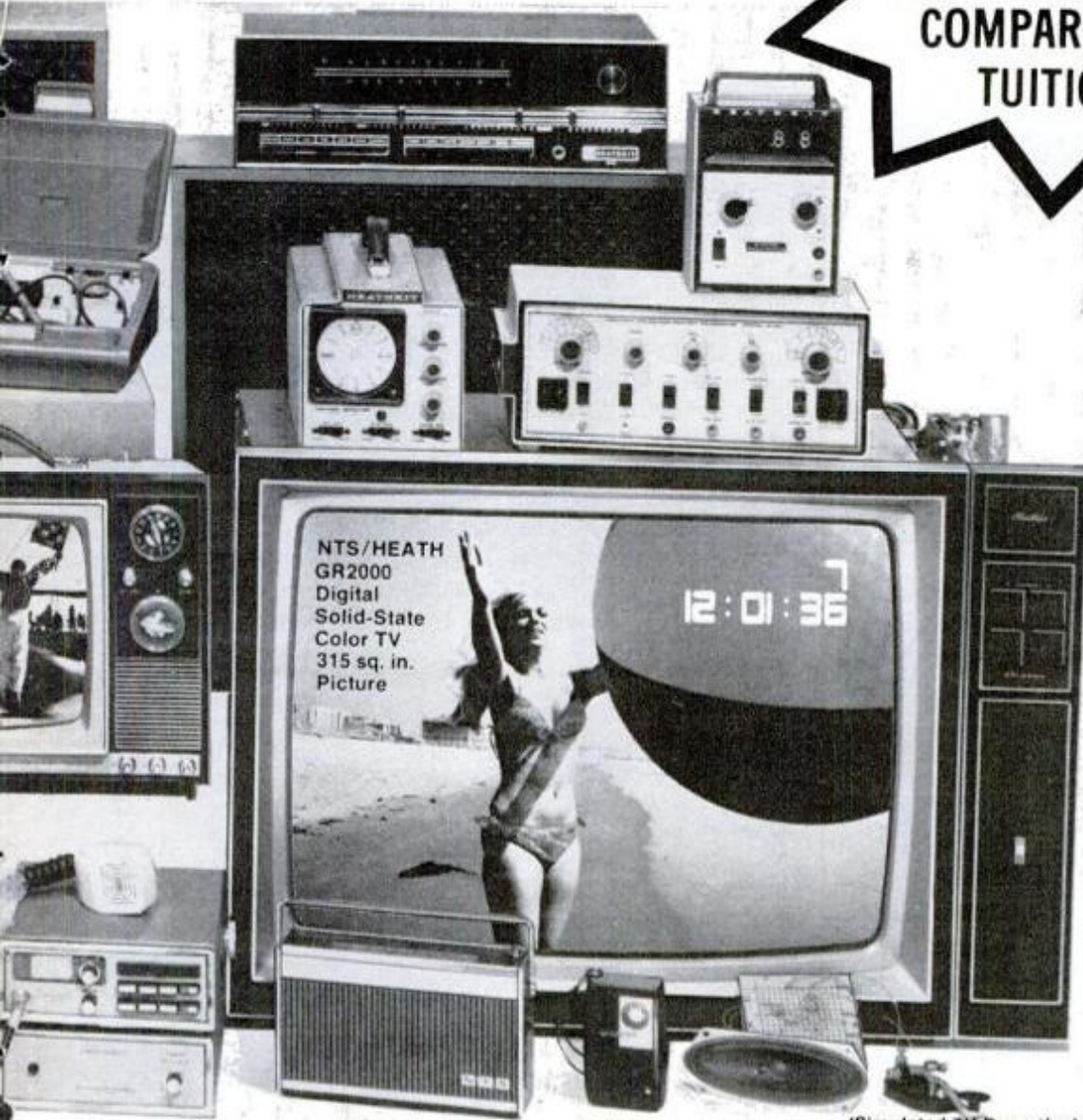
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# IMPORTS AND MOTORSPORTS



## Rover 3500

Get in front of one and you'll think you're about to be run down by a Ferrari Daytona. Go around the back and look in the hatch and you'll find the new British Leyland Rover one of the most practical sedans around. It'll be a while before you can risk the former and do the latter, however, since the car won't go on sale in Europe until spring '77, and there's still no official word of whether Rover will return to the U.S. market.

The 3.5-liter, all-aluminum, V8-powered four-door hatchback represents a monumetal investment for Britain. The cost of the all-new Rover plant near Birmingham was \$56 million. So it's hard to imagine that Leyland won't bring it to the United States. The car would easily adapt to federal safety and emissions standards and its introduction here would give British Leyland a very handsome entry a price notch below the Jaguar. The 3000-pound sedan has unitized body; wheelbase is 110.5, length 185.0, width 69.0 and height 53.5—all inches.

## Practical Alfas

The racy Alfa Romeo marque is adding a diesel-engine model to its lineup. Italy's first diesel will be mounted in the respected Alfa Giulia sedan shown here. The diesel en-



gine being used is a four-cylinder Perkins. It's rated at 55 hp and will run the Giulia up to a top speed of 85 mph.

Also on the practical side, Alfa Romeo recently participated in the New York Museum of Modern Art's Taxi Project. Anyone who has ever wriggled into one of the Big Apple's cramped cabs (with the exception of the Checker which has good leg-



room) will appreciate the idealism of this design project. Working prototypes presented were from AMF, VW, Volvo and Steam Power Systems. Alfa's design prototype, shown here, was done by Ital Design using van production parts. It's got sliding door, retracting ramp for wheelchair or baby carriages and civilized accommodations. It's a cab you can hail . . . but probably not in my lifetime.

## Mercedes and Mazda

We missed a good one when we did our high-mileage cars feature in last May's *Car Care Guide*: a Mercedes diesel with 789,000 miles on the clock! The 1953 170SD is owned by Warren Angstadt of Wernersville, Pa., and Mercedes-Benz of North America believes it to be the highest mileage Mercedes in the U.S.

They'd like to hear if anyone has topped this mark.

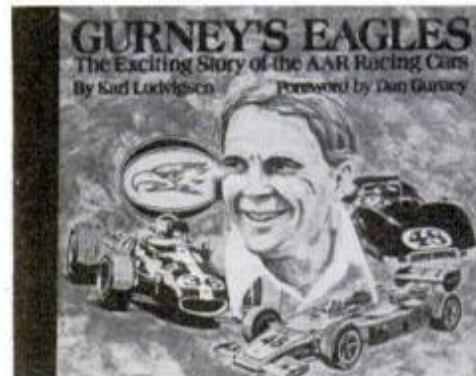
We at PM would like to hear from all you owners of high-mileage cars (gasoline or diesel—or anything else!) who are running up hundreds of thousands of miles on your cars. Tell us about them—even send a picture—and we'll consider telling your tale to all our readers in a story in a future issue.

There's a first-ever engine war-



ranty that Mazda has just put into effect. It's five years or 75,000 miles on all rotary-engine cars sold from July 15, 1976 on. That beats the five-year, 60,000-mile warranty that GM has on the Vega Four. The Mazda warranty is backed by Mazda builder Toyo Kogyo in Japan. It's even transferable from owner to owner.

## Drivin' with Dan



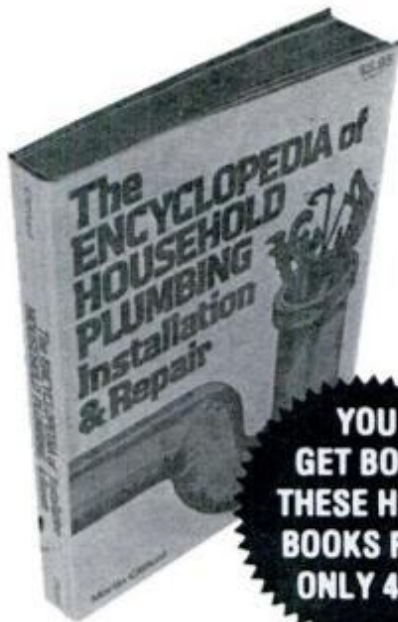
The success of the Eagles at Indy is only part of the fascinating story of Dan Gurney's All American Racers (we remember the PM stickers Dan ran on his cars when he wrote a column for *Popular Mechanics*). It's all wrapped up in Karl Ludvigsen's *Gurney's Eagles*. Motorbooks International, 3501 Hennepin Ave. South, Minneapolis, Minn. 55408. \$10.95. ★★★

# HOW-TO BOOK CLUB

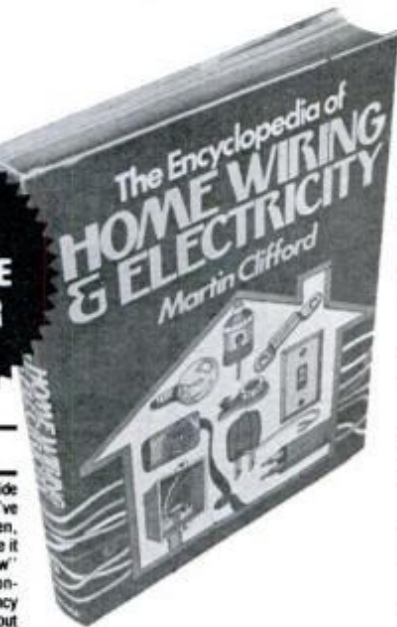
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## Encyclopedia of Home Wiring/Electricity

This authoritative, easy-reading guide bypasses the doubletalk and presents the how-to of practical house wiring in words all of us can understand! If you've been wishing you could do your own home electrical work, this definitive, plain-talk guide is all you need! It will teach you how to repair, maintain, and install everything electrical in your house or apartment—step by step. Ever wish you had more lights in the kitchen, basement, or dining room? Ever want to install new wiring or additional receptacles and switches? How about that lamp or doorbell that needs repairing? This book gives you all the know-how you'll need to confidently handle all these jobs—and many, many more. With this plain-speaking volume, learning the basic facts about electricity is easy. From plugs to polarity, it's all here: how to install electrical fixtures, how to solve wiring problems, how to locate shorts and blown fuses, how to repair table and floor lamps, how to insure better-quality lighting, how to read electrical symbols, how to hook up ranges, driers, water heaters, etc. Accurate drawings and pictures make even the most complex electrical system easy to understand. You'll know precisely what to do about overloads, underloads, broken wires, bad connections, faulty switches, breaker problems, and worn motor brushes. You'll learn to instantly recognize all kinds of electrical hardware. You can be your own home electrician; at last you'll be able to afford those costly electrical repairs because you'll be your own repairman, your own expert. This book shows how to get the most out of every penny of electricity you use. You'll learn how to make your lighting system operate at peak efficiency, how to extend the life of your household appliances, and how to shop intelligently for electrical parts to avoid the markup. There are detailed Chapters on planning wiring systems, maintaining electrical motors, soldering, grounding, calculating costs, appliance circuitry, two- and three-wire systems, and relays. Step-by-step instructions are given for everything from minor wiring adjustments to complete household rewiring. And, the Chapter on wall and ceiling fixtures is a complete guide to household lighting. Armed with "The Encyclopedia," you'll be able to take on any electrical project with confidence—even if you've never soldered a wire or tried to repair a lampcord before! 230 pps., 321 illus., 7" x 9 1/4". Hardbound.

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● The 2 Introductory books carry a publisher's retail price of \$29.90. They are yours for only 49¢ for both (plus postage and handling) with your Trial Membership ● You will receive the Club News, describing the current selection, alternates and other offerings every 4 weeks (13 x a year). ● If you want the selection, do nothing: it will be sent to you automatically. If you do not wish to receive the selection, or if you want to order one of the many alternates offered, you simply give instructions on the reply form (and in the envelope) provided, and return it to us by the date specified. This date allows you at least 10 days in which to return the form. If, because of late mail delivery of the Club News, you do not have 10 days to make a decision and so receive an unwanted selection, you may return it at Club expense. ● Personal service for your account—no computers used! ● To complete your Trial Membership, you need buy only four additional monthly selections or alternates during the next 12 months. You may cancel your Membership any time after you purchase these four books. ● All books—including the Introductory Offer—are fully returnable after 10 days if you're not completely satisfied. ● All books are offered at low Member prices plus a small postage and handling charge ● Continuing Bonus: If you continue after this Trial Membership, you will earn a Dividend Certificate for every book you purchase. Three Certificates, plus payment of the nominal sum of \$1.99, will entitle you to a valuable Book Dividend of your choice which you may choose from a list provided Members.

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If you own any one of eight different light truck vehicles, our tire-selection table will help you find the Goodyear Truckin' Tire that's right for you.

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**What a difference a tire makes.**

**GOODYEAR**

LIGHT TRUCK TIRES



The Glas-Guard Tire. Fiberglass belts help guard a strong, bias-ply nylon body. Good traction, long wear. Quiet tread.

Find yourself.



little pickup

X



big pickup

X



sporty van

X



family van

X



pickup camper

X



mini-motor home

X



motor home

X



4-WD machines

X

# your kind of truckin'.

## Find your tire.



**Custom Flexsteel LT Radial.** Goodyear's best for extra MPG on long runs. Steel-belt protection, easy-riding polyester.



**The Cushion Miller Tire.** For quiet, comfortable traveling especially for motor homes and other recreational vehicles. Non-flat-spotting, smooth ride.



**The Goodyear Customgard GT Radial Tire.** Wide-profile Flexten-belted radial auto tire, for vans and pickups up to 6,000 GVWR.\*  
Outlined white letters.

\*Gross Vehicle Weight Rating



**The Goodyear Rally GT Tire.** Wide 60 and 70-series. White letters. Economical, good looking. For vehicles up to 6,000 lbs. GVWR.



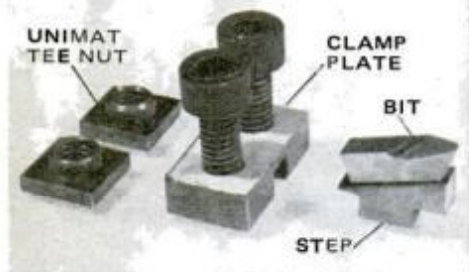
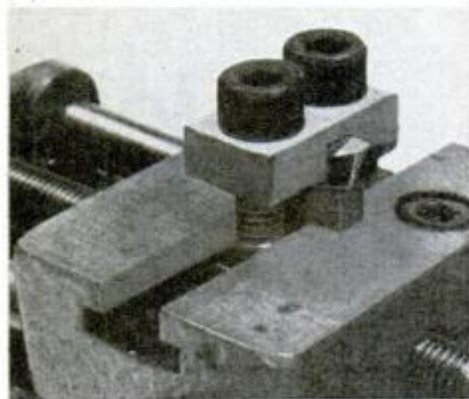
**The Goodyear Tracker AT Tire.** Tough 4-WD tire for on and off the road. Good highway traction.



**The Wrangler RT Tire.** On-road, off-road 4-WD tire. Handles mud, snow, sand, rocks and stumps.

X		X	X		
X	X				
X		X	X		
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X	X				
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				X	X

# Mini toolpost for turning steel



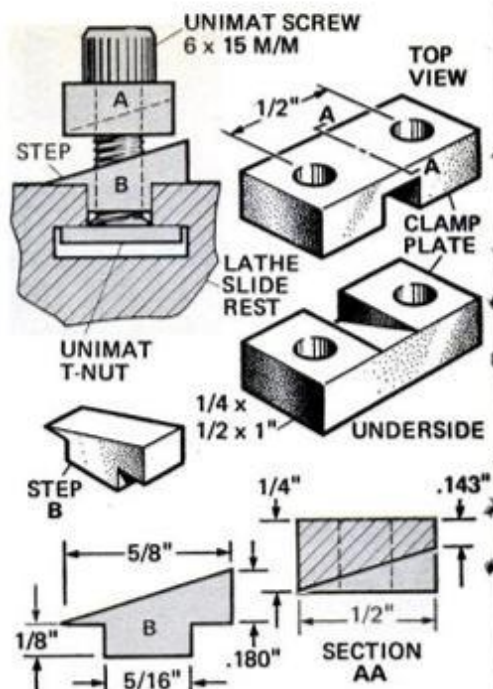
A horizontal toolpost such as you find on the Unimat lathe is fine for turning brass or aluminum which requires a tool bit with little or no top rake. But for turning steel you have to grind the bit so it has a 10° to 15° back rake. Not only does this mean a lot of grinding and short tool life, but each sharpening of the bit lowers the cutting edge so you must keep shimming the bit to raise it.

While full-size lathes have tool holders which hold the tool bit at an angle of about 20°, you can't fit such a tool holder on the Unimat because it has less than 1/2-in. clearance between the centers and the cross slide.

So I made a toolpost that would fit it and hold short tool bits at a 16° angle. It reduces tool-bit grinding, and permits rapid and exact adjustment of the height of the cutting edge. I also can salvage tool bits that are too short for use in my horizontal toolpost.

## How you make it

To make it, cut the step from cold-rolled steel the same thickness as your tool bits. Mine is 3/16 in., but 1/4 in. would work equally well. The dimensions given produce an angle of approximately 16°.



Lay out the clamp plate on 1/4-in. steel. Drill the two 15/64-in. holes on 1/2-in. centers before cutting the plate to shape. File or mill the slanting notch to match step angle.

Borrow the two screws and one of the T-nuts from your Unimat's horizontal toolpost. Extra screws and T-nuts can be obtained from a Unimat dealer.—Donald MacChesney



## CO<sub>2</sub> "38" for guys who always wanted a .38, but...

CO<sub>2</sub>38 is the answer to cost and space problems. It has the looks, the weight, of the real thing. But it costs a bundle less to own and shoot. And you don't need a range built like a battleship.

It shoots six .22 caliber Super Pells®. Gets about 40 shots from a CO<sub>2</sub> Powerlet. And with Crosman's unique new seal, you can load-in a Powerlet ... and it'll keep its zing for months!

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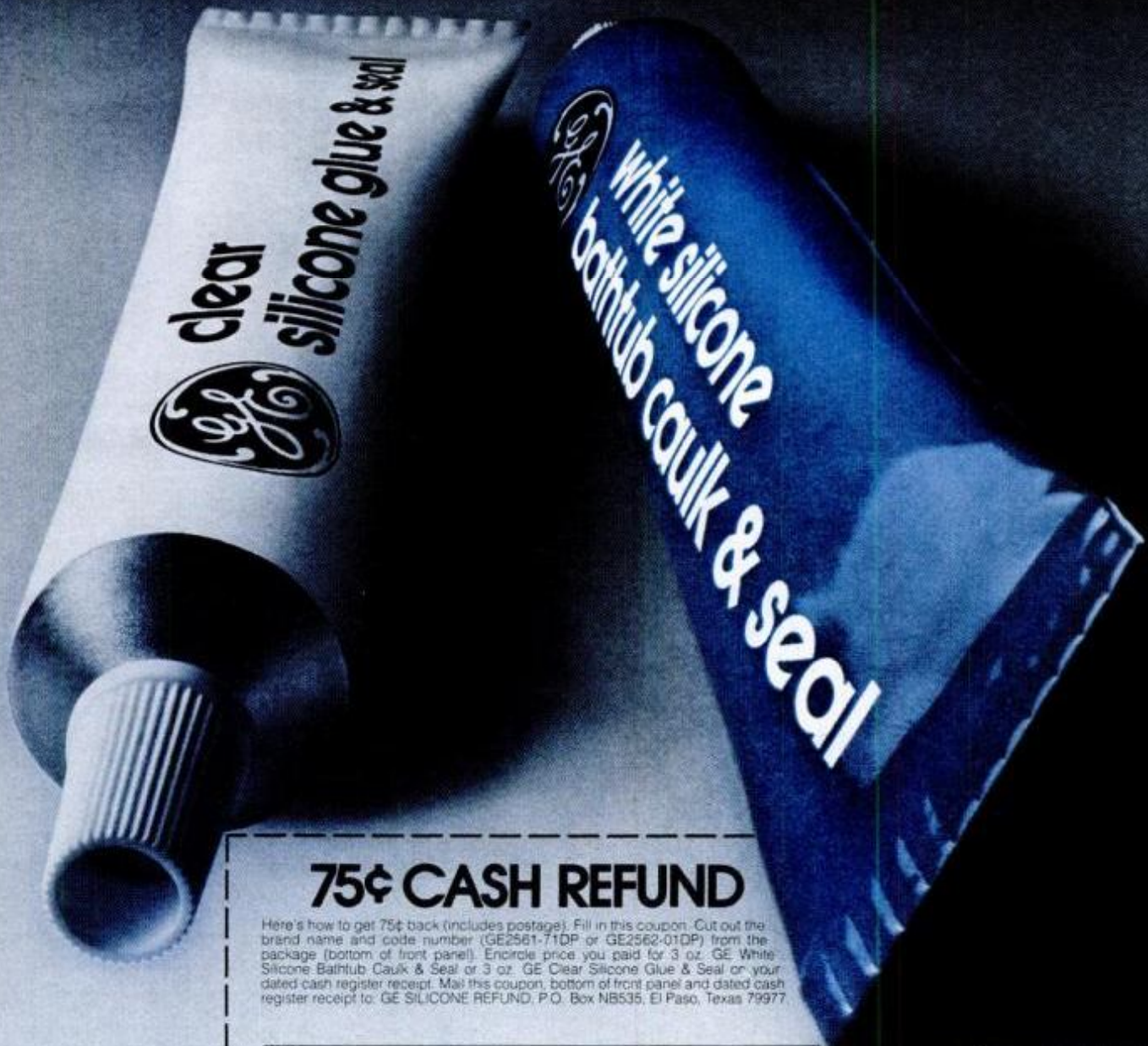
Retains its original whiteness, flexibility and mildew resistance so permanently it carries a 10 year warranty.

GE Clear Silicone Glue & Seal goes on working when ordinary adhesives and sealants may fail. Reason: the extraordinary staying powers of silicones are not affected by heat, cold, moisture, weather or most household chemicals.

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Try one of these extra-strength, extra-life household sealants today. You'll get a 75¢ cash refund for sticking with them.

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Here's how to get 75¢ back (includes postage). Fill in this coupon. Cut out the brand name and code number (GE2561-71DP or GE2562-01DP) from the package (bottom of front panel). Encircle price you paid for 3 oz. GE White Silicone Bathtub Caulk & Seal or 3 oz. GE Clear Silicone Glue & Seal on your dated cash register receipt. Mail this coupon, bottom of front panel and dated cash register receipt to: GE SILICONE REFUND, P.O. Box NB535, El Paso, Texas 79977.

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Limit one refund per family or address. Offer void where prohibited, taxed or otherwise restricted by law. Offer good in Continental U.S.A., Alaska and Hawaii only. Allow 6 weeks for delivery. This coupon must accompany your request. Duplication or copies will not be honored. Offer expires December 31, 1976.

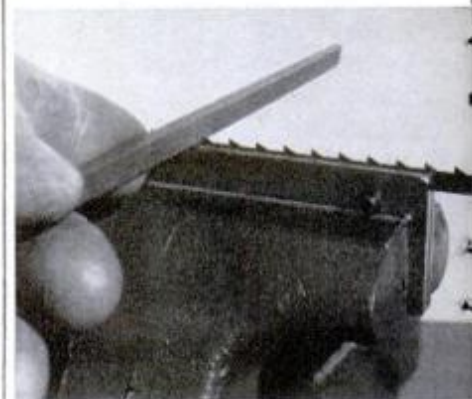
NOT A STORE COUPON

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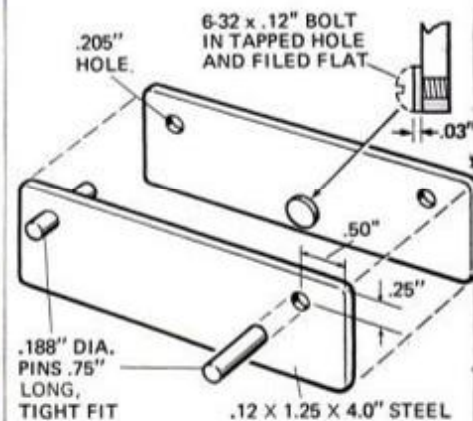
GENERAL  ELECTRIC



## Easy fixture makes filing simple



Blade-holding fixture is dimensioned for 1/4-in. blades. Guide pins are placed farther from the edge for wider blades



**H**and-filing a bandsaw blade to touch it up is easy enough—holding the narrow band of steel is the problem. It was for me until I made this fixture that clamps in my machinist's vise. It's nothing more than a couple of flat pieces of metal fitted with two alignment pins to rest on the jaws and to keep the saw teeth a constant distance above the top. A thin screw-head shim at the bottom of the two plates keeps them parallel when clamped.

Use about a No. 2-cut file for sharpening. A pillar file with a safe edge works best on skip-tooth blades. The safe edge rests on the gullet and the tooth is filed on the front face only. Use a three-corner file on regular teeth, hitting both the front and the back of the tooth. Count the number of strokes to sharpen a tooth and use the same number on each tooth to keep the height even. File across the blade at 90°, and mark the starting tooth with a felt-tip pen. All the teeth supported by the jig are sharpened, then the vise is loosened and the blade is advanced

—R. S. Hedrick

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**A&C.**  
**One beautiful smoking experience.**

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## Marine Reserve

You'll start with tough training. Because nobody likes to fight, but somebody has to know how. As a Marine Regular, you'll know how.

After boot camp, depending on your occupational specialty, you'll go to school or to on-the-job training to learn anything from air traffic control to telecommunications maintenance to food services. Or combat arms, the "cutting edge" of the Corps.

Stick with it, and you'll travel the United States and the world. You could even be part of an embassy detachment or serve as a sea-going Marine aboard command ships of the U.S. Navy. Ships like missile cruisers and aircraft carriers.

The Marine Corps offers a challenging, good-paying occupation. With free medical and dental care. And thirty days paid vacation every year.

And something else...the pride that comes only with earning the title: United States Marine.

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We're looking for a few good men.

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After boot camp, you'll continue your 130 days of active duty with more training. In fields like electronics, communications and combat arms. All the same opportunities that Regular Marines have.


After school, you'll return home to pursue a civilian career. You'll attend drill meetings one weekend a month and two weeks of training each summer so you can keep your Marine Corps skills sharp, your body in shape.

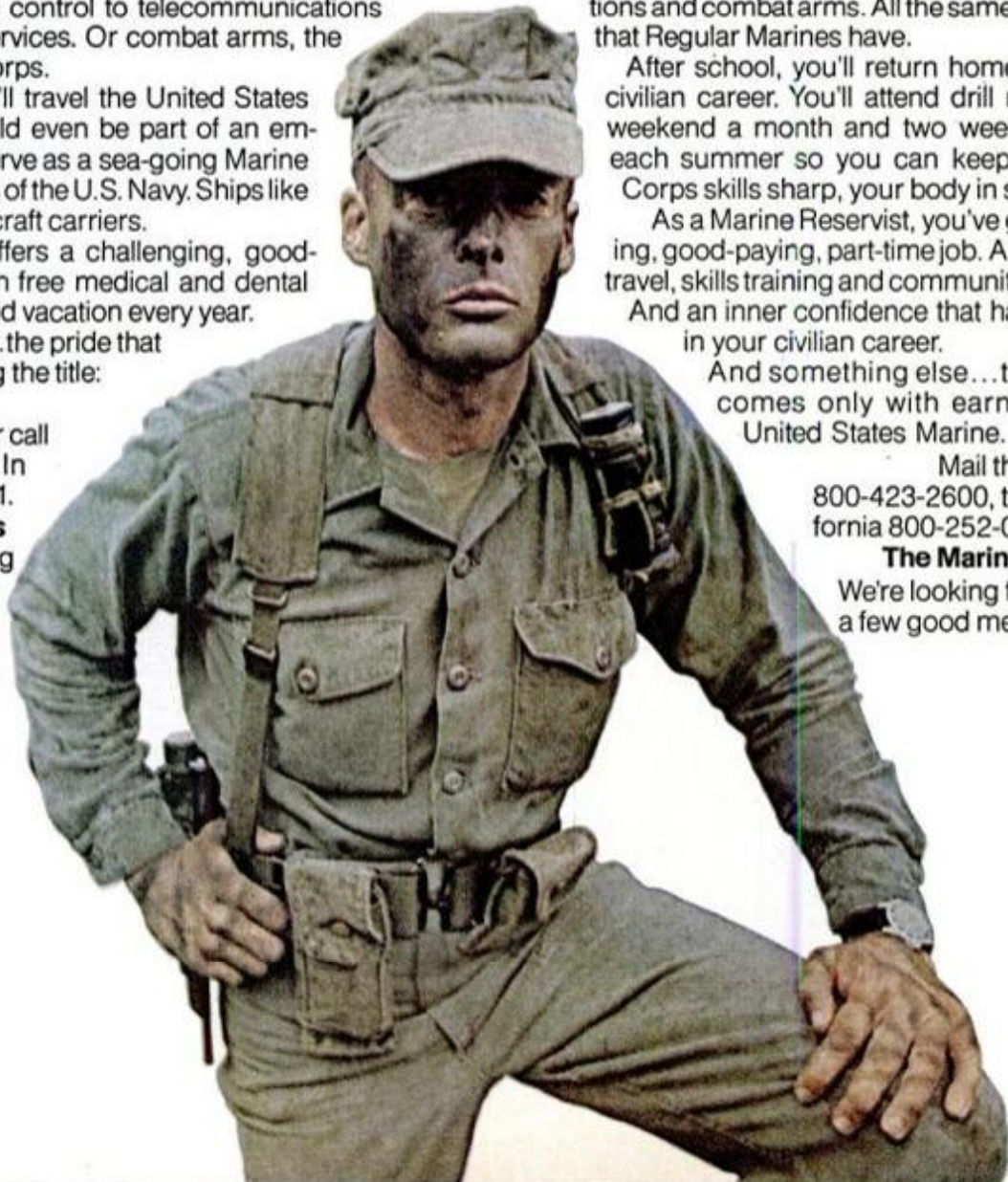
As a Marine Reservist, you've got a challenging, good-paying, part-time job. A job that offers travel, skills training and community involvement.

And an inner confidence that has to help you in your civilian career.

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We're looking for a few good men.



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**filter plus**™\*

FP104

A name you can trust on the outside. A phenomenal breakthrough in oil filtration on the inside.

This timed-release chemical disc revolutionizes oil filtration by regenerating your oil's protective potency as you drive.

This filter element cleans your oil. No other oil filter on earth can both clean and regenerate your oil.

# Monroe launches an oil filter unlike anything on earth.

## A patented, timed-release disc revolutionizes oil filtration.

This is not just the introduction of a new filter. It's an announcement of the most revolutionary oil filter in the world. An oil filter that not only cleans your oil, but one that helps regenerate the protective qualities of your oil every mile you drive. Its name? Filter Plus™. The dramatic breakthrough? A chemical disc that dissolves protective chemicals back into your oil, automatically, as you drive. A chemical disc of such importance that it's fully patented by the U.S. Patent office to protect it against any possible infringement. A chemical disc that sets Filter Plus worlds apart from ordinary oil filters and makes it unlike any oil filter on earth.

## 20% of oil isn't just oil.

To fully understand the importance of Filter Plus, it's important to understand that premium oil has changed. Chemicals have been added by the oil companies. Chemicals that dramatically improve the performance of your oil and increase the lifetime of your engine. Without these chemical additives, some modern automotive engines would seize up in less than 500 miles. So these chemicals are just as important as the oil itself. They keep the oil thick when it's hot, and thin when it's cold. They help protect your engine against the effects of heat. Prevent corrosion. Help keep your rings from wearing

out. They even help keep the oil slippery. But these chemicals don't last forever.

## Filter Plus: A generation ahead of ordinary filters because it regenerates your oil.

Many of these chemicals break down or get used up, and today's oil filters don't do anything about it. Filter Plus does. The patented, timed-release disc in Filter Plus is made of the chemicals found in motor oil. As you drive, this disc dissolves, replacing critical chemicals as they wear out. Rebuilding your oil's protective potency as no ordinary filter can. Protecting your engine as no filter on earth can.

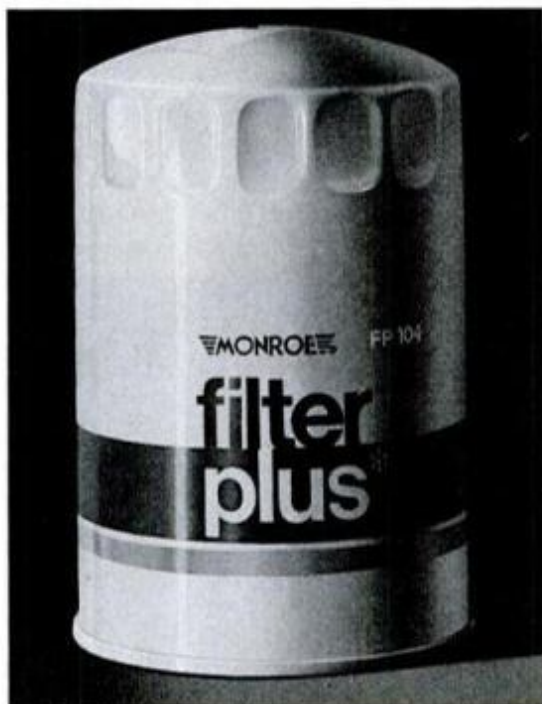
## For the double protection no other filter can give your car, demand Filter Plus.

When you buy Filter Plus, you're buying not just one—but two insurance policies for your engine's

life. Because while the filter element is cleaning your oil, the chemical disc is rebuilding your oil and helping protect your engine.

**A filter you can trust from a name you can trust.** Filter Plus is made by Monroe. A trusted name in the automotive industry for over 50 years. And now Monroe makes the only oil filter of its kind in the world. We believe it's the only oil filter you should trust under the hood of your car.

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Available wherever quality automotive products are sold.

# Filter Plus, the only oil filter of its kind in the world.

# 40 sports awards you can win on your own

Fitness can be fun as you  
take tests while you exercise.

by Jack Galub

**W**ant to win an award and improve your health while doing it? Now there are 40 athletic activities that can earn you physical fitness badges while you're having fun.

Anyone over 15 years old is eligible, and the chance to test yourself adds incentive. Boy Scouts and Girl Scouts have merit badges. Even the U.S. Army has its Expert Infantryman Badge, the long blue bar with an embossed revolutionary musket running its length. To win one, a GI must be able to march 12 miles in three hours fully loaded, qualify as a sharpshooter or better, know first aid, cope with mines and handle other details designed to help him survive in combat.

The new civilian tests are demanding in their own way, and the President's Council on Fitness and Sports (PCFS) presents a fabric emblem that can be worn on a windbreaker or parka, a pin, and a certificate signed by the President to persons completing the test requirements. Youngsters from 10 to 17 can compete for a separate Presidential Physical Fitness Award through school, club and Scout troops.

## Choose your favorite

What is your favorite outdoor sport? Check at the right to see if it is one of those listed. Then send to Presidential Sports Award, Box 129, Radio City Station, New York, N.Y. 10019, for free log books and qualifying procedures for the sport of your choice. Are you most interested in backpacking, bicycling, climbing, soccer or softball? Each has activity requirements including whether you may practice it alone or must play under supervision or on a team, plus the number of hours of credit you may earn each day. Jogging, for example, requires 125 hours to earn the award, with credit for no more than 2½ miles a day. Tennis needs 50 hours and must

include 25 sets of match play, with credit for 1½ hours a day. Many sports have both distance and time requirements. Canoeing-kayaking specifies paddling a minimum of 200 miles within a period of four months with no more than seven miles a day.

Once all specifications are completed, your signed log is mailed to Presidential Sports Award, Box 1412, Annex Station, Providence, R.I. 02904, plus \$3 for the emblem, pin and certificate. A physical exam is suggested before starting any qualification program. ★ ★ ★



Achievement emblem for contestants.



Canoeing has recently joined the sports activities that can earn a Presidential Award. Recording logs are available by mail and from Grumman Canoe dealers. Paddlers must cover at least 200 miles within four months, but can count only 7 miles a day.

## Qualifying Standards

**ARCHERY**—A minimum of 3000 arrows

**BACKPACKING**—At least 50 hours

**BADMINTON**—At least 50 hours

**BASKETBALL**—50 hours of play

**BIATHLON**—Run or ski 150 miles;  
fire 330 rounds

**BICYCLING**—Ride 600 miles

**BOWLING**—Bowl 150 games

**CANOE-KAYAK**—Paddle 200 miles

**CLIMBING**—50 hours, Alpine conditions

**EQUITATION**—50 hours horseback

**FENCING**—Fence 50 hours

**FIGURE SKATING**—Skate 50 hours

**GOLF**—Play 30 (18-hole) rounds

**GYMNASTICS**—50 hours

**HANDBALL**—Play 150 games

**ICE SKATING**—Skate 200 miles

**JOGGING**—Jog 125 miles

**JUDO**—Practice 50 hours

**KARATE**—Practice 50 hours

**ORIENTEERING**—Run 100 miles, complete 4 events, locate 25 checkpoints

**PENTATHLON**—Practice skills 50 hours, including running, swimming, fencing, shooting, riding

**RACQUETBALL**—Play 150 games

**RIFLE**—Fire 2500 rounds

**ROWING**—Row 50 miles

**RUGBY**—Play or practice 50 hours

**SAILING**—Practice or compete 50 hours

**SCUBA-SKIN**—Dive 50 hours

**SKEET-TRAP**—Fire at 1250 targets

**SKIING (Alpine)**—Ski 50 hours

**SKIING (Nordic)**—Ski 150 miles

**SOCCER**—Play 50 hours

**SOFTBALL**—Play 50 hours

**SQUASH**—Play 50 hours

**SWIMMING**—Swim 25 miles

**TABLE TENNIS**—Play 50 hours


**TEAM HANDBALL**—Play 50 hours

**TENNIS**—Play 50 hours (25 sets)

**VOLLEYBALL**—Play 50 hours

**WATER SKIING**—Ski 50 hours

**WEIGHT TRAINING**—Train 50 hours



# Marlboro Lights

The spirit of Marlboro in a low tar cigarette.

Lighter in taste. Lower in tar.  
And still offers up the  
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Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health.

13 mg. tar, 0.8 mg. nicotine av. per cigarette, FTC Report 2/75

# SCIENCE WORLDWIDE



## Blast-off heat tests for Orbiter model



The first orbital flight of the Space Shuttle Orbiter—the “space taxi” of the 1980s—is getting closer. The schedule calls for a 1979 blastoff. But before that happens, the hardware must be put through thousands of rigorous tests.

The photo above shows one such test being set up in a supersonic wind tunnel at NASA’s Lewis Research Center in Cleveland. The Space Shuttle scale model, equipped with small hydrogen-oxygen engines and solid-propellant rocket motors, is used to investigate heat problems associated with the blastoff and boost phase of the flight. The model is mounted upside down to accommodate tunnel attachment hardware.

For more information on the Shuttle program, read *Rescue in Space*, which appears on page 67.

## Go underground, save money

Going underground is one answer to high land prices and a shortage of living space, according to two engineering professors—N.B. Aughenbaugh and J.D. Rockaway—at the University of Missouri. They cite an industrial and office complex in an abandoned limestone mine in Kansas City, Mo., as well as projects in Montreal and Moscow, to illustrate practical underground development.

“Huge savings are a major factor influencing building underground,”

the professors say. They term underground heating and cooling costs “just a fraction” of those for surface structures. Other advantages include lower construction costs, more fire resistance, lower maintenance costs, more freedom in choice of location, and the preservation of the surface of the ground for other purposes.

## Diet removes pounds—and hair

A diet can change your appearance in more ways than one. According to a recent report in the *Journal of the American Medical Association*, a stringent diet can knock off excess pounds—and also make your hair fall out.

Two Army physicians, authors of the article, report that nine patients put on crash diets dropped 25 to 55 pounds and that hair loss occurred two to five months after the weight-reduction program started. The doctors think that severe caloric restriction led to an inadequate supply of energy to hair roots. Fortunately, hair lost because of a diet usually grows back after a few months.

## Looking ahead to plastic decade

The world will be a lot more plastic in the mid-1980s than it is today, according to a recent study by the Du Pont Co., the big chemical producer. The demand for engineering plastics will reach 2 billion pounds,

about four times the amount currently produced.

The study foresees greater use of structural plastics in the manufacture of home appliances, farm machinery, office equipment and plumbing components. Autos of the future probably will have plastic exterior panels, grills, dashboards and molded seats. In addition to favorable strength and weight characteristics, engineering plastics are said to make for low-cost assembly operations.

## Tiny pistons for superpressures

A new research tool for creating pressures greater than 8 million p.s.i.—equivalent to stacking four 50-ton locomotives end-to-end on a tack head—has been successfully tested by scientists at a General Electric lab in Schenectady, N.Y. To achieve and maintain such amazing-



ly high pressures, GE created two tungsten carbide pistons tipped with thousands of man-made industrial diamonds. Diamond is the world’s hardest substance and tungsten carbide is the strongest structural material used by man.

The half-inch-long pistons (one is shown above) were installed one above the other in a hydraulic press that forced them together to generate the superpressures. Without diamond tips, say GE researchers, the pistons would have shattered or deformed. ★★★



# There's a world of music between having a guitar... *and knowing how to play it!*

**Discover the secret of teaching yourself  
to play the guitar, piano, or spinet organ  
—the "right" way. Send for free booklet.**

Any one can own a guitar. Playing it well, however, is a different tune.

Why not give yourself a chance to play as well as you really could? You could be playing all your favorite songs. Folk or rock. Classical or pop. Hymns or spirituals. Jazz or ballads.

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The Guitar is just one of several popular instruments taught by the U.S. School of Music. If you prefer, learn the piano or spinet organ — all for far less than you'd pay a private teacher. Our courses teach you to play the right way, not just chords and bass notes in combination.

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# HINTS

## FROM READERS

### Rubber cement 'magnet'



Replacing tiny screws is an easy task if you first dip the tip of your screwdriver in rubber cement and let it dry a few seconds. The tacky cement will grab a screw like a magnet and let go just as easily. The residue rubs off.—*E. G. Borgeson*

### Water where wanted



Two 3-in. slit sections of garden hose cut to slide over the holes in a lawn sprinkler will tailor its spray pattern to suit the area. Closing off some of the holes will narrow the spray.—*William Waggoner*

### Seeing eye



Often when shaping tiny parts, a small magnifying glass fastened to a hand grinder will let you see what you are doing. An angle iron and a hose clamp are used to hold the glass above the chuck.—*Ken Patterson*

**NEWS RELEASE 1976**

**OFFICIAL TESTING LAB RATES ALLISON #1...**  
the BEST of ALL Ignition Systems!

The ALLISON "Opto" was Officially Rated #1 by a Foreign Government Testing Laboratory as the BEST "Fuel Saving" Ignition of ALL the Ignition Systems Tested, including Systems with C.D. "add-ons"!

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- ★ Since there is NO Mechanical Friction, there are NO Parts to ever WEAR or need replacing, and ONCE properly Timed, it should NEVER need any Maintenance! DWELL never needs adjustment, it is PRE-SET to supply the OPTIMUM Performance at BOTH High and Low Speeds. The RPM Capability of the "XR-700" is Factory Tested to 15,000 RPM.
- ★ The "High-Energy" SPARK INTENSITY and DURATION... permits the Positive FIRING of Spark-Plugs, even under the MOST ADVERSE conditions, results in more COMPLETE COMBUSTION and Eliminates "Engine Misfire", hence fewer exhaust Emissions, IMPROVED Fuel Mileage, a HIGHER Performance Level... and helps keep Plugs FROM FOULING, which greatly extends the Spark-Plug LIFE!
- ★ Only the Highest Grade (U. S. Made) Solid-State Components are used. UNAFFECTED by Moisture or Vibration! The Allison "XR-700" was engineered to OUTLAST the LIFE OF YOUR CAR!
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## DETROIT LISTENING POST

### GM to fleet-test diesel

GM is determined its diesel engine for a passenger car won't go the way of the Wankel. Down the drain. One thing the company wants to do before releasing the diesel for production is to get some in-field experience with the engine in the hands of outsiders. Outside of GM.

The plan is to put a batch of diesel engine cars in the hands of a fleet user—cab fleet, utility company or a government agency. GM will monitor these cars, probably for a year, and use the information from the monitoring operation to supplement its own testing. The fleet diesels should be ready soon. Assuming they pass the test, Oldsmobile will put the engine in a new line of luxury cars in 1978.

### MPG gain takes toll in noise

If you are driving a three to five-year-old rattler and this is your year to trade for a new car, don't be surprised if the new car has as many rattles as the old. Several of the '77s I've driven have been noisier than the predecessor cars. The reason for this is that many car divisions eliminated sound deadeners on the '77s to reduce vehicle weight as a means of improving mileage. Sound insulation materials can easily add 75 to 100 pounds to the weight of an automobile.

The companies met their weight-related-to-mileage objectives, but they are paying for it with noisier automobiles. I'm not faulting the companies for this. The government makes the rules and one rule frequently conflicts with another. The carmakers have to make trade-offs and assign priorities to meet different goals decreed by the government. One compromise this year was more noise in return for an improvement in mileage. Win some, lose some.

### Batteries are better but . . .

One part of the car that's greatly improved in recent years is the battery. PM did an A to Z on batteries last February and you might want to dig out the issue and reread the article if you are in the market for a replacement battery or if you are

ordering a '77 car that offers an optional battery at extra cost. I made a point of asking questions about batteries on the '77 cars at the press previews and turned up something that was news to me.

I assumed a "lifetime," maintenance-free or no-maintenance battery—different companies use different terminology—was superior to a low-maintenance battery. No maintenance means you don't have to add water or do anything to the battery. Low maintenance means you have to check it occasionally and add water about twice a year. My assumption was wrong. One of the no-maintenance jobs has a life of only three years. One of the low-maintenance makes, on the other hand, is good for six years or 90,000 miles if you drive 15,000 miles a year.

I'm not identifying the car lines or battery companies involved because there is no attempt to deceive. The estimated life of all batteries is spelled out in the guarantee. But don't make the mistake I made of assuming a low-maintenance battery is necessarily inferior to a maintenance-free battery.

### Specs to vary on '77s

That familiar disclaimer carmakers tag on most printed matter distributed to the public, "Specifications subject to change without notice," really means what it says this year. Suppliers who make parts for cars say there will be a lot of variance in specs during the '77 model run.

The auto firms are experimenting with different materials and suppliers are being asked to give as many as three or four bids on the same item. One bid if the part is made of steel, another bid if the part uses aluminum, another if it is made of plastic and yet another if a combination of materials is used.

### Cat converter on the way out

Although the auto companies are working to develop more effective catalytic converters—that's the plumbing that purifies exhaust from the engine—emission engineers don't look for the cat converter to be around much longer. Maybe three to

four more years at the outside.

The way to clean up the air is to clean up the engine. That is, make the engine burn cleaner, so that there's no pollution to put through a strainer. That's easier said than done. But it's thought not to be impossible. Some engineers believe the industry could be building no-cat cars as early as 1980.

One of the supplier companies already has a catalytic muffler that meets all government standards on controlling emissions through 1978. But the company is so convinced the cat is on the way out that it doesn't want to invest in production equipment to manufacture the item.

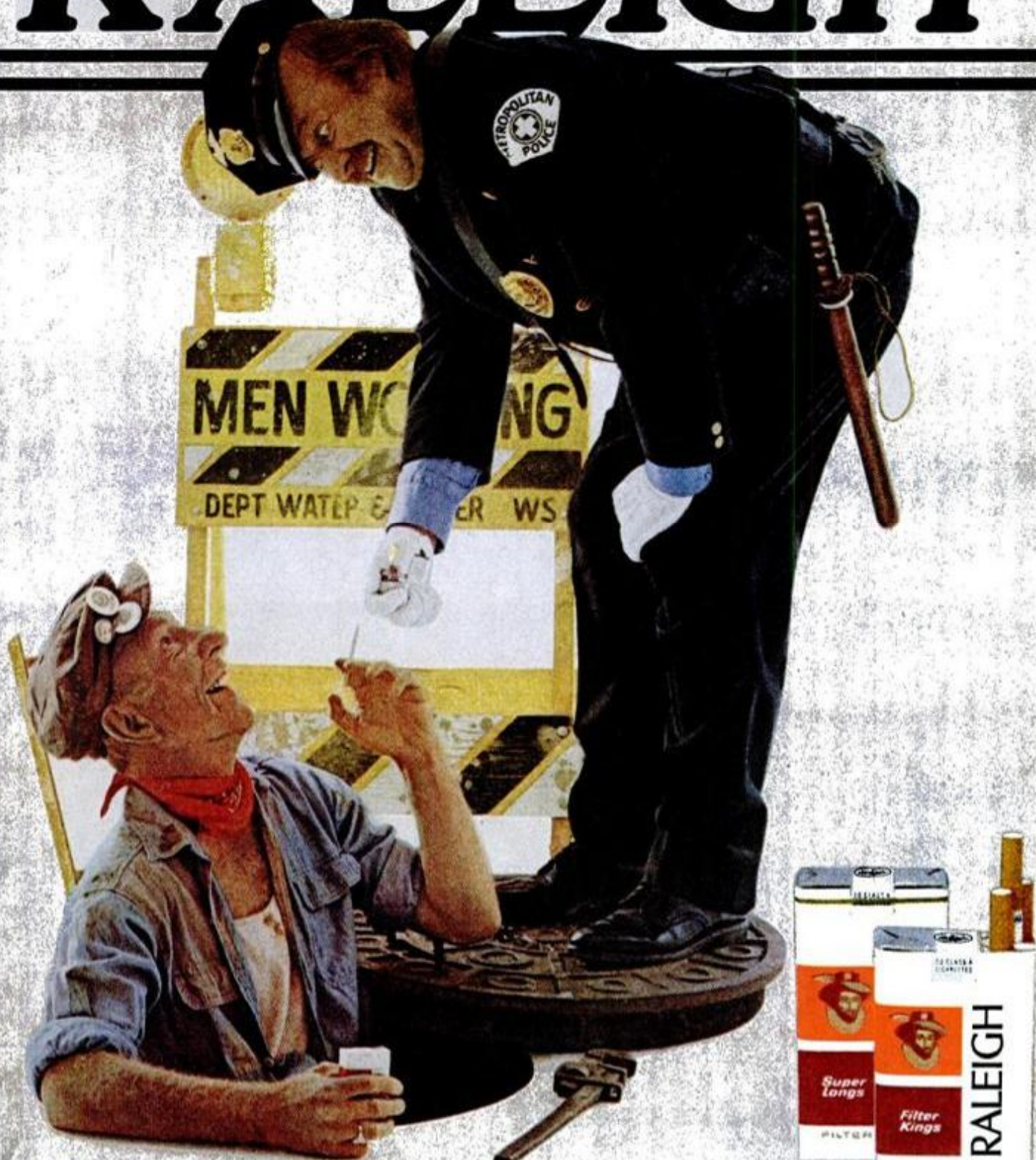
Chrysler is working on a new type of three-way catalyst for its small Six, the 225-2V. The three-way hasn't been put in production, but if all goes well, it will appear later in the model run. Chrysler says the three-way does a better job of controlling NOx emissions than can be achieved by modifying the engine and, additionally, improves fuel economy.

### Tip on towing

Even though you have insurance that includes free towing if your car breaks down, watch what you sign when the tow truck arrives. More and more tow truck operators ask you to sign a waiver relieving the towing company of all responsibility if the car is damaged while being towed. There's a right way and a wrong way to pull a car and a wrong-way tow can damage the car. If there's a way around it, don't sign the waiver.

I got a bad load of gas a few weeks ago and had to have my car towed. When the guy asked me to sign the waiver, I pretended to sign without doing so and handed the form back upside down. The driver didn't look at it. The reason for the sleight of hand is because I had a bum experience with a tow truck a couple years ago. My car was damaged to the tune of \$106. My insurance company told me to collect from the tower and the tower said to collect from the insurer. I figure if you are paying for towing, you are entitled to be towed in a way that doesn't damage the car. ★★★

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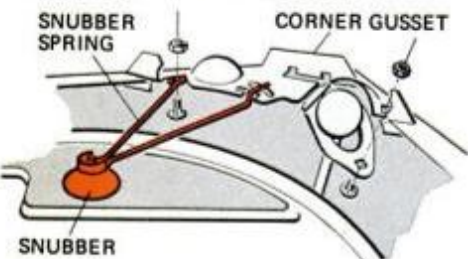
# APPLIANCE CLINIC

BY PAUL MANN



## Snooty snubber

The tub of our Sears Kenmore automatic top-loading clothes washer, which is about 10 years old, has started banging against the cabinet during the spin cycle. Redistributing the load helps only sometimes. I've checked the level and that's okay. What else could be wrong?—



Sidney Pick, Hartford, Conn.

If the level and leveling legs are okay, the most likely trouble is a worn, loose or oil-coated snubber. The snubber reduces oscillations of

the tub during the spin cycle. It consists of a tempered steel wire spring that's secured to a rear corner gusset of the cabinet and a pad that presses against the tub ring.

To check the snubber, unlatch and raise the top of the unit. You will spot the snubber. In most units it is in the right rear corner and looks like the illustration. If the snubber has oil on it, is loose or looks worn, replace it. After getting a new assembly, lift up on the snubber spring and remove the snubber pad. To remove the spring take off the bolt holding one leg of the spring until its other leg releases from the slot in the gusset. Reverse this procedure to install a new assembly.

## Will-o'-the-wisp

I have traced a sickening odor in the kitchen to our frost-free refrig-

erator. The odor is not constant, but comes for a few seconds at a time then goes. No amount of cleaning the refrigerator inside and out has helped. To our knowledge, nothing has ever been spilled on or in it. Please, any hint will be welcome. Give us something else to investigate. This is driving me nuts.—John McGann, Columbus, Ga.

Not long ago I traced an "elusive" odor in a frost-free refrigerator owned by a friend of mine. I found that for several years he had failed to remove and clean the condensation pan into which drainage drips. You wouldn't believe the smelly crud that had built up. Every time the refrigerator fan operated, he got a wisp of a smell that worsened as time went on.

You wanted an idea? Okay, I think you should undo the grille at the base of your refrigerator and

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slide the drain pan out. If your case is like my friend's, you should wash the pan thoroughly with warm water and detergent. You may have to use a scouring pad to remove buildup. Some drain pans are plastic and retain odor. I found that spraying a plastic pan with a disinfectant, filling it with cold water and allowing it to sit in the open air for an hour or so helps. Changing the water often will also help.

To keep this problem from reappearing you have to remember to remove that pan every six months or so for a washing. After getting a whiff of that odor, who can forget?

### An extra helping

*When cutting a roast with my General Electric electric knife, a thin slice of meat emerges from between the blades. What causes this?—Ralph Upshaw, Vero Beach, Fla.*

"Double-cutting," as it's called, occurs when the gap between the two blades is too wide or meat is being forced between the blades by unnecessary pressure. A sliver of food slithers up between the blades. Electric knife blades should have virtually no gap between them. If there is one, the blades will have to

be replaced to eliminate the problem.

To determine the extent of any gap, place the blades in the handle (with the unit disconnected). Insert a 1/4-inch strip of typewriter paper between the blades at the handle end and run the strip along the entire length of the blades.

If the strip of paper moves without any drag on it, the gap is too wide. Replace the blades. But if the strip is very hard to move, having a heavy drag on it, there is nothing wrong with the blade gap and double-cutting is probably a result of your putting too much pressure on the knife. Ease off, and let the blades do the work.

### Third down play

*We own a Hamilton gas-operated clothes dryer, model DS 345-W11. The machine works well until we put in a third or fourth load of wash. Then it refuses to start unless it rests for 30 to 60 minutes. The gas jet and electric igniter seem to work okay. So what's wrong?—Herman C. Heess Jr., Valley Stream, N.Y.*

A safety sensor beneath the burner is used to switch the electric (spark) igniter on and off. Were it not for this sensor, which allows the spark igniter to turn off when a cer-

tain temperature is reached, the spark igniter would stay on all the time and would fail prematurely from overuse.

Over a period of time, safety sensors suffer a certain amount of fatigue. Used continuously, as for multiple loads of wash, they are unable to activate the spark igniter for a third or fourth cycle until they cool down. This is probably what's happening with your unit.

However, I do not recommend that you indiscriminately replace the safety sensor. The part costs about \$20. Test your old sensor first. Call your utility company, explain the problem and ask them to send a serviceman. The safety sensor must be in its state of fatigue for testing. This means the machine must be run through two or three cycles. Make a definite appointment and have the machine warmed up and ready when the serviceman arrives. He should be able to tell if the safety sensor does in fact need replacing. ★★

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

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The picture on the left was taken with a popular 110 pocket camera that sells for about \$115. The picture on the right was taken with the Yashica Electro-35 GSN which sells in the same price range. The difference is obvious.

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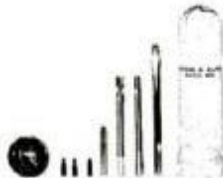
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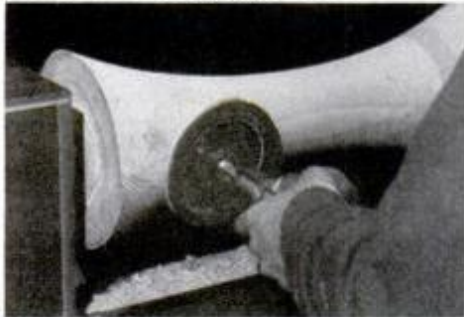
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# HINTS

FROM READERS

### Rough-sanding lathe work



A No. 50-grit sanding disc chucked in your portable drill will make short work of rough-sanding large lathe turnings. Run the lathe at low speed and hold the drill at such an angle that only the left half of the disc touches the work.

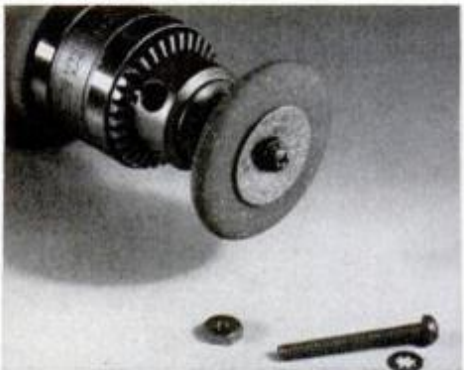
—Frank D. Aerni

### Paper-clamp depth stop



You can't miss when drilling for depth in a lathe if you clamp a stop rod to the side of the bit with a spring paper clamp. Pick a rod that fits tightly in one outer channel of the clamp and let it project an inch or so.—Walter E. Burton

### Groovy polishing wheel



The grit-impregnated rubber of a round typist's eraser makes a dandy little polishing wheel for grooves when mounted on a 6-32 bolt and chucked in your electric drill or flexible shaft.—Walter E. Burton

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# CAR CLINIC

BY MORT SCHULTZ



## Hoping for fraud

*Please tell me why my 1973 Chevrolet Nova with 307-cu.-in. engine and automatic transmission has cracked three flywheels since I bought it nine months ago. The car has only 34,000 miles, but so far has cost me \$250 in repairs. I can't afford this. Neither can I afford to sell the car since I'm a self-supporting full-time college student. Help, I'm desperate.*

—Norman Jones, Chicago.

Norm, who the heck has been doing your mechanical work? It's obvious from what you've told me that the fly-wheel damage must be caused by a misalignment condition (or sloppy work). I get mad when I think of some half-witted ape just sticking on one flywheel after another without giving any thought as to why so many are being damaged.

The misalignment probably exists between the crankshaft flange and torque converter bushing in the front pump. Now I have to say this:

I'm just wondering if the odometer reading on the car is legitimate. Damage of the kind being exhibited by recurring flywheel cracking is rare in an engine that has seen only 34,000 miles. If I were in your shoes (and I didn't know the party from whom I bought the car), I would take my suspicions to state or federal consumer authorities who can examine the odometer for tampering. Federal law makes odometer tampering bad news for tamperers. You may have recourse.

But if the malfunction causing the damage is legit, then I'm afraid the kind of repair work that will be necessary to stop the trouble is going to cost you a lot more than you have already spent. Sorry.

## Locked in

*When I took delivery of my 1974 Matador, the seat belt interlock system was disconnected by the plug beneath the seat being disengaged. Recently, the "fasten seat belt" light flashed on, and the engine refused to start unless I pressed a reset button under the hood. The dealer told me the logic module which controls the system was defective and had to be replaced. It cost me \$33, and the dealer says the same thing*

*may happen again. Isn't there a better way of eliminating this system, which is no longer required by law?—Paul L. Kiley, Framingham, Mass.*

Sure is, but your dealer doesn't seem familiar with it. Tell him to look up service bulletin 20 (11/15/74), group 3, which explains how to disconnect the interlock system by blocking out the module.

## Rusty wheels

*My question concerns my new Plymouth Duster; the wheels were taken off for a state brake-lining inspection by an independent mechanic. When he saw wheel lugs and brake drums covered with rust, he said I should have rust removed before it causes trouble. Is he right?*

—Morris Kaplan, Philadelphia

He is right that what you saw on lugs and drums is rust. These parts are cast iron, and cast iron rusts. If you removed wheels from 20 new cars, you would find that many, if not all, had the same condition. But cause trouble? I've never seen one that has. I don't see what harm this rust can do. It is on the outside looking in.

## Lost his kick

*When I had the automatic transmission of my 1968 Oldsmobile Vista Cruiser serviced recently, the mechanic who road-checked the car said I had lost my passing gear—the one that drops into second gear when the gas pedal is stomped on. I didn't realize it, because I never use it. The transmission behaves normally otherwise, but the mechanic tried to sell me \$180 worth of repairs. I'll pop for this only if you tell me it's necessary.—J.A. Krell, Albuquerque, N.M.*

I don't think it is. The trouble may be in the valve body with the detent valve or solenoid that controls the kick-down gear. The valve may be sticking because of sludge, but if this was the case chances are that valves controlling other gear ranges would also be affected, and apparently they aren't. But assuming this is the cause of the problem, why spend \$180 to repair a function you hardly use as long as other functions aren't being hampered?

Anyway, I would say that loss of the kickdown gear is a result of the downshift switch not being adjusted properly, or a malfunction in the downshift circuit, such as a blown fuse or bad connection.

As for having the part replaced at no charge, the warranty status specified in the bulletin states, "reimbursable within the provisions of the warranty and policy manual." This means that there is no charge whether or not the car is still within warranty.

## Close it up

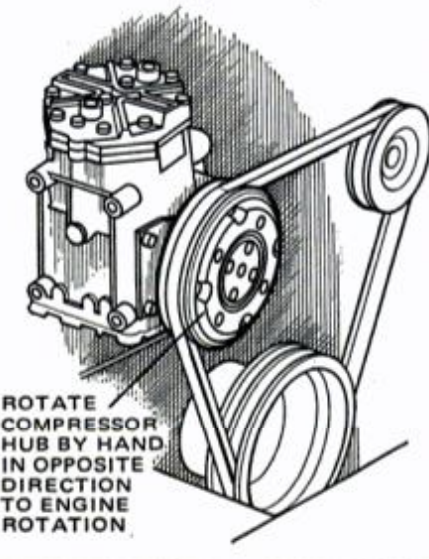
*Is there anything that can be done about a broken gas-cap cover on a*

*(Please turn to page 54)*

## Prevent airconditioner freeze-up



Oil is put into a car's airconditioner compressor by the maker to lubricate compressor bearings. If bearings get dry, they may fail, and then you'll have a whopper of a repair bill on your head. There's a sure way to get oil back where it's supposed to be—to keep it from draining away from bearings. If you haven't run your airconditioner for an extended period in four weeks, rotate the compressor hub several revolutions by hand (engine off, of course) in opposite direction of engine rotation. This pumps oil to bearings. It's better than running the airconditioner a few minutes every week all year.



ROTATE COMPRESSOR HUB BY HAND IN OPPOSITE DIRECTION TO ENGINE ROTATION.



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**'77 Dodge Charger**



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DODGE RAM CORPORATION

## CAR CLINIC

(Continued from page 52)

1975 Granada? It seems to be made very cheaply. I have noticed quite a few Granadas and Monarchs with this problem. I have heard that a new part has been made which isn't supposed to break. Is this true? If so, why can't the part be replaced by the company at no charge? With so many people having this problem, Ford could help them out by doing this.—Mike Goddard, Kingston Springs, Tenn.

Let's take it from the top, Mike. Yes, something has been done about the incidence of cracked fuel-filler door hinges on Granada and Monarch. A new door assembly has been issued, and the repair is outlined in technical service bulletin 87, article 1069.

### Smarty pants

I own a 1975 Pontiac Ventura. When the engine is started after it has been off for a few hours, I get absolutely no oil-pressure indication for several seconds. This worries me, because I have never owned a car that acts this way. On the few occasions I have complained, the dealer has told me not

to worry—that this is normal for the 350-cu.-in. engine. This is hard for me to accept, and I would like your opinion.—Clarence Dobies, Munster, Ind.

You are wise not to believe him, because your dealer is handing you a line of (bleep). Oil pressure should be immediate on starting any engine. If it isn't, there is a problem somewhere. It might be no more serious than a sluggish oil-pressure gauge. However, it might be as serious as a malfunction with the oil pump. The way to tell is to disconnect the oil sending unit and take a pressure gauge reading. Snappy oil pressure would mean a problem with the oil sending unit or gauge.

But whatever, I sure as heck wouldn't let the dealer off the hook, because once your warranty expires you could whistle the *Star Spangled Banner* for all this guy seems to care. Get a factory field representative called in and get the problem resolved—now! You may want the number of the closest Pontiac zone office, so here it is: (312) 654-6440. It's in Oak Brook, Ill., near Chicago.

### Time and time again

We have a great 1970 AMC Am-

bassador SST with 360-cu.-in. engine and automatic transmission, which has accumulated a fantastic 127,000 miles. But we also have pieces of plastic in the oil. Our trouble started with the oil pump freezing up and then the timing chain going out. We had it fixed and drove about 700 miles. Crunch—oil pump and timing chain again, only this time the garage found a piece of black, semi-rigid plastic in the oil pump. The repair lasted only 80 miles, and then it happened again. And more pieces of plastic were found. Well, it's been fixed once more, and we have our fingers crossed. But we would like to know what's going on inside that engine.—J. J. Klobucar, Denver

Dear J: The pieces of plastic you've been finding are probably pieces of timing gear that have been trapped in the lubricating system. The first time the timing chain gave out, the timing gear probably went to pieces, too, but failure on the part of the garage to eliminate remains of the chain has been the reason for the trouble occurring over and over again.

With this engine, you see, the oil pan doesn't have to be dropped to replace the oil pump. The pump is

**JOE GARAGIOLA M.D.**  
(MOPAR DOCTOR)

WHEN THEY'RE CALLING FOR BATTER UP BUT THE BATTERY IS DOWN CALL FOR MOPAR

WE'RE GOING TO MISS THE GAME.

WHAT A TIME TO HAVE MY BATTERY GO DEAD.

TIME OUT FOR MOPAR'S FIRST AID. MOPAR'S GOT A WHOLE TEAM OF BATTERIES TO KEEP YOU IN THE STARTING LINE UP.

MOPAR'S CAD TIP BATTERY ANALYZER FOR EASY TESTING

Supercharger

MODEL CAD

incorporated inside the timing gear cover, and to replace it involves simply removing the cover. But if you don't get inside, you don't get everything out.

What I'm getting at is this: To do the job right and keep your trouble from happening over and over again, the oil pan should be removed and the oil screen replaced. That's where the pieces of plastic are being trapped.

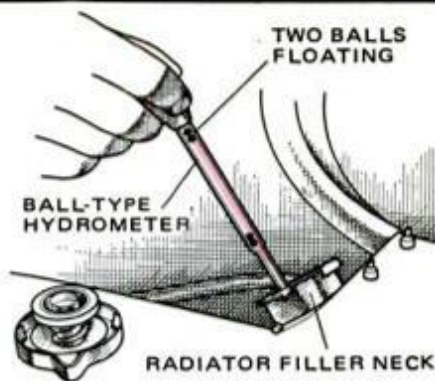
### Hot time in the old compartment

*My 1972 Chevrolet Caprice is running on its third battery and third voltage regulator in just 28,000 miles. Everyone is stumped, including the factory representative who says he wants no part of the problem. The battery overheats and starts spraying electrolyte over everything. Three weeks ago an auto electric shop set the voltage regulator back as a trial, but the same thing is happening again. Help.—William Wood, Enfield, Conn.*

There are three reasons why batteries overheat badly enough to throw out fluid: 1. The voltage regulator setting is too high. 2. A poor voltage regulator ground wire connection. 3. High underhood temperature. You have already seen to

### Floating balls check coolant

This is the month to check the condition of your radiator coolant. An inexpensive ball hydrometer tips you off to the degree of protection your radiator has against freezing. With the engine cold, draw coolant into the hydrometer until its about three-quarters full. Note how many balls are floating. If all, the cooling system is protected to minus 50° F.; four balls mean the engine is protected to minus 30°; two balls, 5°; one ball, 20°. By the way, how long has it been since your cooling system was drained, flushed and refilled with fresh ethylene glycol antifreeze? Over two years? That's too long.



the first. As for the second, disconnect the regulator ground wire and clean sand, dirt or paint from the ground connection, leaving it shining. Now clean off the ground-wire terminal and reconnect.

Although it is more common with 1975 and 1976 models, high underhood temperature in engine compartments having close quarters has affected batteries, causing overheating which leads to electrolyte loss and grid deterioration. Champion Spark Plug Co. recently warned that "high underhood temperatures

have caused a significant increase in battery failure," and advises that a battery heat shield may be needed. The shield is a plastic case that slides over the battery, leaving only terminals and vent caps exposed.

However, I haven't been able to find an auto-supply store in my area that carries heat shields. Maybe you will have better luck. If not, you can try insulating the battery by wrapping the case with several layers of heavy aluminum foil and insulating tape. Leave terminals and caps exposed. ★★★

TOUGH CONTAINER WITHSTANDS IMPACT

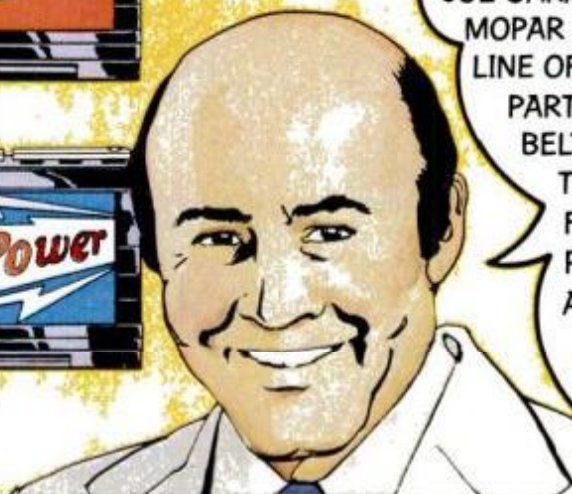


ONE PIECE, CRACK-RESISTANT TOP COVER

METAFLEX GRIDS FOR PROTECTION AGAINST OVERLOADING

### FIRST AID TIP FOR LONGER LIFE

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First aid Mopar for cars

MOPAR RENEWAL PARTS



CHRYSLER CORPORATION

# HOMEOWNERS' CLINIC



## Treasured bottles that glitter

*I collect old bottles, and some not so old—both colored glass and clear. Some bottles seem impossible to clean thoroughly inside with water and detergent, even vinegar. Do you have a helpful suggestion?—H. Vernon, Birmingham, Ala.*

Dirt and residue of whatever the bottle may have contained can generally be removed by filling the bottle a quarter to half full with a mixture of water and clean, sharp sand. Then shake it vigorously with a rotary motion. Often the treatment must be



repeated several times for thorough cleaning. Incidentally, old bottles of clear glass that have been exposed to sunlight for long periods may be discolored to varying degrees, but this is part of their appeal.

## Bumpy floor has rain puddles

*The home we recently purchased has a concrete entryway to a screened porch with concrete floor. Water tends to puddle on the entryway and porch floor during driving rains. There are several small areas that need leveling . . . but how?—Nelson P. Bristol, Woodbridge, Conn.*

There are concrete patchers for this purpose. One is called "Patcho" by Roxseal Co., Inc. It is easily applied with a trowel and can be "feathered" to a thin edge with a brush or whiskbroom. Patcho is available from your building materials dealer or hardware store. Make sure all of your surfaces are thoroughly cleaned before applying the patcher.

## New face for aluminum siding

*The aluminum siding on my home is over 20 years old and the finish is chalking. Can I repaint it?—Edw. Mentell, Garden City, Mich.*

If the siding is chalking because

of age or weathering, it can be painted successfully. First it should be wire-brushed to remove loose material and grime. Hose the siding to remove any remaining dust. Then apply an oil-alkyd paint according to instructions on the container. You'll get a somewhat smoother job by renting a sprayer, but with care you can do a creditable job with a brush. If you do the job yourself, work from a freestanding scaffold. A ladder leaned against the aluminum may dent the siding.

## Finger-staining

*When I repair old furniture I always have problems matching the color of the veneer patch to the old finish. Have you any suggestion?—Verne Holden, Albany, N.Y.*

You can usually lessen or intensify the color value of commercial stains, either by using a thinner or the "settlings" in the container. Where this has not worked, I've used artist's colors as a substitute, applying these with the finger. Use the stain as it comes from the tube, a small amount on the tip of the finger. If the stain's too thick, dip your finger in turpentine. Allow 48 hours or so to dry, sand lightly if necessary and then finish.

## Peeling paint problem

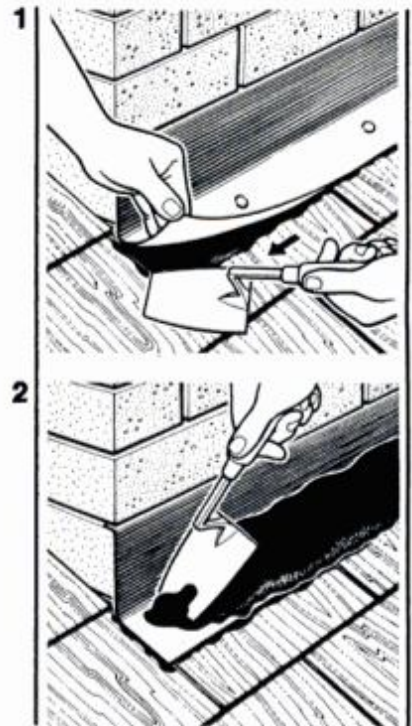
*The paint on my older home is peeling badly. I've planned to remove all of the old paint and start over. I understand that no primer was originally used. What kind of new paint and primer should I use?—F.K. Starr, Kelso, Wash.*

You've let yourself in for a tedious, tiring job in removing all the paint. Although your way certainly is the most thorough approach, you should get good results by removing all the loose material, sanding down the rough areas and repainting. If the old paint left is still adhering solidly to the wall, there's no need for a primer. But spots where peeling goes back to bare wood should be primed before repainting. I would use an oil-based paint rather than a water-soluble paint. Another possibility is to use the newer oil-alkyd paints. Make sure the surfaces are clean.

## Leak in chimney flashing

*Lately I've noticed a drop-by-drop leak near my chimney, which is outside the wall in my ranch house. Checking on the roof I found several roofing nails driven through the metal flashing along the edge of the shingles. These are loose, and I'm sure they are causing the leak. What are the nails for, and how can I stop the leak?—Tom Walton, Charlotte, N.C.*

Shingle nails are not ordinarily driven into the metal flashing in an exposed position, and it is likely that these are causing the leak. As long as the flashing is loose, take the opportunity to apply a layer of asphalt roof cement between it and the roof. Then drive two-inch roofing nails down through the holes and



be sure to coat the flashing surface with cement, too. Use the roof cement liberally. ★★★

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





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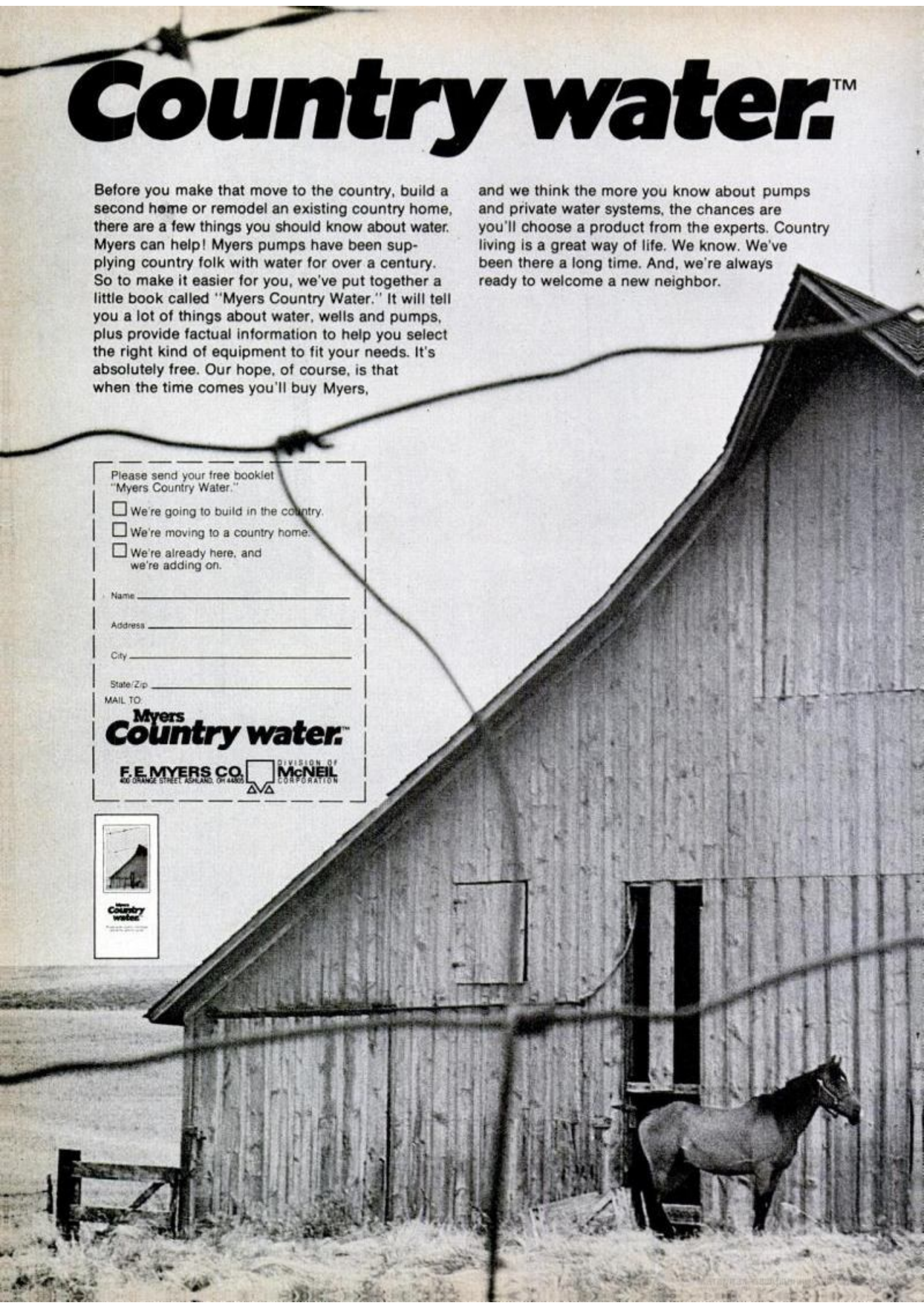
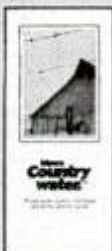
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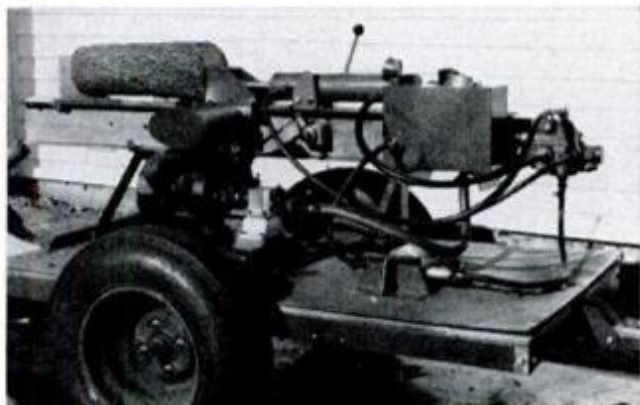
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# Split your firewood the easy way

**S**plitting firewood by hand is doing it the hard way. With this hydraulically operated log splitter you do it by merely moving a lever. The rig exerts some 10,000 lbs. pressure and will split with ease 2-ft. lengths of maple and ash logs 12 to 14 in. in diameter. Its backbone is an I-beam, and its double-acting hydraulic cylinder, control valve, hydraulic pump, oil filter and 3-hp. gas engine are easy to round up. Plans, with full instructions, show how to build the splitter step by step. See how to order plans at right.



When splitter is mounted on a two-wheel trailer, it can be towed to splitting site by a garden tractor. You can make money with it for neighbors will gladly pay you to split their wood when they see how it saves them an aching back.

## HOW TO ORDER PLANS

For plans and an instruction booklet to build the log splitter, send \$8.95 (check or money order) to Log Splitter, Popular Mechanics Plans Library, Box 1014, Radio City, N.Y. 10019. Allow two to three weeks for delivery.



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BRADLEY, Automotive Division of Thor Corporation, Dept. PM-10 7669 Washington Ave. So., Edina, Minnesota 55435.

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BY EUGENE A. SLOANE

## THE BICYCLE SHOP



### Riding no hands is a no no

*When I ride with no hands my bike turns to the left. Is this because there is a speedometer on the left front axle? Also one of my tires has a slit about  $\frac{3}{8}$ -in. wide and  $\frac{1}{16}$ -in. deep. What should I do?—Greg Uhl, Sellersburg, Ind.*

I would pray a lot, especially if you ride no hands with a tire that's about to blow out. The deep slit you describe has only one solution, a new tire. The bike pulls to one side because the fork or the frame is bent. Solution: Any bike shop should be able to straighten the fork or frame or replace the fork with a new one. Good luck!

### What freewheel for Weyless?

*Can you tell me which freewheel I should use to fit a Weyless hub? Also what type of tire and which gear ratio I should use for an extended cross-country tour?—Duane Klinge, USS G.W. Carver, F.P.O. New York.*

Weyless rear-hub freewheel flanges are threaded 1.370 x 24 TPI, so any freewheel similarly threaded will fit. As for gearing, I recommend a 14 to 34-tooth, five-cog cluster freewheel, such as the Shimano, for those extra low, low ratios you need for steep hills. As for tires, stick to the new lightweight 27 x  $1\frac{1}{8}$ -in. wired-on type. They are heavier than tubulars, but overall the weight advantage is lost when you have to carry two extra tubular spare tires, vs. only one extra tube and a patch kit for the wired-on tires. Any good bike store has the lighter wired-on tires. When mounting them, be careful to inflate to 20 p.s.i. first, seat the valve area in the rim, inflate another 20 p.s.i., check tire seat all around the rim, inflate to 90 p.s.i. Otherwise, the tube can get stuck under the tire edge and you can have a very noisy blow-out. I know.

### Arms too short?

*I am 65, 5 feet,  $10\frac{1}{2}$  inches tall and have short 32-inch arms. I have had to give up riding my new \$200 bike because of pressure on my hands, wrists and arms. I tried all adjustments and still found pressure too*

*great when resting my hands on the bars. Is there a solution?—Philip Liskin, Whitestone, N.Y.*

In general, you should be able to distribute your weight on the bicycle partly on the saddle and partly on the handlebars, with most of the weight being on the saddle. You should be able to sit on the saddle, bent slightly forward, and be able to place the first two joints of your fingers around the bars. If not, you need a longer stem. Handlebar steps come in lengths up to  $5\frac{1}{2}$  inches.

For a more exact fit, you could buy an adjustable stem so you can move the handlebars in and out and lock it in the position you like best. You can also slide the saddle forward a bit, if it isn't already as far as it can go. Also raise the bars till they are about even with the saddle. You must have  $2\frac{1}{2}$  inches of the stem inside the headtube, so you may not be able to get the bars quite as high as the saddle, especially if the frame is too small for you.

There is absolutely no reason you should be in pain because of pressure on hands, wrists and arms, given all the adjustments one can make on a good bicycle.

### Pie-plate problem

*I need to replace 12 spokes on a five-speed rear wheel. How do I get the metal plate behind the freewheel cluster off after removing freewheel?—Roger Franz, Annapolis, Md.*

Sometimes the thin aluminum metal of the spoke protector metal plate (we call 'em pie plates) is bent so a lip forms behind the threading on the freewheel side of the hub and the pie plate is difficult to remove. You can wiggle and pull it off at the same time, or carefully apply prying pressure behind it.

I think pie plates are extra weight and suggest that you throw yours away. You'll find that the chain won't jump off the low gear if the derailleur is properly adjusted. ★★

*If you have any questions about bicycling send them to The Bicycle Shop, 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.*

**Experience is the best teacher.** You might settle for any CB first time around. Understandably. A lot of people think they're all pretty much alike. But you'll soon discover that, like everything else, there are exceptions.

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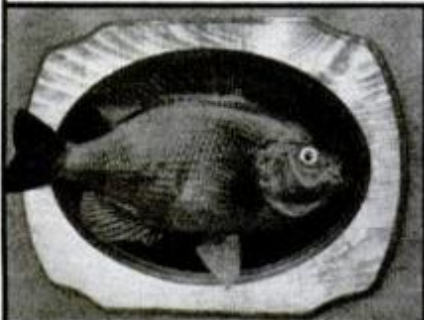
**Biggest fishing rig** for regular trailering may be 24-foot Blackfin with 30-mph Caterpillar V8 diesel, from Karanda Marine, Fort Lauderdale, Fla.

# New gear that gets the fish

**Shallowest running** of hunting and fishing inboards is probably log canoe pirogue-shaped Electric Feather by Fin & Feather Mfg.



**Permanent proof** that you caught that big one can be hung on the wall after about three hours' work with \$20 E-Z Mount Inc. Taxidermy Kits of St. Paul, Minn. Bird kits are also available.



**Spinnerbait-making** is simplified with Cotton Cordell's kit of hooks, paints, skirts, lead and molds, instructions from Cordell Tackle, Hot Springs, Ark. \$30.

**Rail-mount rod holder** from Tempo Products is designed to hold rod upright until the fish strikes, with enough play so angler can pull back to set hook. It then drops automatically from trolley to horizontal position so rod can be quickly removed to fight the fish. \$15.



**O**bservant fish will soon see a considerable assortment of new tackle, accessories—and boats. Some careless ones may try to add a few of the colorful lures to their diet.

At a preview of next year's gear at the annual American Fishing Tackle Manufacturers Assn. show in Dallas recently, a number of trends appeared that could make angling easier and more successful.

Much equipment is getting lighter and smaller. Baitcasting, spinning and spincasting reels will be offered in miniature to balance new light rods that are providing more action and sport but with less weight. Telescoping and multisection compact travel rods are now available from a number of makers. St. Croix has a "Fishing Machine" with built-in range-and-depth finder reel that converts from 15½ inches to a 5½-foot rod with a flick of the wrist. The new magic rod material is graphite, with ratios running from 100 percent down to dubious traces of it mixed with fiberglass. Best bet, as usual, is to deal with quality makers. Shakespeare guarantees its new "Ugly Stik" for five years. Fenwick has HMG graphite blanks for the do-it-yourselfer who wants to make his own.—*Bill McKeown*

**Wrap-around pushbutton** of 63S Uni-Spin reel from True Temper lets thumb-controlled reel mount on spinning rods.



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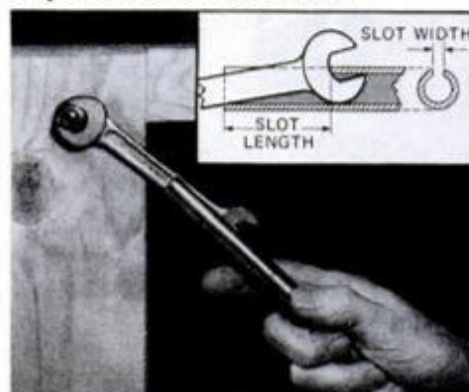
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**HINTS**

FROM READERS

**Slip-on wrench extension**



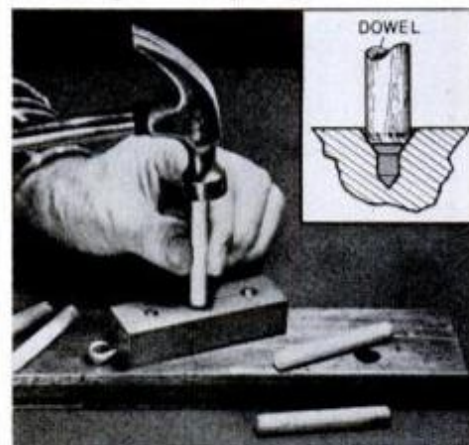
When additional torque is needed to loosen or tighten a nut, you can add a handle to the wrench by slotting the end of a length of pipe and hooking the slot over one jaw as shown.

**Key-ring clamp**



When you want to hold thin metal pieces in alignment for soldering, you won't find a better clamp than a split key ring. Its open center makes soldering a cinch.—*Walter E. Burton*

**Pointing the easy way**



A quick way to "point" the end of a glue dowel is to stand it in a countersunk hole in a steel block and tap with a hammer. Holes of varying size are made with center drills.



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# Rescue in space

A new era in space travel in the 1980s will see the Shuttle making weekly trips into Earth orbit. For an extra margin of safety, NASA is developing rescue systems for marooned or injured astronauts.

by John F. Pearson  
SCIENCE EDITOR

"Hey, we've got a problem here." It was this laconic report from the crew of Apollo 13 to Mission Control in Houston that served to let the world know that the flight was in trouble. Some 200,000 miles from Earth as it hurtled toward the moon, Apollo 13 had been crippled by the explosion of a liquid-oxygen tank in the big service module.

The three astronauts suddenly were faced with a grim possibility: They could become the first men stranded in space. That they ultimately avoided this fate was a tribute to their own coolness and training, and to the engineering know-how available to them via radio from Houston.

As a waiting world was to learn,



The "ball" astronaut carries is a "personal rescue enclosure" now under development at NASA's Johnson Space Center, Houston. It's big enough to contain a person sitting with knees pulled up and has its own life-support system. The spacesuit, also new, is lighter, less bulky than Apollo suit. Below: Rescue Orbiter glides to a landing at Florida or California base.



smooth coordination between the astronauts and Mission Control solved the problem. Using power and life-support systems of the lunar module (intended for the moon landing), Apollo 13 swung around the moon and returned to the vicinity of the Earth. On Apr. 17, 1970, the command module carrying Jim Lovell, Tom Mattingly and Fred Haise made a safe re-entry.

In Houston, relief was mixed with the knowledge that a grim lesson had been learned. Robert R. Gilruth, then director of the Space Center, put it this way: "I think it has been made quite clear, more than by any of the Apollo flights up to this point, that flying to the moon is not just a bus ride."

No flight into space is "just a bus ride." An astronaut stranded in a crippled craft only 200 miles from Earth is as vulnerable as if he were adrift 200,000 miles away. In time he will fall victim to the same deadly environment; in time his life-sustaining oxygen will give out. The big difference is he is in Earth orbit, close enough to be helped by a quickly mounted rescue effort.

When NASA's Space Shuttle program is in full swing in the 1980s, there will be a flight a week into Earth orbit. More flights mean more chances that something may go wrong. It is not surprising, then, that NASA is now working on a rescue system for this program.

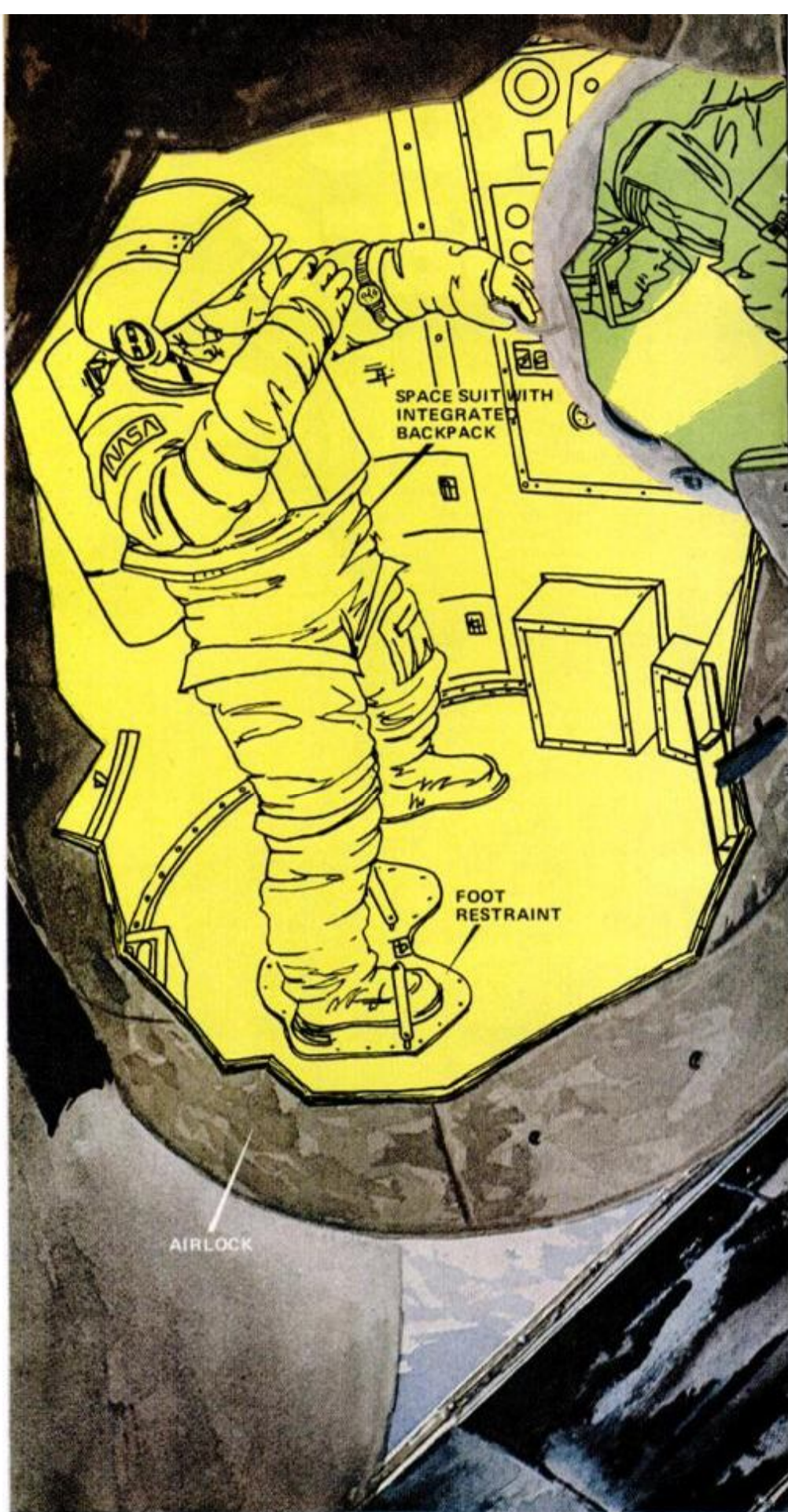
The Shuttle project is built around the Orbiter, a delta-winged craft about the size of a DC-9 that is a combination space vehicle and airplane. By the time this article appears, the first Orbiter will have been rolled out of a California factory. An extensive test program will lead up to an initial orbital flight in 1979. If all goes well, as many as five Orbiters will be in operation in the 1980s.

### How Shuttle will work

Here, in brief, is how the Shuttle will work: In addition to three big rocket engines in the Orbiter's tail, two solid rocket boosters will be used to get the vehicle into orbit. At an altitude of 25 miles, the boosters will be jettisoned and descend by parachute for ocean recovery. Like the Orbiter, the boosters will be used for many flights.

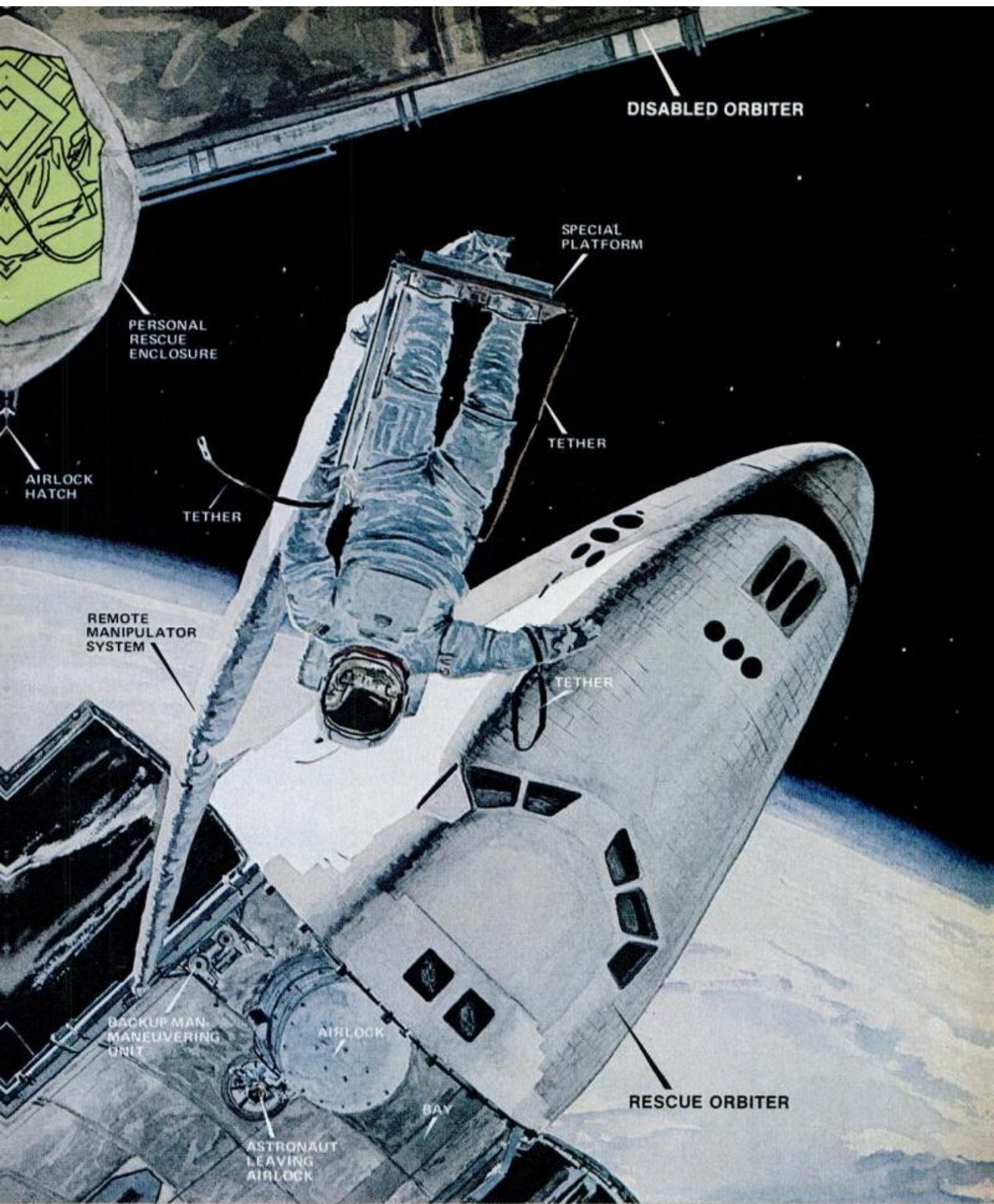
Depending on the mission, the Orbiter will be placed in an orbit ranging from 100 to 600 miles from the Earth. Typically, the craft will remain in orbit for about seven days, but will have the capability of staying up for 30 days. On re-entry into the Earth's atmosphere, the Orbiter

*(Please turn to page 126)*



Marooned in an orbit some 500 miles from Earth, the crew of a disabled Orbiter starts to "abandon ship." In an airlock, a suited astronaut maneuvers rescue ball through a hatch. The ball, now disconnected from the craft's life-support system, contains almost an hour's supply

of oxygen. It also has a compact communications system and a small port for visibility. Ready to grasp the ball by a fabric handle is astronaut from the rescue Orbiter. He's tethered to a small platform rigged at the end of the Orbiter's remote manipulator system. When he's



PM art: Paul Fjeld

secured the ball, the manipulator arm will retract, bringing the astronauts back to the rescue craft's bay. This painting, by artist Paul Fjeld, shows one of three rescue modes under development at the Johnson Space Center. A second method involves a clothesline device strung be-

tween two Orbiters, with the rescue ball being pulled from one craft to the other. In a third method, an astronaut equipped with a man-propulsion device simply carries the ball to the rescue Orbiter. Though the normal capacity of a Shuttle Orbiter is seven crewmen and passen-

gers, as many as 10 persons could be accommodated in an emergency, according to NASA engineers. Soon after stranded astronauts have boarded, the rescue ship will use rocket propulsion to re-enter the atmosphere, then finally glide to a landing at one of its U.S. bases.

# Big performance from small optics

The secret?  
Folded light.

by Ivan Berger  
PHOTOGRAPHY  
EDITOR



A

Bend the light path and you shrink the optics. It's done with mirrors in Vivitar's new viewfinders in Vivitar's new viewfinders. The 600-mm "solid cat" lens (A); conventional telephoto of a mere 400-mm towers over it (right). Roof-prism design shrinks Honeywell Pentax monocular (C) which doubles as a 22X microscope (B), and Minolta Pocket binoculars (D) which fold compactly (E).



B



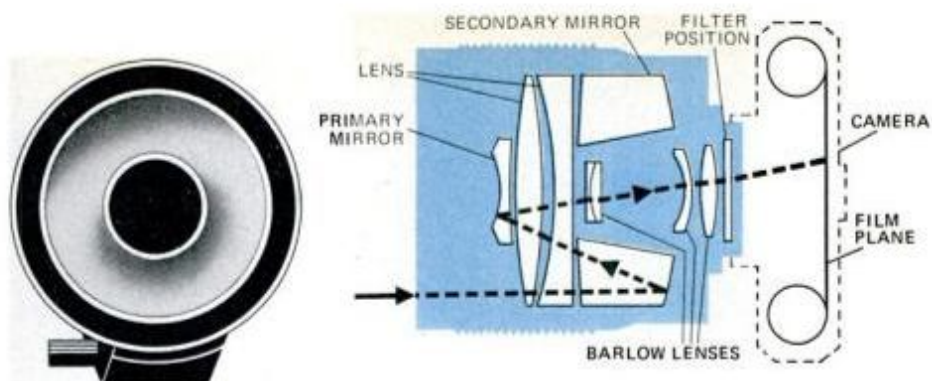
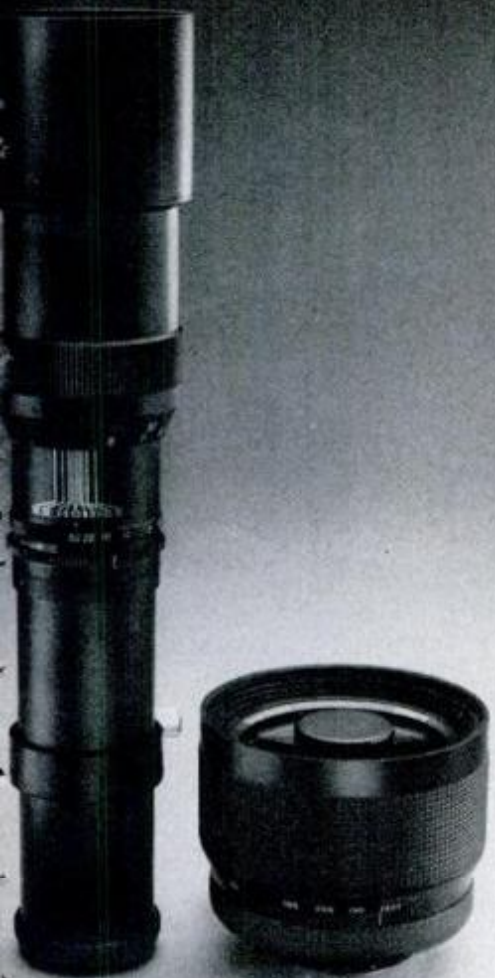
C



D



E



**Vivitar "solid cat"** (above) reflects light twice to lengthen the light path while shortening the lens; light enters in a ring around the primary mirror at the lens's front. Barlow lenses at rear of the lens act as teleconverters to magnify the image and increase the lens's power. To keep the filters small and economical, they fit at the rear of the lens. Camera mounts are interchangeable.

**H**ow do you shrink a pair of binoculars? Or a camera lens? You fold it—not by bending the glass, but by using prisms and mirror surfaces to bend the light rays that pass through the optical system.

That's the secret behind a raft of new optical devices which have been made incredibly compact without serious losses in performance.

Most dramatic of this new breed is Vivitar's "solid cat" 600-mm telephoto lens (above and left). Just  $3\frac{3}{4}$  inches long, it has a focal length of 600-mm (23.6 inches). That's 12 times the focal length and magnification of a normal 50-mm lens, in a housing only about twice as long as a 50, though considerably wider.

Mirror lenses are not new. What distinguishes the Vivitar from other such "catadioptric" designs, however, is that it's practically solid,

with little airspace between its elements—hence the nickname "solid cat."

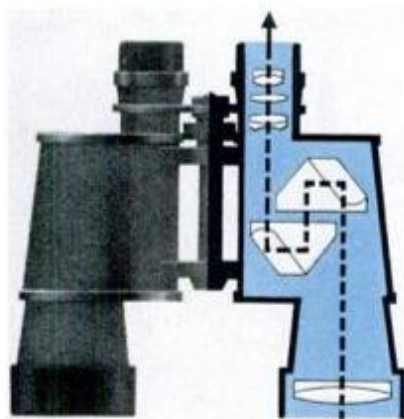
Solid construction saves space. The Vivitar 600 is about half the length of many conventional, air-spaced 500-mm mirror lenses and an inch shorter than the shortest 500. Solid construction also makes the lens more rugged and more stable in changing temperatures. And it concentrates the lens's weight close to the camera, making it easier, though still chancy, to take shots with the camera supported only by hand.

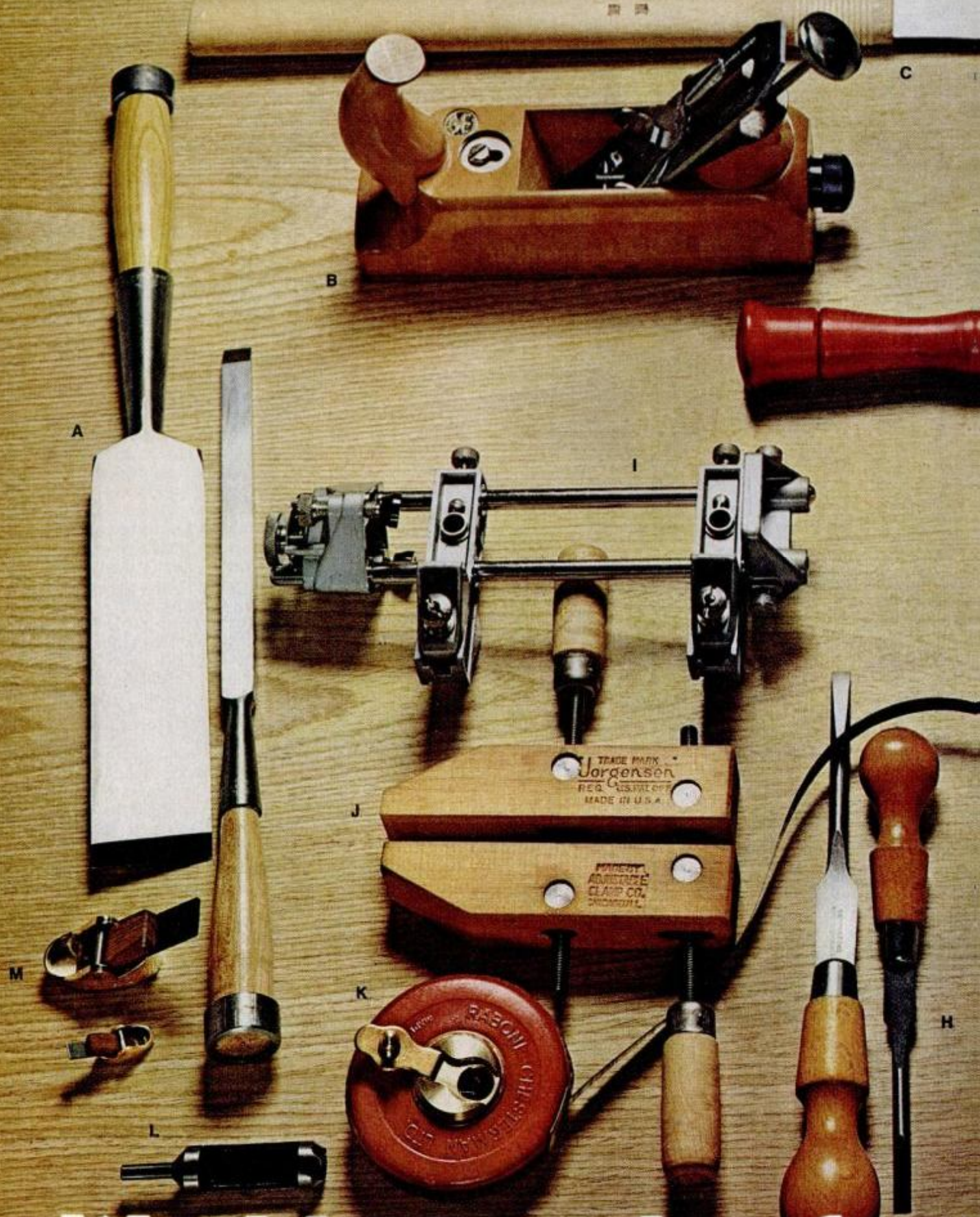
Mirror lenses have their drawbacks, though. They have only one f-stop, nearly always f/8. Neutral-density filters must be fitted if you want the exposure you'd get from smaller apertures. (To keep filters small and economical, they fit behind the lens.) Out-of-focus light spots register as blurry doughnuts instead of fuzzy dots. Contrast is often so low that focusing can be difficult. To these drawbacks add the disadvantages of weight (at 3 pounds,  $5\frac{1}{2}$  ounces, the "solid cat" is about a pound heavier than most mirror 500s) and high price (\$799).

Still to come are 800 and 1200-mm "solid cats" where compactness should really pay off in those super-

*(Please turn to page 186)*

**Compact binoculars** below are (clockwise from upper left corner): Bushnell, Minolta/Celtic Compact 6x20, Minolta/Celtic Compact 8x20 and Minolta/Celtic Pocket 6x20. Binocular in center is full-size 7x35 Scope model shown for size comparison. Straight tubes of the Pocket model are due to roof-prism design (lower left diagram), that folds light back on itself; compare conventional design above.





Working works of art



**T**here's nothing like the feel and performance of a carefully crafted, top-quality hand tool. Pictured here are tools that represent the finest money can buy. You'll recognize the exceptional quality—and see the difference it makes on your woodworking projects—the first time you use them. Here are the particulars.

**A. SOCKET CHISELS:** Special alloy steel is tempered to a 62 Rockwell hardness for extra heavy-duty use. The large chisel is 17½ inches long. Set of five, \$45.

**B. PRIMUS PLANE:** A fine smoothing plane with a fruitwood body, jointed lignum vitae sole, depth adjustments and a blade-tensioning screw. Should last forever. \$53.75.

**C. RYOBA SAW:** A unique hand-tempered, set and sharpened saw from Japan. The teeth are angled toward the handle so you pull to cut. It's 28 inches long. \$11.

**D. PUUKKO KNIFE:** The blade tang on this 8½-inch Finnish beauty runs the full length of the handle. The high-carbon stainless-steel blade keeps an edge. One of the best tools I've ever used. \$18.95.

**E. BACKSAW:** An 8-inch Sheffield steel, brass-backed jewel for extremely fine cutting. \$17.50.

**F. HAND DRILL:** The hardwood handle holds seven drill points. A heavily geared, easy-to-control drill for cabinet work. \$20.95.

**G. MULTIPLANE:** The most unbelievable tool from the Record works in England. Metal parts are plated; handles, select rosewood. Has 24 tungsten steel cutters (20 more optional). It can plough, dado, bead, fillister and much more. \$108.

**H. SCREWDRIVERS:** High-carbon steel is forged with a flat shaft for wrench-assisted turning. Beechwood handles. Set of five, \$15.95.

**I. DOWELING JIG:** A versatile, precise dowel-centering tool, with a set of drill guides. \$29.90.

**J. HANDSCREW:** The ultimate high-torque clamp with 4 to 14-inch jaws. The 6-inch clamp shown is \$6.35.

**K. MEASURING TAPE:** A 33-ft. steel tape with brass fittings in a hand-stitched leather case. \$29.90.

**L. PLUG CUTTER:** A ½ x 2-inch cutter to make your own glue dowels and hardwood plugs. \$10.40.

**M. FINGER PLANES:** Used by violin makers, the solid brass planes are for extra-fine work. The 1-inch model is \$19.50; 2-inch, \$24.70.

#### TOOL SOURCES

A, B, C, G, M: Woodcraft Supply, 313 Montvale Ave., Woburn, Mass. 01801.

J, L: Silvo Hardware Co., 107-109 Walnut St., Philadelphia, Pa. 19106.

E, I, K: Garrett Wade Co., 302 Fifth Ave., New York, N.Y. 10001

D, F, H: Brookstone Co., Vose Farm Rd., Peterborough, N.H. 03458.

Beauty, efficiency and durability make these some of the most valuable tools you can own, regardless of price.


by Mike McClintock

ASSOCIATE HOME AND SHOP EDITOR

# Two miles down—and an earthquake on the way

A reporter rides along as the research submarine Alvin explores a deep rift in the Caribbean seafloor—just two days before the great Guatemalan quake took the lives of 23,000.

by Walter Sullivan



Edging carefully along steep cliffs more than 10,000 feet deep, Alvin, with author aboard, probes for rock samples with its articulated mechanical arm. Samples are placed in basket under bow; may help scientists determine how earth evolved.

PM art: Ed Valigursky

Walter Sullivan is science editor of The New York Times and a noted science writer who has received many awards for the excellence of his technical reporting. On Feb. 2 this year, he accompanied the deep-diving submersible Alvin on a two-mile descent into the Cayman Trough, a precipitous rift in the Caribbean seafloor long known to be a major source of earthquake and volcanic activity. Less than two days later on Feb. 4, one of the severest quakes in Central American history struck Guatemala, claiming more than 20,000 lives. What follows is the author's account of that daring dive into the deep, black depths of the inner earth.

—The Editors

Our diving pilot, John D. Donnelly, allows water to flood the ballast tanks of our deep-diving submersible Alvin. Our sinking journey of an hour and a half into the Cayman Trough has begun. The descent of 11,550 feet—more than two miles—is to be, in the words of Dr. Robert D. Ballard, chief scientist of the project, a “journey into the interior of the earth.”

The walls of the trough, in places 22,000 feet high, are believed to expose layers raised from the earth's deep interior. They may even include the so-called Third Layer, a deep portion of the earth's crust that, at least until this project, has never been directly observed. Sampling this layer to learn more about how the earth evolved is one of the goals of the project, launched by the Woods Hole Oceanographic Institution which operates the Alvin and our surface mother ship Lulu.

The Cayman Trough, a great rift in the seafloor three to four times as deep as the Grand Canyon, has been produced by continuous movements within the earth that generate earthquakes from Guatemala to Haiti. In fact our exploration took on a special—and unanticipated—significance when less than two days after our dive a major quake struck Guatemala, taking more than 20,000 lives.

### Cramped quarters

Two of us, in addition to our pilot Jack Donnelly, are aboard the three-man Alvin sub as scientific observers, the other being Dr. Jelle deBoer, a Dutch-born geologist from Wesleyan University. Between us sits Jack on a boxlike seat. Jelle and I have no seats but are reasonably comfortable, our legs curled to fit within the heavy titanium pressure sphere, six feet

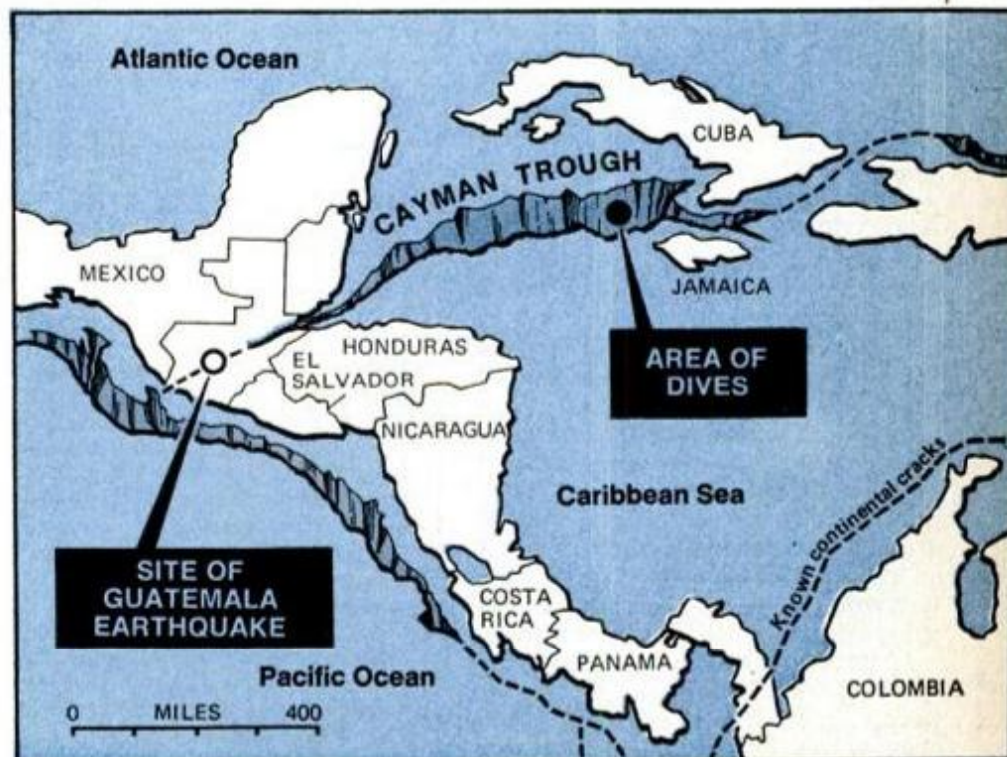


Pilot Jack Donnelly surveys complex array of instruments in tiny, six-foot pressure sphere of deep-diving submersible Alvin. Donnelly, at controls on author's dive, was also hero of earlier incident in 1974 when he freed sub trapped deep in mid-Atlantic rift.

## WHERE IT HAPPENED

The map below shows the site of the author's dive into the Cayman Trough, a deep trench in the Caribbean seafloor extending from Guatemala to Cuba. On Feb. 4 of this year, less than two days after the daring dive, a major earthquake struck Guatemala not far from where the explorers had been. Registering 7.5 on the Richter scale (out of a possible 10), the massive upheaval proved to be one of the worst

natural disasters ever to occur in Central America. Following a known fault line connecting the Cayman Trough with other trenches on the Pacific side, the violent quake virtually tore Guatemala in two. Left in its terrible wake: 23,000 dead, some 77,000 injured and more than a million homeless. Luckily for the author and his companions, they were safely out of the trench when the shock hit.





Back from dive, Alvin is carefully guided into stern well of mother ship Lulu for retrieval in a cradle (left). Above, a technician checks diving weights—stacks of steel plates each weighing 230 pounds—that can be released to control buoyancy.

in diameter, that is to be our home for the next eight hours.

Each of us has a saucer-sized port through which to view the watery world outside. Donnelly's port is directly in front of him for driving the sub, but our observers' ports are near the floor of the sphere to enable us to see the bottom. This makes for contortions and neck-craning. Since each observer scans an area invisible to the other, he is required to tape-record a running commentary of what he sees.

As we start down, the surface blue of the Caribbean changes rapidly from azure to the rich blue of medieval stained glass, to midnight blue and finally, below 600 feet, to total darkness. In the black depths, I recall the briefing we had all been given before the dive on emergency procedures in the event of trouble. It is essential we know every possible situation and how to deal with it should our pilot become incapacitated.

### A wild ride

As a last resort if trapped, we were told, we could lift the floor board of the pressure sphere, pull a release pin, insert a special wrench and detach the entire stern half of the submarine. Thus released from its afterbody, the pressure sphere would have a positive buoyancy or upward pressure of 2400 pounds. Fortunately, to date no one has had to take so drastic a step to escape entrapment on the seafloor as it would probably be a wild ride to the surface since the sphere would no longer be stable.

If forced to do this, we might even reach the surface upside down, we were warned. In this case, we should open valves to vent enough oxygen into the chamber to equalize the out-

side water pressure. This would enable us to open the hatch (normally overhead but now beneath our feet), dive into the water and swim to the surface. If we were luckier and found ourselves right side up, we could exit the normal way, but each man should slip into the water as soon as he was out, lest his weight capsize the sphere.

### Tiny lights in a black world

Entrapment is not a comforting thought. I concentrate my attention on my observation port. We are now plunging through a new world of tiny lights. It is tantalizing, for they flash past so fast it is never possible to tell precisely what they are.

Outside each port is a lamp that can be switched on and I do so in hope of catching a glimpse of the creatures. Instead, little can be seen ex-

cept the famous "reverse snowfall" described by many divers—the apparent upward motion of myriad flakes as the sphere plunges downward. Some of these flakes are living creatures. Others are the remains of those that have died, sinking slowly to add to the seafloor sediment. So much light is reflected back by nearby flakes that you can't see very far—like trying to drive through mist with high-beam headlights.

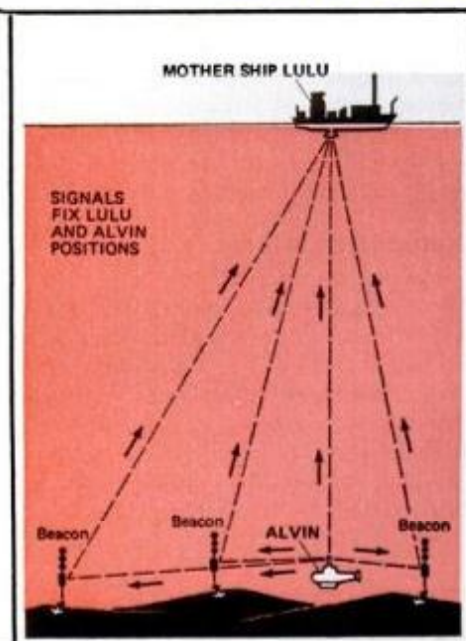
Periodically, Jack Donnelly checks and adjusts the oxygen supply. As on manned spacecraft, oxygen is fed into the cabin at a controlled rate and carbon dioxide from our exhalations is purged by lithium hydroxide canisters. Our cabin, however, is considerably smaller than that of the three-man Apollo.

Every few hundred meters Don-

*(Please turn to page 140)*

## NAVIGATING A SUB TWO MILES DEEP

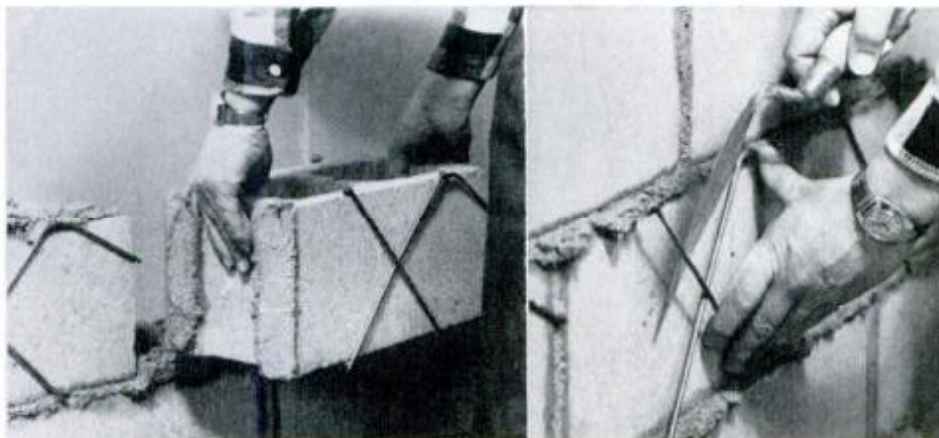
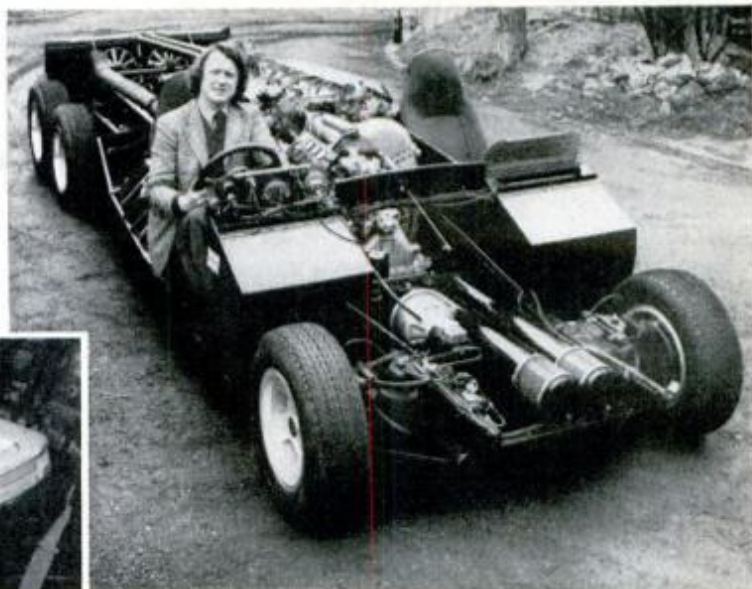
Elaborate electronic plotting system is needed to precisely pinpoint Alvin's position underwater at all times. Sonar buoys—transponder beacons—are first arranged in roughly triangular pattern around dive area near bottom. Signals from mother ship Lulu are returned by the beacons and their differing travel times enable a computer to determine Lulu's position relative to beacons. Signals from Alvin to beacons are also picked up by Lulu, indicating Alvin's position relative to the beacons. Since Lulu's position has already been established, computer can then calculate Alvin's position relative to Lulu. Direct signals from Alvin to Lulu are used to determine sub's depth.



# IT'S NEW NOW

## High-powered personal car with pizzazz

Paul Jameson of Betchworth, England, calls the six-wheeled, 12-cylinder vehicle he built "the world's most powerful private car." Its 27,000-cc Rolls Royce Merlin can push it over 250 mph. The engine boasts four valves and two plugs per cylinder, fuel injection, two magnetos plus a two-stage supercharger.



## Block spacer system for amateur masons

Wire spacers clip to the facing edge of any standard concrete block so even the most inexperienced do-it-yourselfer can produce a professional-looking block wall. Mortar is spread on the lower course blocks in the normal manner; snap-on spacers are secured to the block face. The next block end is then buttered (above, left), laid in place and tapped until it contacts the spacers at bottom and end. Excess mortar then can be troweled from the seams and joints finished with a jointing tool. When the mortar has partially set, spacers can be popped off with the trowel point (right) and their marks smoothed over. Spacers come in sets of 12—enough for most first-time masons. Additional sets can be purchased as proficiency increases so longer sections of wall can be constructed before the spacers are pulled for reuse. Denco, Inc., Box 175, Onalaska, Wis. 54650.



## Motorcycle trailer

Loads up to 500 pounds—including snowmobile or second bike—can go with you in a trailer designed to track behind a motorcycle or small car. A 360° universal hitch accommodates the 14-cubic-foot unit. The removable polyethylene carrier box can also be used on any car-top. Trailer has dual leaf springs, welded tubular steel frame, 48-inch track and 12-inch wheels. Trailmaster, Inc., 1754 Howard St., Des Plaines, Ill. 60018.



## Mini-Phantom ramp sweeper

Diminutive F-4 Phantom II fighter, built by U.S.A.F. maintenance crews in Germany—from scrap parts plus a VW engine and chassis—fights plane-damaging debris left on the airport ramps. The "pilot" makes a pass over the aprons and trash is scooped up into open undercarriage.



## New holes in (hair)line play

If you're bored with your old tonsorial style, you might like to try "Tino the Greek's" new football helmet hair stylers. It's on Madison Ave. in New York City. Tino vacuums tufts of hair through holes in his patented helmet and snips what comes through. Sorry, no "after" photos.

# Video games: Put your backhand on TV

by Cindy Morgan

PM photos: Benn Mitchell

**H**ow can you play tennis or hockey without working up a sweat? Go racing without accidents or traffic tickets? Shoot targets in your living room without nicking the plaster? With a video game, that's how. Plugged into your TV set, it lets you play a variety of games without leaving your chair.

Video games don't build your muscles, but they do challenge your reflexes. Moving an on-screen "paddle" to volley back an on-screen "ball" may seem easy—but wait till you try it.

And once you've gotten the hang

Doubles tennis for two on Magnavox's Odyssey 200.



of that, most games increase the challenge: Some have controls that let you increase the ball's speed, others speed up automatically as you play. (Pong not only does that but slows down again, if you miss; and First Dimension has a handicapping feature that can speed up one player's serve while slowing down the other's to give novices a chance.) Or you can control "English"—the spin on the ball and the angle at which it bounces off the paddle. (Some games increase that angle as the ball gets closer to the paddle's edge.) And for a further challenge, some games let you shrink your paddle.

### Tennis isn't everything

Nearly all video games offer tennis, though they may call it by another name, such as Pong. In all these games, the screen shows a dotted line where the net should be (the clumsy plastic overlays required by early TV games are gone now), a rectangular white ball, and two movable white bars, representing paddles. Some games show two paddles over side, for "doubles"—but not all of them let four players participate.

As the ball moves back and forth, you manipulate your paddle controls to intercept it, volleying the ball until one player misses.

Scores are shown on the screen: numerically, in most sets, but in others approximated by hard-to-interpret sticks that advance across the screen as each player scores. Executive Games' "Face-Off" has numerical scoring on the control panel.

But tennis isn't the only game these TV add-ons let you play. Hockey (also called Soccer, Football or Goal by different makers) shows up on many models. Usually, goalies and forwards serve as double paddles, and you score by bouncing the ball through your opponent's goal. In newer Odyssey games, the goalies are actually human silhouettes.

Then there are the handball games, where the player or players stand at one end of a three-wall court, returning the ball as it rebounds back to them. Squash and racquetball are two-man versions; practice, solitaire and ricochet are one-man versions; and handball can be either.

Both Zonk and Tournament 2000 have target-shooting whose "guns" don't shoot but just look at their targets, photoelectronically. And Video Action has a road-race in one model.

### More value, lower cost

Today's models play more games and offer more action features than the early ones, while their prices are

coming down. Most are now below \$100. As toymakers enter the field, prices should become still more competitive and could drop as low as \$30 or so.

### Installation? Easy!

All current video games contain miniature TV transmitters whose signals feed directly into your TV set's antenna terminals. The playing field is just another program you tune in instead of comedies and commercials.

But you don't need a broadcast engineer's knowledge to install a game. Just follow easy directions to connect the game's adapter between your antenna and the set's antenna input. A switch—usually on the adapter behind the set, lets you select either the game or a TV program. The switch keeps your game signal from going out your antenna line or cable to interfere with your neighbors' TV reception.

Even with these switches, poorly designed games could radiate interference. So the FCC tests all new models, allowing sale of only those that pass. The wait for FCC approval is one reason why new games aren't popping up that rapidly. Besides, the FCC plans to slow down or stop approving transmitter-type games in the future. But there's still quite an assortment (see the accompanying table) and more are in the works.

There's no transmitter, though, in Heathkit's new, six-game "Screen-sport" kit. It will connect directly to the picture circuits of Heath solid-state TV sets. But Heath hopes to have a transmitter-type kit soon, for other sets.

Sets with factory-wired video inputs for games like the Heath can be expected soon—not just to handle video games but also to accept inputs from video tape or disc players, TV cameras, and quite possible from home computers, too (see *Home Sweet Computerized Home*, page 112, Sept. '76).

TV sets with built-in games are already here: There's a color set from Magnavox and a black-and-white model from Broadmoor/Olympic.

### How to pick one

The more games you can play with the model you pick, the more fun you'll have with it. But there are less obvious points, including some that only show up as you play with each unit in the stores. So try as many games as possible, till you find the one whose feel you're happiest with.

Control layout has a big effect on

## Games TV sets play



Handball

Handball can be for one player, as shown, or for two serving alternately. Same game may be called squash, racquetball, or other names on different models.

True doubles tennis, for four players, as shown here, is rare; most "doubles" games just give each player double paddles, as on facing page.



Tennis doubles



Singles tennis

Singles tennis is the most common video game. You move your paddle to intercept the ball and volley it back to your opponent on other side of the "net."

Flashing displays like this indicate a point has just been scored, or that the game is over—a cheerful extra on some models, especially if in color.



Scoring display



Hockey

Hockey, football, soccer and other goal-oriented games usually put two men—a goalie and a forward—on field for each of two players. Men move in unison.

Hockey with one on-screen "man" per player is also common. In either version, the object is to fire puck past the opponent's goalie and into the "net."



More hockey



Robot

Robot game shown here has two players (right) trying to get ball past a robot goalie controlled by the game unit—it's you two against the machine!



**Sampling of current games** (clockwise from upper left) includes Executive Games's TV Tennis, Video Action III, First

Dimension, APF TV Fun, Coleco Telstar, and Unisonic Tournament 2000 (with "target pistol"); Atari's Pong is in center.

feel and fun. Games with both players' controls on one box are easier to store, but you may feel cramped, shoulder-to-shoulder with your opponent: Games like Television Tennis, Ricochet and Zonk win points from us for having separate control boxes for each player. And we liked the 360° joystick control on "Face-Off," though it took some getting used to. The more controls, the merrier, too, if they add challenge, as the English, speed and paddle-size controls do.

Two players are standard for most game sets; many also offer one-man play, and a few provide for four players. But some games just imply

four players are involved by merely doubling the number of paddles or the number each of two players controls.

If you have a color set, you'll want a game that offers color display; but you needn't avoid games with color if you have only a black-and-white set—you'll still get all the action of the game.

Batteries will run these games for 40 or 50 hours of play. But a.c. adapters (under \$10) are worth getting, both to make sure your game is ready any time you are, and to eliminate worries about battery leakage.

Check that all controls and knobs

are sturdy and fit flush against the panel so they won't easily break off. If you have children, remember that slide controls are more vulnerable to food spills than conventional knobs.

Warranties on most games provide for replacement by the dealer if the game fails within 90 days. After that, you have to ship it to the manufacturer for repair. Shipping is safest in the original carton, so save it if you can.

### Coming: video game library

Today's video games play only specific games they're built to play. But soon, you'll be able to reach into your library of game cartridges, pop one in your TV set, and play away.

Fairchild Camera and Instrument's Exetron Div. will soon market an impressive model based on a microprocessor—a computer on a fingernail-size chip. Two games are built into the unit, but more are available in pop-in cartridge form, for a total of 16 games—with still more possible.

An educational cartridge game, "Fact," by the makers of Indy 500, flashes questions instead of playing fields onto your screen; multiple-choice buttons select answers. It can be a learning aid for one or a game for two. ★ ★ ★

## VIDEO GAMES: HOW THEY COMPARE

Make and Model	Price	Number of players	Games played (See notes below)	Color	Dimensions of paddle movement	English control	Speeds	Paddle size adjustment	Remarks
Allied Leisure Name of the Game	\$100	1-2	P, S, T(2), H	no	1	no	2	yes	TV/game switch on control unit; separate control units
APF TV Fun	\$ 90	1-2	P, S, H	no	1	no	2	yes	Manual or auto-serve; ball angle selection
Atari Pong	\$ 80	2	P	yes	1	no	auto speed-up	no	
Super Pong	\$ 90	1-2	P(2), H, C	yes	1	no	auto speed-up	no	
Broadmoor Four-Play	\$200	2-4	P, S	no	1	—	auto speed-up	no	Includes 12" B&W TV set
Channel Master Challenger	\$ 80	1-2	P, S, H	no	1	no	2	yes	Sound comes through TV set
Coleco Telstar	\$ 70	1-2	P, S	no	1	no	3	no	
Control Sales Video Action III	\$200	1-2-4	P, S	yes	1	no	variable	no	To be discontinued
Indy 500	\$130	1-2-4	P, S, R	yes	1	no	variable	no	
Dyn Paddle IV	\$ 80	1-2	P, S, H	yes	2	no	2	yes	Separate control units
Executive Games Television Tennis	\$ 60	1-2	P	no	1	no	variable	no	Separate control units; "stick" scoring
Face-Off	\$ 90	2	S	no	2	no	variable	yes	360° "joystick" controls
First Dimension FD-3000W	\$130	1-2-4	P, S	yes	2	no	variable	no	"Handicap" adjustment; "stick" scoring
Magnavox/Odyssey 200	\$130	2	P, S, H	no	2	yes	variable	no	No auto-serve; to be discontinued;
300	\$ 70	2	P, S, H	no	1	no	3	yes	"stick" scoring
400	\$100	2	P, S, H	no	2	yes	variable	no	
500	\$130	2	P, S(2), H	yes	2	yes	variable	yes	Includes a.c. adapter
4305	\$500	2	P, S, H	yes	1	no	2	yes	Includes 19" color TV set, separate control units
Microelectronic Systems Ricochet	\$120	1-2	P, S, H	yes	1	yes	2	yes	Separate control units
Novus Adversary	\$100	1-2	P, S, H	yes	—	no	auto speed-up	yes	Separate control units; sound comes through TV set; a.c. only
Phone Mate Zonk	\$ 99	1-2	P, S, T(2), H	yes	1	no	variable	yes	Separate control units; includes target "guns," a.c. adapter
Unisonic Tournament 2000	\$120	1-2	P, S, T(2), H	yes	1	no	2	yes	Separate control units; includes target "guns"

Notes: C=catch; H=handball/squash/racquetball; P=Ping-Pong/tennis; R=road race; S=soccer/football/hockey; T=target shoot; (2)=two versions

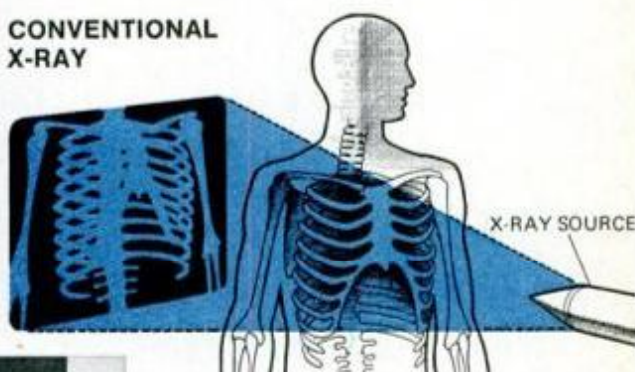


# Computerized X-ray: Powerful new medical tool

by John F. Pearson  
SCIENCE EDITOR



## CONVENTIONAL X-RAY



The cross-section X-ray of a human lung being viewed on TV screen was taken in less than five seconds by a new scanner (right) developed by General Electric. After scan is made, it's reconstructed and enhanced by high-speed computer.

A seriously ill woman recently entered a Washington, D.C., hospital. Physicians, using conventional diagnostic methods, concluded that she was suffering from a brain aneurysm—a bulge in a section of blood vessel caused by a weakening of the vessel walls.

The doctors decided that surgery was not indicated, but asked the woman to remain at the hospital for observation. She wanted to get another opinion, however, and had herself transferred to the Georgetown University Hospital. At this large medical center, also in the nation's capital, she was given a brain scan with a new type of computerized X-ray device.

The picture obtained showed a much larger and more dangerous aneurysm than had been suspected. She was operated on immediately and subsequently made a routine recovery.

The woman's life was saved by the use of an X-ray scanning machine that employs a technique called computerized axial tomography (CAT). The first of these devices, introduced

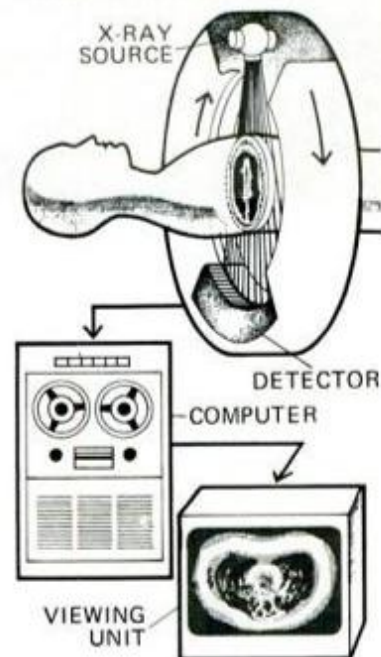


to the medical world only three years ago, were designed for examining the brain only. They proved to be revolutionary, capable of revealing abnormalities that previously often escaped detection.

Now whole-body scanners are on the market, and they, too, have become recognized as powerful diagnostic tools. They have proved especially useful in obtaining clear

*(Please turn to page 150)*

## COMPUTERIZED X-RAY



A conventional machine (top), with its stationary X-ray source, produces a flat picture in which one organ may blur another. In the new scanners, the X-ray source and the ray detector rotate around patient, take many "pictures" along a single plane. The result is a sharp, contrasty image such as cross section of abdomen reproduced here (above, left).


# New no-hands landings for airliners

Planes that land themselves will get you down more safely and speed up traffic flow—without a pilot touching the controls.

by Mort Schultz

It was exactly like a real jetliner cockpit except for one big difference—there were no windows to see out of. Panel lights blinked, gauge needles flickered and the controls moved eerily all by themselves as if under the spell of an unseen supernatural force. The two pilots in front of me sat with their hands in their laps.

It might have been a simulator—but it wasn't. We were aboard a real jet—a Boeing 737—making a real landing from a completely enclosed “blind” cockpit. The nose dipped as we turned on final and started down the glide slope to the field. The pilots intently scanned the instruments



PLANES FOLLOW EACH OTHER IN AT 40-SECOND INTERVALS

PLANES TOUCH DOWN, STEER, REVERSE ENGINES AND APPLY BRAKES—ALL AUTOMATICALLY

VANIGURSKY

but otherwise did nothing. Minutes later, the nose came up in the typical flare-out and we settled gently onto the runway. The landing was so smooth only the faint squeal of the tires on the pavement told us we were on the ground.

I peered at a TV monitor screen linked to a camera in the nose—our only visual contact with the world outside. Amazingly, the plane was perfectly lined up on the runway centerline, rolling down it straight and true—still with no one at the controls. Power settings were automatically adjusted, the engines reversed themselves and the wheel brakes took hold. Not until we

reached the turnoff point did the pilots take over manual control to taxi back to the terminal.

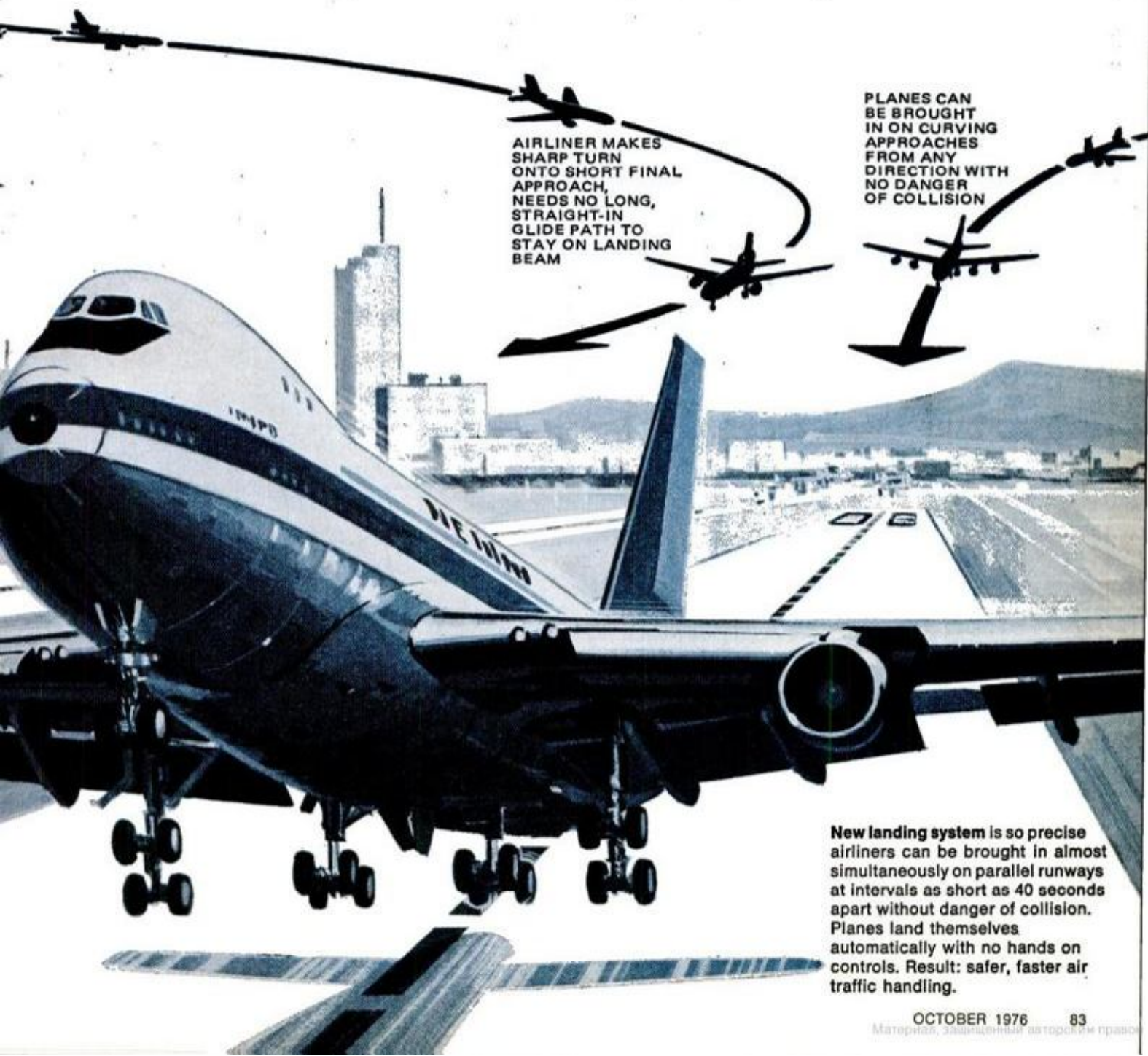
The purpose of our flight, made at the FAA's National Aviation Facilities Experimental Center in Atlantic City, N.J., was to demonstrate a radically new automated landing system designed to revolutionize traffic control at busy air terminals plagued by the problems of increasing congestion.

### Two cockpits, four pilots

The highly modified 737 we were flying is used by NASA as a sophisticated test bed for developing and evaluating the latest in aviation

electronics. It is a unique craft—it has *two* flight decks and *four* pilots. One flight deck is in the conventional location in the nose and has windows. Aft of this is a second flight deck—an exact duplicate of the first except for the absence of windows. This windowless cockpit enables pilots to monitor blind landings under the only truly realistic conditions possible—from a truly blind cockpit. According to Jack Reeder of NASA's Langley Research Center in Hampton, Va., it is "the most exotic plane in the world."

On our demonstration flight we made three touch-and-gos and one final landing. A touch-and-go is a



AIRLINER MAKES SHARP TURN ONTO SHORT FINAL APPROACH, NEEDS NO LONG, STRAIGHT-IN GLIDE PATH TO STAY ON LANDING BEAM

PLANES CAN BE BROUGHT IN ON CURVING APPROACHES FROM ANY DIRECTION WITH NO DANGER OF COLLISION

New landing system is so precise airliners can be brought in almost simultaneously on parallel runways at intervals as short as 40 seconds apart without danger of collision. Planes land themselves automatically with no hands on controls. Result: safer, faster air traffic handling.

touchdown followed by an immediate takeoff. I alternated my observer's position between fore and aft cockpits so I could watch the landings visually and on instruments. In every case, the plane hit the tip of the runway at dead center.

The electronic wonder responsible for this is called MLS for Microwave Landing System. An advancement over ILS (Instrument Landing System), it will, among other things, end the danger of landings.

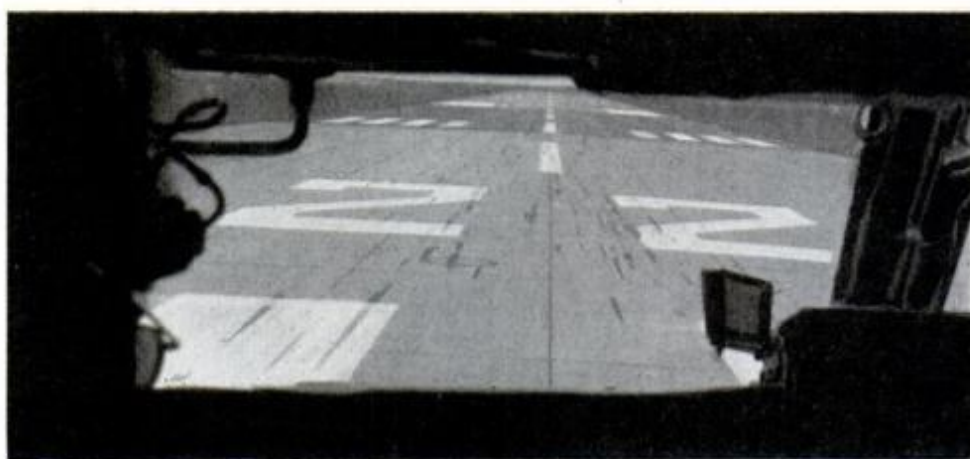
The landing, which pilots agree is the most dangerous part of flying, has claimed the most lives. Since 1960, 1190 have died in landing accidents involving U.S. commercial airliners. This figure more than triples when you include mishaps involving foreign airliners and general aviation and military aircraft.

### New system more flexible

As its name implies, MLS operates at the upper (microwave) reaches of the radio frequency spectrum. It will ultimately replace ILS, the long-standing workhorse developed during World War II and adopted for worldwide commercial use in 1949. ILS has served well, but because of the tremendous growth in air traffic and inherent weaknesses in the system, it is fast becoming inadequate for handling today's aviation needs.

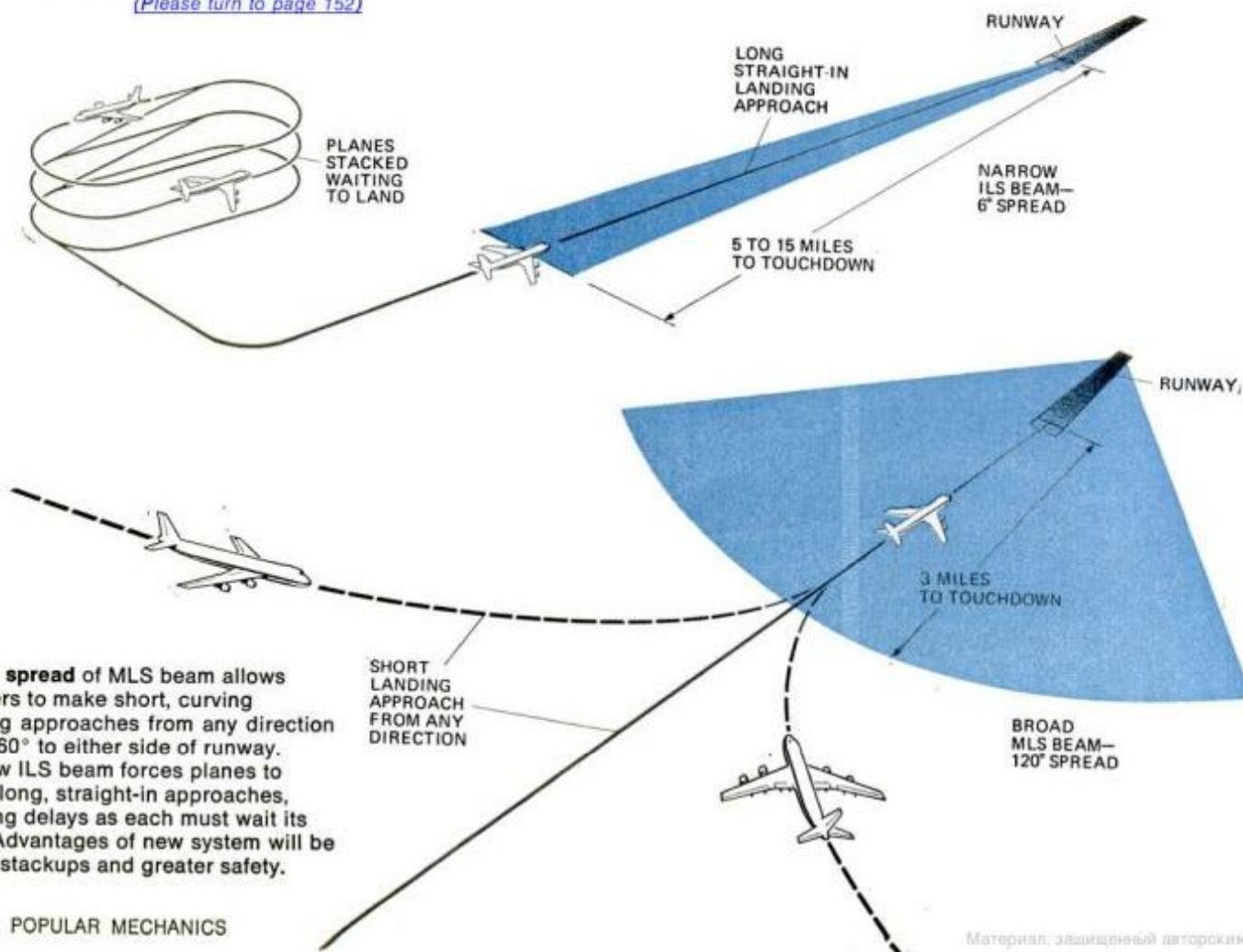
ILS guides inbound aircraft to a

*(Please turn to page 152)*



Two cockpits—one with windows, one without—are feature of specially equipped 737 used by NASA to test new automatic microwave landing system. View from conventional forward flight deck (top) shows perfect touchdown on

exact runway centerline as plane lands itself—with no hands on the controls. Lower photo shows "blind" aft cockpit with duplicate controls but no windows, enabling pilots and engineers to monitor blind landings under truly blind conditions.



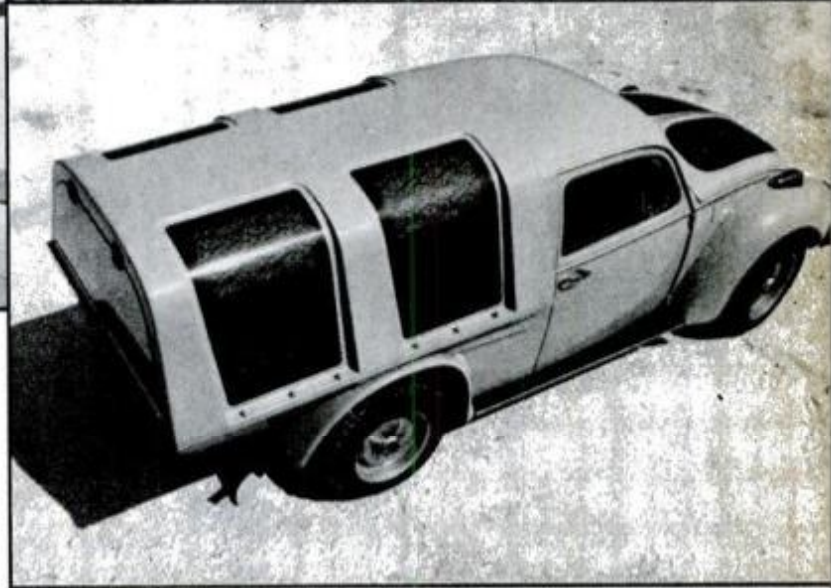
**Broad spread** of MLS beam allows airliners to make short, curving landing approaches from any direction up to 60° to either side of runway. Narrow ILS beam forces planes to make long, straight-in approaches, causing delays as each must wait its turn. Advantages of new system will be fewer stackups and greater safety.

# IT'S NEW **NOW**



## Flatbed kit for VW Beetle conversions

If you're a Beetle buff, you now can transform any standard or "super" sedan into a flatbed carryall, pickup or camper with a do-it-yourself kit using common home workshop tools. No mechanical changes or suspension modifications are involved. Kits include instructions, fasteners, lights and templates for cutting (no torches or welding required). Bed extends six feet; camper sleeps two adults. Prices: about \$400 to \$600. Domus, 312 East 17 St., Kansas City, Mo. 64108.



## Fun and games with calculators

Latest in cops-and-robbers sport is a "prison breakout" game played with electronically controlled lights. Convicts try to break free; guards try to foil them. Opposing players use electronic calculators. One switches lights on in "escape" sequences on the board; the other has buttons to block them. It's called Gotcher. Dacoll House, Gardners Lane, Bathgate, W. Lothian, Scotland.



## Cold water heat for your house

It's not a water cooler; it's a space heater that uses tap water from which heat is extracted by a reverse airconditioning principle. Freon, circulating through coils immersed in the water stream, removes the heat and carries it to a heat exchanger where fans blow warmth to the room. It produces the same BTU as a conventional radiator for a medium-size room. The unit uses 31 gallons of 60°F. water an hour. Electro Technique, 37 Boulevard de Bellechasse, 94100 Saint-Maur, France.

# 30 new add-ons to

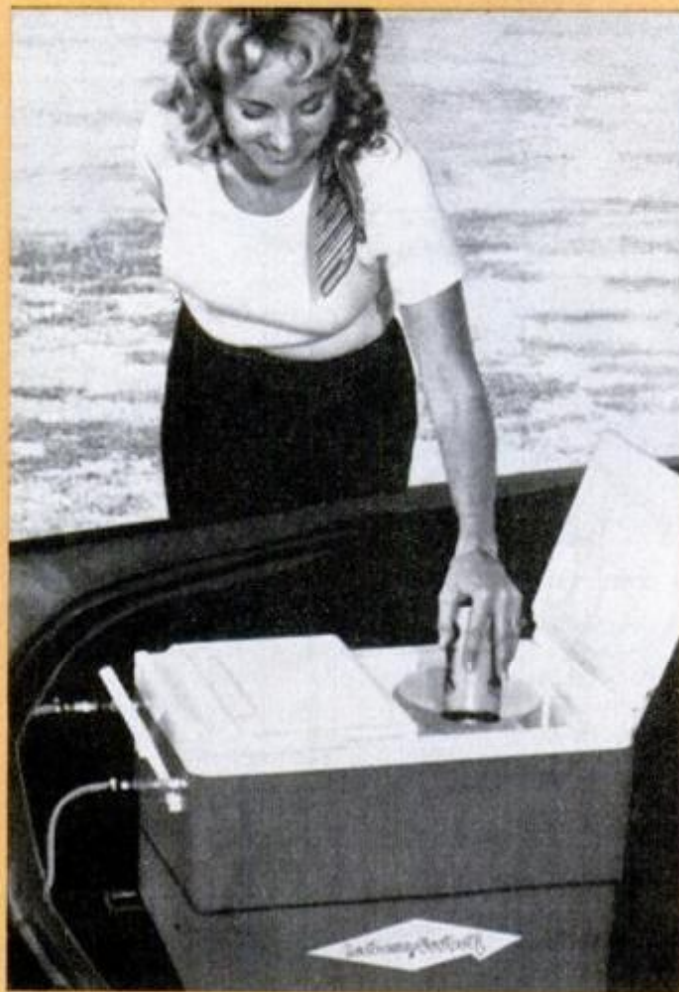
Even the kitchen sink can now be installed. Result: A rolling fun machine equipped and decorated to show its personality at 55 mph.

by Ray Gill

**T**oday's van is a vehicle that can turn into a rolling motor home, mini bus, workshop, executive office, beach buggy, raised-top camper, off-road explorer, traveling library, hot dog stand, plush pad, ambulance, or something that just looks like a sunrise. And you can have it customized to order, buy it ready-made or do it all yourself.

Want to add a few simple or spectacular extras? Take your choice from porthole, bubble or stained-glass windows, mag wheels, flair fenders, fancy light fixtures, extra steps and tire mounts, stereo, radio, CB, public address, TV and radar detection systems, fold-out bunks and pop-up tops, paneling, padding or shag or fur carpeting in interior decorator styles that have been called Early American, Far Out Oriental, Rustic Ranch, Beaded Brothel and Migraine Modern. More functional inside additions include running water, furnace, airconditioning, stove, shower, refrigeration, bar and fold-up toilet. Exterior decor may feature air-brushed stencils, vinyl murals, stylized decals, tape stripe and metallic trim. Selected here are 30 examples of the gadgets and add-ons now available for your van.

**1** Iceless cooler is a portable refrigerator that needs no electricity or LP gas. Instead, it hooks up to your airconditioner and, reportedly, doesn't affect its cooling capacity. Installation, with a loop line back from the conditioner, is claimed to be easy, with disconnection equally simple so it can be removed for use on a picnic table or beach. About \$100 from Dick Cepek, 9201 California Ave., South Gate, Calif. 90280, it can also be mounted in a passenger-car trunk. **2** Semiautomatic step slides under the side door while you're driving, but can be released to open out by tapping the spring-loaded trigger handle with your foot. It is \$31.95 and is made by Blackstone Manufacturing Co., RV Div., 4630 W. Harrison St., Chicago, Ill. 60644. **3** Power shower is a simple, portable unit with a generous 11-foot hose, 20-foot cord with clips to clamp on your 12-volt van battery, shower head, switch



**1** Iceless cooler hooks into airconditioner.

**2** Semiautomatic step slides under van.



**3** Power shower gives 10-minute rinse.

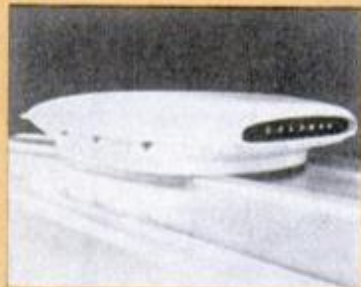


**4** Rooftop vent from Sears lets in light and air.



**6** Vista dome by CCI is fiberglass roof-raiser.

**5** Polar Cub is low-cost cooler.



# customize your van



**7** New Ford Cruising Van offers Econoline ready for customizing.



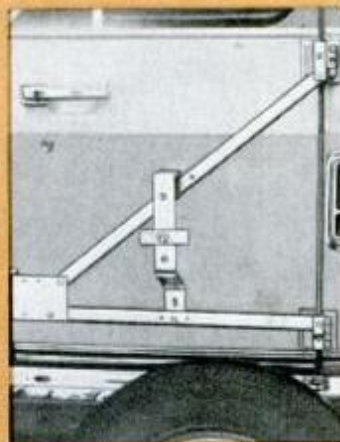
**8** Mini-furnace warms van with engine off.



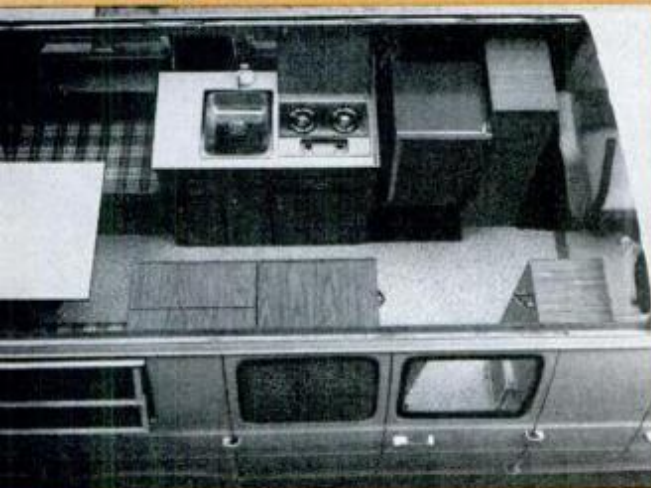
**10** CCI's Pop-Top raises for headroom.



**9** Dinette becomes bed, and bucket seats swivel.



**11** Clamp-on spare tire carrier of BCM can be removed easily.



**12** Interior by ABC with top off shows added units.

and a three-gallon container. It also comes, for \$19.95, from the noted off-road tire and camping gear supplier, Dick Cepek. It can provide an eight to 10-minute shower-down.

**4 Super Scoop**, about \$43 from Sears, can let in both roof light and air, and is one of an expanding line of van accessories listed in both the Sears large general and smaller recreational vehicle catalogs. **5 Polar Cub cooler** is a third of the size and weight of regular airconditioners and can operate on 12-volt d.c. Adding only 20 pounds to the roof and with flush ceiling controls inside, it cools by evaporation except under conditions of high humidity. The unit is made by Coleman Co., Wichita, Kans. 67201, costs about \$190. **6 Vista Dome**, one way of raising the roof, is an add-on fiberglass top that can be installed on most long-wheelbase vans, like the Dodge Maxi-Van shown, for about \$895. It's by Camper Conversions, Inc., Pepper & Industrial Roads, Barrington, Ill. 60010. **7 Cruising Van**, new from Ford, comes with rainbow striping, stand-out rear-view mirrors, mag wheels, open-out side doors, luggage rack and rear tire rack. Interior shows carpeted floors, walls and ceiling, swiveling high-back bucket seats, silver trim on doors, seats and console, and an open layout ready for customizing. **8 Coleman's forced-air furnace** is the recreational vehicle type needed for cold-weather camping. Fitted into a side-wall of the van, the mini LP gas-fired unit provides safe heat when your rig is off the road and the engine heater is shut off. It's about \$150 plus installation. **9 Convertible dinette** that folds down to become a double bed is another van accessory from Sears. Available in a variety of coverings and designs, the units run about \$170, plus \$34 for the table, up to nearly \$500 for models with seat backs hinged to face the table or face forward. High-backed, swivel-type bucket seats cost about \$69 to \$94, depending on upholstery, plus \$30 for the pedestal and \$12 for a sliding fore-and-aft adjustment. Padded interior paneling, shag carpet, port-hole side windows, rear window

(Please turn to page 168)



Using a locomotive diesel/electric engine, this huge 10-wheeler dwarfs the automobile parked in front of it (top). Mike Lamm (above) first takes a look at one of the two giant radiators, and then mounts the ladder to the cab which is constructed above the 12-foot wheel. When fully extended, the bed of the truck (right) lifts to give an overall height of almost six stories.

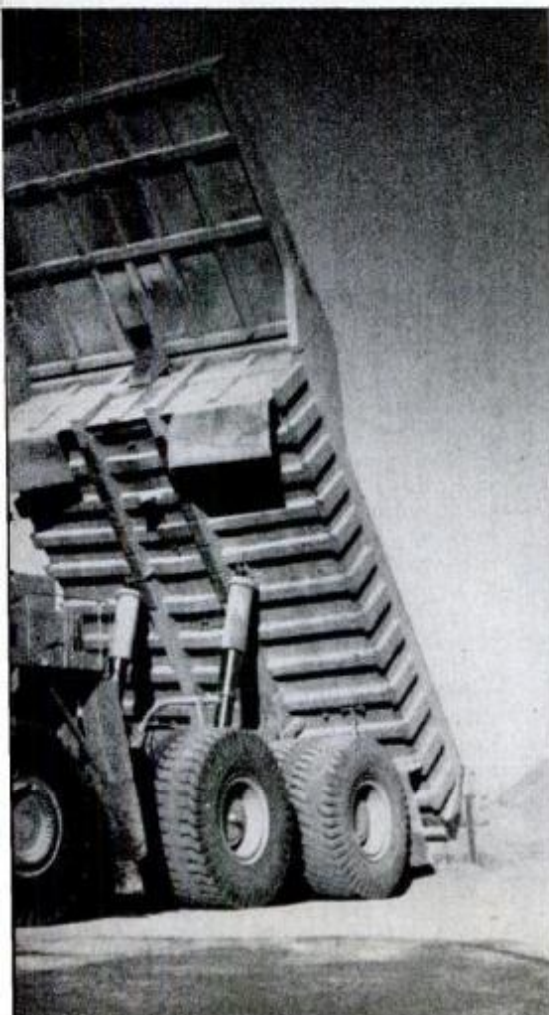




# Highballing the world's largest truck

PM's West Coast Editor (right) climbed a 15-foot ladder to get behind the wheel of this amazing rig. Handling a 350-ton payload, this monster is a GM prototype tested for a year in the scorching mines of our Southwest.

by Mike Lamm  
WEST COAST EDITOR



**W**hat's it like to drive a two-story, three-bedroom house? A lot like driving the world's biggest truck — the General Motors Terex Titan 350-ton diesel/electric.

Everything about this monster comes straight out of Guinness. In fact it's listed in their *Book of World Records* as the world's largest dump truck. The tubeless tires stand almost 12 feet tall. The dump bed lifts to a height nearly that of a six-story building.

The V16 engine, manufactured by GM's Electro-Motive Div., displaces the equivalent of 29 normal 350-c.i.d. Chevrolet V8s. It delivers 3300 bhp and needs two radiators the size of garage doors in order to cool it.

The Titan's engine and drive system make up, in fact, the same GM power team used in locomotives—a diesel/electric combination that ties the two-stroke engine directly to a generator, which in turn powers four electric motors, one at each rear wheel. The reason Terex (GM's earthmoving equipment division) uses the Electro-Motive power system in its behemoth is this:

## The reason

Electric traction motors, unlike piston engines, develop maximum torque at stall or low speeds. With a reciprocating engine, torque peaks

somewhere around the middle of its rpm range. With an electric motor, though, you have as much torque as you're going to get right when you start up. So in a truck like the Titan, you get lots more low-speed torque where you need it with electric motors than you could from the diesel engine alone. The other benefit of this diesel/electric system is that the drive motors can be electrically switched to generators for downhill braking. In the generator mode, they produce up to 5400 electrical horsepower for braking purposes.

Before I get to my driving impressions, I want to mention that this world's largest truck is one-of-a-kind prototype. It's experimental—a pilot model for future Titans. GM has been running the Titan dump truck at the Kaiser iron mine at Eagle Mountain, Calif. By the time I drove it, the truck had been tested for over a year under severe working conditions. Two weeks after my spin, the world's only Titan was torn down for inspection so that Terex engineers could learn from any signs of wear or stress.

## How do you drive it?

The day I ventured to the Kaiser mine in the middle of Southern California's Mojave desert, the ther-

*(Please turn to page 158)*



In this 12-page section PM looks at the latest from Detroit and talks to the people behind the cars.

# FORD SPENDS ON THE MID-SIZED AND SITS ON THE FIESTA

## The intermediates

Ford's heaviest spending in reworking the '77 cars was on the intermediates. The intermediates have new bodies, while the small cars and big cars are carryovers. But the company hasn't stinted in giving the carryover cars a new look.

"Make no mistake about it," says William O. Bourke, executive v.p. of Ford's North American automotive operations, "styling still sells and a new-looking product provides an incentive to buy that a look-alike does not. One of our strategies was to freshen and renew those models that have gone the longest without significant change in appearance.

"As for the intermediates, where we are all new, this is the largest single segment of the business. The great middle market alone accounts for roughly twice as many sales as all the imports in the United States combined. This is a big growth segment and we intend to grow in both volume and share in 1977.

"We are far from being No. 1 in intermediates, but in 1977 we will prove that No. 2 really does try harder."

BOURKE



## Thunderbird

Just what was Ford's thinking behind the big change in Thunderbird? The Bird used to be as distinctive a car in its class as the VW Bug is among small cars.

Has the Bird become "just another car?" PM put the question to Charles B. Kitz, marketing plans manager for Ford Div.

Kitz: The answer can be yes or no, depending on how you look at it. The '77 is a distinct change from the Thunderbird of the past. If you go through the history of the car, we went from a two-passenger to a four-passenger and then to a big four-passenger. This is the next step down to a smaller four-passenger—a definite departure from what we've done in the past, so from that standpoint you can say it's a different car.

But most of the features you recognize and expect in a Thunderbird are still there: the hidden headlamps, grille treatment, wrap-over roof, full-width taillamps. There's a long list of things that still say the car is a Thunderbird.

PM: But why change it dramatically so fast?

Kitz: We had two thoughts;

(Please turn to page 93)



KITZ

## What about rust?

Probably Ford's most important not-visible-to-the-eye improvement is its rust-resistance treatment. While no mass-production car is immune, Ford has made a hang-the-cost effort to reduce the possibility of rust. This includes the use of special dips, coatings, sealers, waxes and various ways to prepare the metal prior to painting. On unitized-body cars, a can't-corrode plastic shield is used in wheel housings to keep water and stones from hitting the underside of the fenders and breaking through to the metal.

Such attention to the rust problem can be traced back two years, when critics charged that Ford cars rusted out more quickly than other makes. Not true. What got the company in trouble was a secret warranty arrangement whereby Ford made good and repaired rust if a car owner got nasty about it and persisted. But

owners who made no fuss got the brushoff.

PM asked Ted Harman, of body engineering, if the measures the company has taken to prevent rust on the '77s was in response to that ruckus.

Harman: That's not my department and I can't comment on it. My assignment was to find out if we had a problem and, if so, fix it. I can tell you we are still experimenting with different pre-coated steels to find a more optimum material. If we find something better, we'll use it.

PM: When Chevrolet introduced Chevette last year, GM said the car had the best rust and corrosion protection of any car made in the United States. How does Ford's rust protection compare with Chevette's?

Harman: Based upon our testing, I don't know of any car made in the United States that is superior to Ford in protection against corrosion.



PM's LUND and Ford's HARMAN



## '77 FORD FIESTA INTRODUCED IN EUROPE

The Ford Fiesta was not shown when the Ford Motor Co. presented its 1977 lineup. We had to get these first photos of the European version of the front-wheel-drive mini by catching a preview in Oslo, Norway—one of many in Europe where the Fiesta was introduced country by country before going on sale last month.

Since the United States won't get its version until next April, there's been no show-and-tell by FoMoCo. Ford has to sell the cookies in the window before too many get wind of what's baking in back. We got a whiff of the Fiesta in Oslo and agree that Ford is rightly worried about those Pintos in the window looking stale.

The Fiesta is good-looking, roomy and practical—the smallest car Ford has ever made. The FWD hatchback configuration—a tremendous success story in Europe—will give Ford an edge on the conventional Chevette and, if the price is right, will give cars like the VW Rabbit, Honda Civic and Renault 5 a real run for the money.

We scrutinized three Euro-

pean models: standard Fiesta, the L and the S. There'll also be a Fiesta Ghia. Unlike many low-buck models, the standard Fiesta doesn't look like a plucked chicken.

A walk-around of the car reveals features that first catch your eye: Grille is simple, with five matte-black, horizontal bars; front deck is short (engine is east/west) and visibility is excellent; three-point inertia belts are continuous loop with no metal connectors (like Saab's); three stalks, two on right and one on left of steering column, are used for lights, horn, wipers, squinters and directionals; parcel shelf and grab handles are built in; latch to release fold-down rear seat is simple; cover for luggage is provided; fuel fill (see above) and tank are far forward for safety in rear-end collisions.

Fore and aft the Fiesta looks good. This "world car" is sure to make waves in Europe. But it still remains to be seen how much it will cost and what it'll do with its 1600-cc engine when available for Main Street, U.S.A.—B.H.



Ford Fiesta 1.1 S is a top-of-the-line model in Europe. As evident in front and rear views (above) the three-door hatchback does not have 5-mph bumpers and uses halogen headlights which will be replaced with sealed beams when the U.S. version makes its debut next April. The S version of the front-wheel-drive minicar has extra equipment like console with quartz clock, tach and trip odometer. Standard Fiesta (below), is the basic car as sold in the European market. The 1800-pound Fiesta has a 90-inch wheelbase, overall length about 150 inches. The 1117-cc Four is mounted transversely. Engine for U.S. version is expected to be 1600 cc; exceed 40 mpg.



## FORD PINTO



## FORD THUNDERBIRD



Ford Pinto streaks along with its optional "flip-up moonroof" flipped up. It can be removed entirely also. Another option for '77 is a "glassback," a new rear hatch on the Runabout. It's a huge expanse of tempered glass hinged directly to the body. Standard on all Pinto and L-M Bobcat models are extruded aluminum bumpers.

Ford Thunderbird is an all-new, scaled-down package for '77. Wheelbase is 114 inches (down from 120.4 in '76) and overall length is 215.5 inches (down from 225.8 inches in '76). The 302-cu.-in. V8 double-barrel is standard engine.

Mercury Cougar is new nameplate for the full line of Mercury intermediates (formerly Montego). Cougar Brougham 4-door sedan is shown here with Lincoln-Mercury marketing planner Aaron Ashcraft (center), PM editors Lund and Hartford.



## MERCURY COUGAR

## New aluminum bumpers are weight savers

Along with the other auto companies, Ford has reduced the weight of many of its cars. That's the name of the game this year—get rid of the fat and flab to improve fuel economy. More miles from a gallon of gas. In some instances this has been accomplished by substituting a smaller engine for the big engine used in previous years. That's an obvious way to go and there's nothing very imaginative about it.

But Ford has shown an imaginative approach in the way it has dieted down its subcompacts, Pinto and Bobcat. These cars weight 108 to 160 pounds less than last year. At least half of that savings, about 80 pounds, was taken out of the bumpers.

The '77 Pinto/Bobcat has a one-piece aluminum bumper (13¼ pounds) in place of the chrome-plated steel (43 pounds) used last year. The energy-absorbing device used on front bumpers of the '77s is a hydraulic unit instead of the elastomeric spring used last year.

PM talked with Jim Bernard, a Ford engineer who worked on the bumpers.



BERNARD

**PM: Will the aluminum bumper be as durable as the chromed steel you had last year?**

**Bernard:** More durable in some respects because of the inherent anticorrosion properties of aluminum. Chrome is brighter initially, but aluminum doesn't show the corrosion you get with chrome. The surface of aluminum is anodized; if the bumper gets scratched, there's no rust bleed-through.

**PM: If this is such an improvement over what you've had before, why have you limited it to Pinto and Bobcat?**

**Bernard:** You have to start someplace and this is the first application of aluminum for Ford. Reducing weight was especially important on the smaller cars this year, more so than on the big cars, so we started with the small cars.

**PM: Does that mean you will have aluminum bumpers on the other cars some time in the future?**

**Bernard:** Definitely.

two motivations. The car got smaller and lighter because we want better fuel economy. That's the trend, downsizing. Second reason, there's five to six times the potential market for a car in the intermediate specialty segment as there is in the luxury specialty segment.

**PM: What competitive cars are you shooting at?**

**Kitz:** Primarily Monte Carlo, Grand Prix and Cordoba.

### Variable venturi

We asked Tom Bosworth, Ford engineer, about the new variable venturi carburetor and why it was developed.

**Bosworth:** Two reasons: Precise fuel control throughout the engine speed range, and improved fuel atomization because air is always at higher velocity. This means better drivability.

**PM: Why is the air always at higher velocity?**

**Bosworth:** Because we can infinitely vary the venturi opening, we can position the

air valve—the throttle in a conventional carburetor—under a smaller opening than with a fixed venturi. The smaller opening in turn increases the air velocity.

**PM: How does varying the venturi maintain precise fuel control?**

**Bosworth:** The venturi valve, the part that controls the venturi opening, is attached to a tapered fuel-metering rod, which moves back and forth in a jet. When the venturi is closed, the thickest part of the rod is in the jet, limiting fuel flow. As the venturi valve opens, it pulls the rod out of the jet, increasing fuel flow proportionately.

**PM: Foreign carmakers have used variable venturi carburetors, the best known being the SU side-drafts on English sports cars, for many years. A piston with a tapered metering rod was used as the device that moved up and down to increase or decrease the venturi opening. Piston-sticking and metering rods jamming in the jets are among the problems. How do you expect to avoid some headaches?**

**Bosworth:** We've given a lot of attention to the manufacturing and we think our design overcomes the usual

problems. For example, the venturi valve has a spring that bears against the metering rod to keep it riding against the roof of the jet. It sounds like interference, but it's designed to work that way and it does.

**PM: Your variable venturi carburetor, like others, has no choke plate. Instead you have cranking enrichment and cold-running enrichment systems. Why?**

**Bosworth:** A choke plate restricts airflow and really doesn't lend itself to use with the variable-venturi concept. A conventional choke, however, provides both cranking and running functions and we needed both.

**PM: The old SU setup for cold enrichment was to simply pull the jet out, effectively the same thing as pulling out the metering rod from the other direction, but without increasing the venturi opening. A simple linkage setup, it was prone to sticking and fuel leakage. Were these considerations in your use of a solenoid setup for cranking enrichment and a thermostatic coil-controlled auxiliary metering rod for running enrichment?**

**Bosworth:** Yes, but primarily the greater degree of precision our system gives us.

**PM: What is the future of this carburetor for Ford?**

**Bosworth:** Right now it is scheduled for the 302 V8 and the 2.8-liter V6, California models only. However, we

have manufacturing capability well above what we need for those and the carburetor has flexibility for other V8s.

**PM: How would you rate this carburetor for serviceability compared with a conventional design?**

**Bosworth:** In some ways it's much simpler. The only service problem we're probably going to have is unfamiliarity with air-valve carburetors.

**PM: Are there some quick, easy checks a weekend mechanic can make to determine if the basic carburetor function is good?**

**Bosworth:** Sure. With the engine running, and the air cleaner off, move the throttle to partly open and see if the venturi valve moves. If you have a cold-starting question, feel the cranking enrichment solenoid for a click as the key is turned to crank the engine. With the air cleaner off, you also can check the cold-running enrichment linkage for freedom of movement.

### High-altitude carbs

High-altitude compensating carburetors have been around for several years, but Ford is emphasizing them in '77. We asked Bob Reed of engine engineering why:

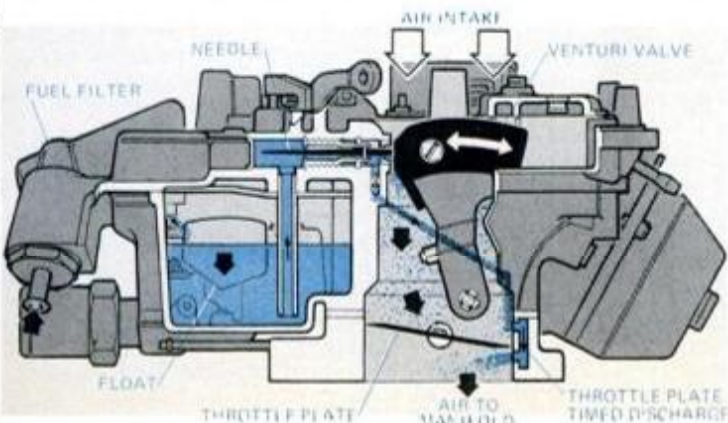
**Reed:** The EPA now requires that anything under 6000 pounds gross vehicle weight sold for use in designated high-altitude areas must meet emission standards when operating at high altitudes.

**PM: What's the problem?**

(Please turn to page 164)



REED



**Variable-venturi carburetor uses a venturi valve in the venturi area of each carb barrel. Valve is linked to a diaphragm controlled by vacuum above throttle plates. On the valve a tapered needle projects into jet, controls fuel flow.**



# CHRYSLER FLEXES ITS MUSCLES AND WORKS ON ITS WAISTLINE

## The XL—not for sale

All automakers are striving to make their cars lighter and smaller. That's the only way to go, the companies say, to meet the tough miles-per-gallon standards the government has mandated for 1978 through 1985. Chrysler agrees with the other auto firms on this, but has a theory that it may be possible to build fairly large cars with a lot of luxury and optional equipment and still comply with the law on fuel economy. Just maybe.

The company has put together an experimental car called the XL (for extra light) to test the theory. The XL is a different kind of lightweight car. The idea wasn't to bare bones the car, strip it, shrink it and put a lawnmower-size engine in it to reduce weight. The goal with the XL was to keep it the same size as a standard Dodge Charger SE, retain the same luxury and drivability while making it much lighter.

PM talked with an engineer, Art Kasper, who worked on the XL. Kasper is supervisor of Chrysler's metallurgy lab.

Kasper: One of the things we tried to prove with the XL is how you can get an

inner-active weight savings.

PM: Inner-active? I don't follow that.

Kasper: The approach used prior to the XL was to reduce weight here and there on individual items. Twenty to 30 pounds on this item, 10 pounds here, 5 pounds on something else. The total weight reduction you can get by this method, by careful redesign of the car, might be in the order of a couple hundred pounds. That's an important savings in weight, but it isn't enough.

After we took off the initial 200 pounds, we looked at substitute materials. By going to new materials, we were able to lop off another 200 pounds. Now we're up to 400 pounds. Then we found we could take off another 200 pounds as a result of this inner-active effect.

Here's how that works: There's a rule that says weight begets weight. As you add things to the car, to comply with government regulations or for whatever reason, you have to add something else, supports or backup components whose sole function is to support the first thing you added. So you get a weight spiral. On the standard SE, for example, as the weight of the car increased, we had to go from a 10 to an 11-inch brake. An 11-inch brake meant the wheel had to go from a 14-inch to a 15-inch. You get a snowball effect. What we did was turn the snowball in reverse. That's what I mean by an inner-active effect.

So where we started out removing 200 pounds from the XL by redesign, we wound up with a total weight

savings of some 630 pounds.

PM: Did you sacrifice anything in durability?

Kasper: That's one reason we built the car. There's no trick in taking weight out of a car. Richard Petty does it all the time. The trick is to take the weight out without sacrificing durability or the luxury features people want when they buy this type of car.

The alternate materials we used are actually stronger for a given weight than the materials they replaced. Take the bumper, for example. The standard bumper is .00105 inch thick and has a strength of 30,000 p.s.i. (pounds per square inch). The bumper on the XL is a special heat-treated steel. It is .00075 inch thick—so we went from .00105 to .00075 in thickness—and it has a yield strength of 100,000 p.s.i. So the new bumper is more than three times as strong as the bumper it replaced.



BUTTS

## The future

Chrysler has improved the torque converter on '77 cars equipped with automatic transmissions. There's a certain amount of slippage of the converter and the slippage takes a toll on fuel economy. Chrysler has tightened the slippage on the new cars to give better gas mileage and reduce noise from the engine.

George F. Butts, v.p. of product planning and development, told PM the low-slip torque converter used on the '77 cars is a step

toward an even more efficient converter on the '78 cars.

"In 1978," Butts disclosed, "we will have a lock-up torque converter on all automatic transmission cars."

Butts foresees "full electronic management of the engine as we look toward 1980." He looks for most of the hardware put on cars to control emissions during this decade to disappear. The hang-ons will give way to modular devices, so if something goes wrong, the mechanic can pull out the complete unit and replace it with a new unit.

"The experience we will get in 1977 with ESA (electronic spark advance) is going to be very helpful to us as we do our surveys and research on what happens to this type of equipment in the field," Butts says, "and as we move to additional electronic controls we are working on for the future."

Chrysler is doing "everything we can" to reduce maintenance and operating costs on its cars, Butts declares. "The cost of operating a car has gone up at an alarming rate. Gasoline, oil, labor, replacement parts, insurance, upkeep and everything else keeps going up. We are concerned about this and we are working in many areas to reduce maintenance and operating costs for people who buy our cars."

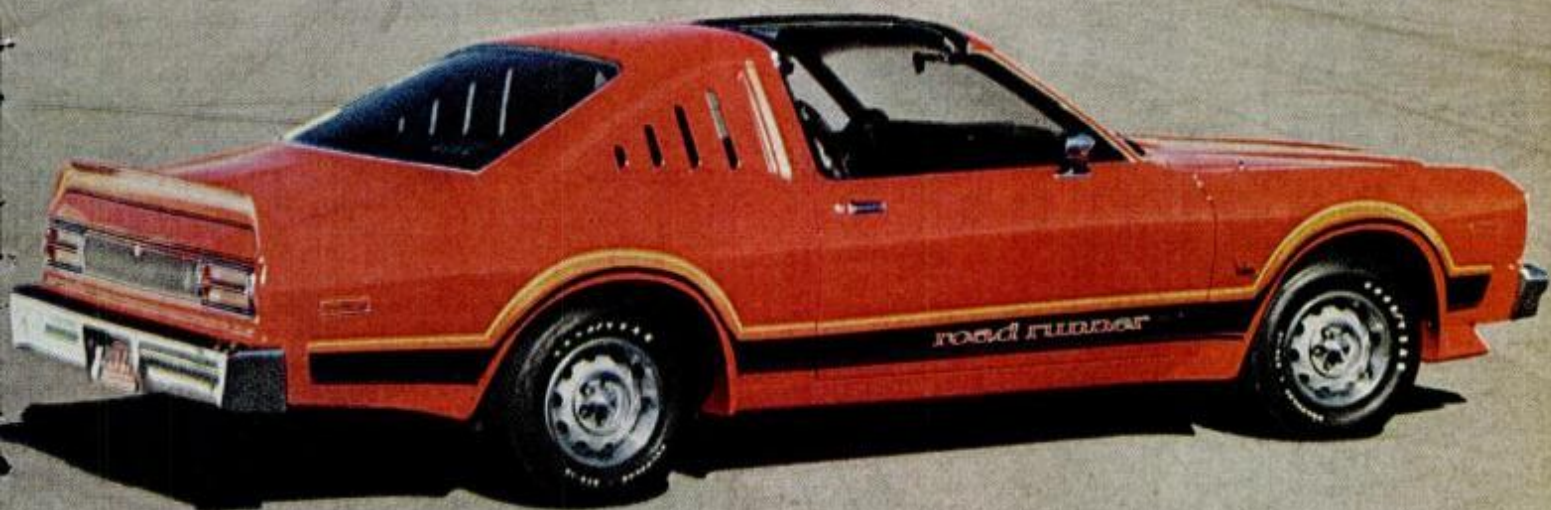
## Regulations

The auto companies have less and less freedom in reworking cars one year to the next. Any major change affecting engines, emissions, safety, miles per gallon, new car warranties, serviceability, vehicle weight and size must be cleared with the government or with an eye to how the

(Please turn to page 169)



PM's LUND and Chrysler's KASPER



PLYMOUTH VOLARE ROAD RUNNER

Road Runner is right on the money if, indeed, "the muscle look is coming back"—the conviction of Bob McCurry, Chrysler's group vice president of U.S. automotive sales. Performance image is bought by ordering Super Pak package. New engines top out with 360 V8. V8 Volares get 20-gal. fuel tank, up from 18.

Monaco Brougham has 400-cu.-in. lean burn V8 as standard. Expanded for '77, the computer-controlled lean burn fuel-delivery system can be ordered as option with the 318, 360 and 440 engines.



DODGE MONACO BROUGHAM

## FAMILY CARS OF THE FUTURE

Definitions of car sizes—mini, subcompact, compact, family-size, full-size—are changing. Every automaker has his own definition of what constitutes small, medium and large, and no two companies agree inch for inch, pound for pound.

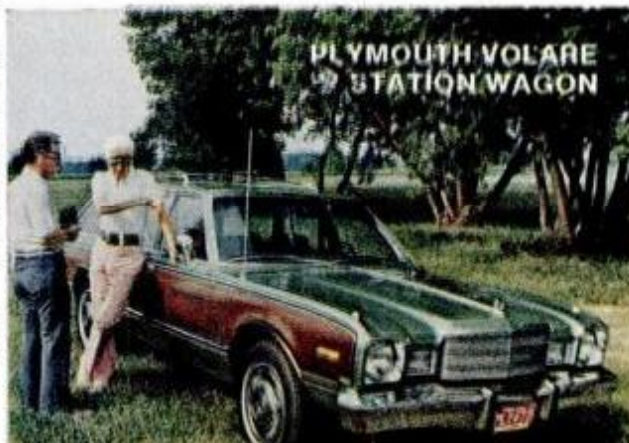
Charles Kelley, manager of compact car planning for Chrysler, believes that by 1978 the standard or full-size car will be no larger than the '77 Plymouth Volare.

"I'm not saying there will be complete unanimity in the industry on the different size designations. It could take four or five years for the definitions to change. There's going to be some confusion over the next few years as cars are re-sized. But Volare-size cars will be the new family-size cars of the future."

**PM:** As cars are downsized, will they be as rugged as the larger, heavier cars they will replace?

**Kelley:** They will be as rugged and durable as any big cars that have been built in the past 25 years. Engine components, drive train, transmission and axle will be just as solid and rugged as any big car. Downsizing does not mean downgrading.

PM's LUND and Chrysler's KELLEY



PLYMOUTH VOLARE STATION WAGON

**PM:** As cars become smaller and the engine compartment shrinks, what's going to happen to all the stuff crammed under the hood? Will you have to find new places on the car for some of the things now housed in the engine compartment?

**Kelley:** Not with this (Volare) size car. There is adequate room in the engine compartment for anything you want to put on the car. But it may be necessary to take some of the things out of the engine compartment of the small cars as they become even smaller.



# AMC PACER STATION WAGON IS A STYLING COUP!

## Pacer wagon

Our first reaction to seeing the Pacer station wagon was, "Who needs the coupe!" It's a very pleasing design, and, by comparison, the coupe looks like a box turtle. We spoke to Dick Teague, vice president, styling for AMC, about the new wagon.



TEAGUE

**PM:** Were there any special problems you had in making the wagon out of the coupe?

**Teague:** No, it was the simplest make-from I've ever been involved with. The wagon is identical to the Pacer coupe, of course, from the B-pillar forward. From the B-pillar aft, we stretched *not* the wheelbase but rather the rear overhang by four inches. It's a different roof, new quarter panels, and the full-opening rear hatch lifts clear from the top surface of the bumper.

When you get the hatch opened up and the seat folded down, you've got 47.7 cu. ft. of cargo space. That compares with the Pacer coupe's 29.0 cu. ft., so it's about 50 percent more. The wagon is easier to load and unload, although the coupe is darn good, too.

**PM:** Did you decide somewhere along the way to introduce the coupe before the wagon?

**Teague:** We had the wagon in mind for the original concept of the Pacer. As far as derivatives, the wagon was

just one that we looked at. We looked at everything from four-door Pacers to pickup Pacers.

**PM:** What do you think the Pacer wagon will do to coupe sales?

**Teague:** I really don't think it'll do that much. It might touch both of them to some degree, but it's a different kind of car.

**PM:** Is the price difference that much?

**Teague:** Prices haven't been set yet, so even if I were lying on the couch with sodium pentothal coursing through my veins I couldn't tell you. I simply don't know. It'll obviously be a little more than the Pacer coupe. Wagons always are.

I can tell you the weight difference, though. For the bicentennial year, it's 76 pounds heavier than the coupe. And a lot of the rumors that were floating around that the Pacer wagon was going to weigh 200 pounds more than the coupe—well, that's just not true. It's 76 pounds, which is generally lighter than most wagons vs. two-doors.

This car was done before the weight crunch—before weight was that much magnified as a super economy consideration . . . because the Pacer itself was done about five years ago. The wagon was done about 2½ years ago, and we're very, very conscious of weight now, and we're able to incorporate some of that concern into this car. That's why it's 76 pounds instead of 125 or more. But it's a very difficult thing to

get weight out of a car once the car has been laid out and designed.

**PM:** Did the wagon turn out aesthetically as you wanted it?

**Teague:** Yes. We didn't want to make a huge, cumbersome, trucklike wagon out of the Pacer. The glass area is real good, and, not because it's the newest, but I prefer the wagon to the coupe.

**PM:** Can you give us an idea of what the tooling on this wagon cost, and would you compare that to what it would cost to tool up the wagon from scratch?

**Teague:** It ran in the area of \$12 million for what we did to convert the Pacer coupe to the wagon.

**PM:** And if you'd started from scratch?

**Teague:** Twelve million plus another \$40 million, so I'd say in the neighborhood of \$52-\$54 million. We spent \$52 million on the coupe. It wouldn't be a great deal more expensive than that to tool the wagon if we didn't have the coupe.

In all, the coupe came to \$60 million; \$52 million was the tooling and \$8 million was associated expenses. It's an expensive game to be in. We probably count our pennies closer than anyone else, but there's no really cheap way, you know. There are shortcuts, but basically it's an expensive game. I don't think the person who buys a new car even dreams that it costs \$600,000 to tool a hood and that a pair of doors is \$3.5 million.

## Small cars

We spoke to Marvin Stuckey, vice president, Product Group and asked him what AMC is proudest of in its 1977 line.



STUCKEY

**Stuckey:** In the passenger-car lines, the significant changes will be the Pacer wagon; also major body changes on the 1977 Gremlin; also the new Hornet AMX hatchback coupe.

**PM:** Were there any problems changing the Pacer coupe into a wagon?

**Stuckey:** No, there really weren't.

**PM:** You had plenty of lead time?

**Stuckey:** Yes, we knew we were going to do it—not necessarily as the final program, but we knew that this was a desirable thing to do. So as we went into it, we wanted to provide for the capability to do it, with the result that the decision was made to add this model. It wasn't a difficult task. The package we ended up with was exactly what we wanted, and we were able to retain the coupe's characteristics with no compromise. What turned out is a pretty pleasant package overall.

**PM:** You mention that you see the wagon segment of the market growing in the smaller range of cars. To what extent?

**Stuckey:** As you look at selected smaller-sized cars, you find that wagons will run 35-40 percent of the total car-line market. This is certainly true in the Hornet line, and I think it's true of others also. As you look at compact sizes on down, wagons are a very popular body style.

In some cases it might be a misnomer to call them pure wagons as such. They're cars with sizable cargo capacity and really very pleasant people packages.

**PM:** Even the Pacer coupe seems to be part coupe and part wagon. For 1977, what are your production plans, coupe vs. Pacer wagon?

**Stuckey:** I don't have specific numbers at this point. We'd start out early in the year heavily slanted toward the wagon in order to get the full distribution system supplied with wagons. But once we go beyond that point, which is several months away, we have the flexibility to build either model with essentially no limitations. I personally am very pleased with the wagon and think it'll do extremely well.

**PM:** What effect will the Pacer wagon have on Sportabout sales?

**Stuckey:** I don't believe it'll really have a significant effect. As we see it, it is somewhat of a different kind of vehicle. The Pacer wagon is, of course, a two-door. The Sportabout has four doors.

There are some similarities, sure. Any time a car manu-

*(Please turn to page 176)*





**PACER D/L STATION WAGON**

Pacer station wagon in Levi's trim is as practical as it is striking in its design. The wagon, shown here with styling chief Dick Teague (right), is 174 inches overall, 4 inches longer than the coupe. Capacity is 47.7 cu. ft. and the tailgate extends right down to the rear bumper for low liftover.



**CHEROKEE FOUR-DOOR**

Cherokee with four doors is new to the Jeep lineup. In the words of Dick Teague, the Cherokee was "only tickled a little" in its appearance for '77. The four-wheel-drive is the two-speed Dana 20 unit or full-time Quadra-Trak. Base engine is 258 Six again, but with two-barrel carb instead of last year's single barrel. The 360 V8 and 401 V8 are optional powerplants.



**HORNET AMX**

Hornet AMX model has stainless-steel targa bar and backlight louvers (right), also chin spoiler and blacked-out grille (above). Bumpers are urethane. Hatchback AMX engine is 258-cu.-in. Six, with 304 V8 optional. Front discs are standard; transmission four-speed manual or automatic.



**GREMLIN X**

Gremlin changes include new sheet metal from windshield forward and (left) larger backlight with lower liftover for tailgate. Car weighs essentially the same as last year—a source of pride to engineering v.p. Tom Walsh: Weight was reduced enough to offset increases from new hardware added.





CHEVROLET CAPRICE CLASSIC



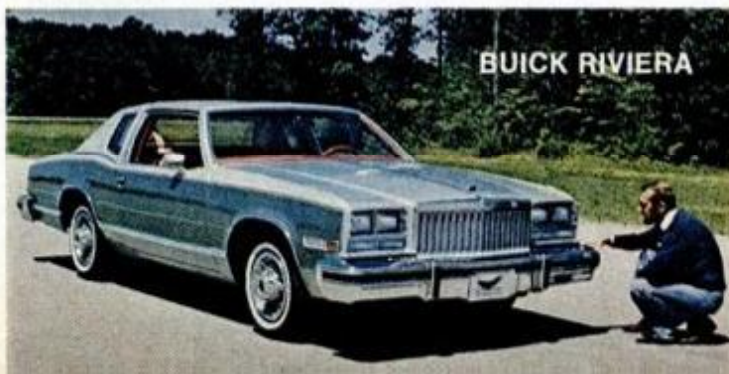
OLDSMOBILE CUSTOM CRUISER



BUICK LeSABRE



General Motors' new generation of family-size cars is shown here in two-door coupe, four-door sedan and station wagon models. The 1977 full-size cars from Chevrolet, Pontiac, Buick and Oldsmobile are lighter and scaled-down in dimensions from their '76 counterparts. The cars were engineered from the ground up to be lighter and therefore more fuel-efficient, and were designed to be smaller outside, but just as big inside—in passenger compartment and trunk. A measure of the project's success is illustrated comparing the 1977 four-door Pontiac Catalina to the '76 model: It's 738 pounds lighter, 12.2 inches shorter, 3.5 inches narrower on a wheelbase 7.5 inches shorter. On the inside, front and rear headroom and legroom are all within fractions of an inch of last year, and mostly on the plus side. Luggage capacity is up 1.5 cu. ft. With weight saved, base engines in the cars can be fuel-saving Sixes—in-line 250 for Chevy and 231 V6 for Pontiac, Buick and Olds. Two-way tailgate (left) replaces clamshell design on station wagon models.



BUICK RIVIERA



Riviera returns to simpler, more classic lines for 1977. The all-new personal coupe, 700 pounds lighter and five inches shorter, has a new, four-wheel disc-brake system as an option. The standard engine is Buick's 350-cu.-in. V8.

# GM BEGINS ITS 'BILLION-DOLLAR CRAP GAME'

## New big cars

Big cars! Get 'em while they last! 1976 was the last year for new-car buyers to get a GM full-size that wouldn't fit in the old garage. And big-car buyers made '76 a boom year.

That's why General Motors—used to annual outlays of only \$200 to \$300 million—is referring to its \$15 billion new-car program as a "billion-dollar crap game." The result will be cars that are shorter, lighter and more fuel-efficient. But will the cars still be "Detroit iron" to the faithful when hoods are aluminum (as some are this year) and more and more parts are lightweight plastic?

The first of the re-engineered GM cars are the full-size Chevrolets, Pontiacs, Buicks and Oldsmobiles, shown opposite and on the following page. While the next months will tell if the big-car boom will continue, the last months, long and hard ones for GM engineers,

were spent bringing the little big ones to market. We asked Lloyd Reuss, chief engineer at Buick, about having to meet a weight goal as dictated by the corporation.

**PM:** What was the starting point for the design of the full-size Buicks?

**Reuss:** We simply said, let's design these vehicles with a major emphasis on efficiency.

We are going to use more efficient materials so when we get all finished, we have efficiency of operation along with efficiency of design.

We're getting the same capabilities as far as what the customer can do with the car, and yet we're doing it with a very lightweight package and a minimum amount of materials. So in our LeSabres and Electras we've been able to provide the necessary interior room for six



REUSS

full-sized people while actually improving luggage space.

We're doing this and still are providing a comparable level of performance and silence, plushness, and good handling—doing all of this with a very appreciable improvement in fuel economy. We're meeting this objective of providing operational economy by literally taking weight out of the vehicle and yet not removing any value. That's an important point.

**PM:** The weight saving has allowed you to use the 231 V6 engine as the base powerplant in the LeSabre, and we were impressed to have gotten 22.7 mpg driving the car on the proving grounds economy run. Turbocharged, it powered the Indy pace car this year. Is economy or performance the engine's strength?

**Reuss:** Neither. It's versatility and flexibility. We think the V6 is actually the engine of the future. We can't talk about everything we're planning, but we'll be exploring every possible application and derivative of this engine taking advantage of the versatility that the basic package offers. It'll have wide usage in our '77s and is playing an important part in our '78 and '79 product plans.

## Full-size models

At Chevrolet Division we spoke to Bob Lund, Chevy General Manager, who is enthusiastic about the full-size models: "You can change the

## New GM radios



It's AM/FM and CB, all in one, and the channel display is digital. In automatic mode, the radio plays until you pick up a CB signal which then comes in over the stereo speaker system.

Another radio option is a digital clock combined with AM/FM stereo. Depending on mode, digital readout shows time, frequency, day and date, and elapsed driving time.

size of cars, but you can't change the size of people. We've designed these '77 cars for people, and we've got more comfort, more convenience, more room in these cars—including trunk room—than we had in our '76 cars. As a matter of fact, the '77 Impala has more room than our major competitor's '76 full-size cars, which they'll carry over to '77."

Chief engineer on the Impala and Caprice, Tom Zimmer, provided an insight into the details of the new car's design.

**PM:** Is the backlight on the two-door coupe unique to Chevy?

**Zimmer:** Yes. The other di-

## 'When you get in these cars, you won't know we took any room away . . .'

That's how William L. Mitchell, GM Vice President of Design, feels about the new full-size cars, and he feels it strongly:

"These aren't small cars . . . you feel that when you get in and out of them. You haven't lost anything. We had to watch the interior dimensions. On the Seville, for example, we had to make sure that the guy buying a Cadillac didn't feel he was losing anything. It was a pretty tough problem. We had to give up some of our pet design features like tumblehome and body turn up. We had to dehydrate the



MITCHELL

car. We brought the body in tighter to the wheels, so the overall width was cut down some five inches, length down 14. This resulted in nearly a 1000-pound lighter Cadillac.

**PM:** Did the Seville have an influence on the design of the new full-size cars?

**Mitchell:** Yes. The Seville was done before any of them. It's got the sheer look which we had to go to to get the fat out of the car. That's the way we sharpened the car and gave it crisp corners. We re-engineered our full-size cars first, of course, to boost our average mpg figures to meet federal standards. We at GM have a greater line of full-size cars than anybody else in the industry, so we knew that we'd have to get going on

the heaviest cars first.

**PM:** Which car—Chevy Pontiac, Buick or Olds—was done first?

**Mitchell:** The first car done was the Chevrolet as it always is. It's a high-volume car. We really all worked together in the design center, with a coordinator working with the chief engineer of each division. Of course, we made the body bucks right here and all the cars were modeled here at the corporate Design Center.

**PM:** How do you feel about the new station wagons?

**Mitchell:** In the station wagon we had to give up one feature that I'm very fond of, and that, of course, is the clamshell tailgate. You need a lot of curve in the lower and upper to have it swing down. That's a pen-

alty from the reduced overall length. By shortening the car, we had to go back to a two-way tailgate.

Let me say, driving these cars—and I'm no engineer—is really an experience. We think the sheer look is going to go over great. But it's the efficient handling and tight feel in driving them that's really tremendous. This is especially magnified in the wagon. You no longer have a wagon that swings and sways going down the road. These cars go as good as they look. You're aware when you're driving that there's not too much weight or overhang. I think that necessity is the mother of invention. We had to do it—go smaller—and in doing it we got a better automobile.



Pontiac Bonneville two-door hardtop coupe is on a 115.9-inch wheelbase. Overall length is 213.8 in.; width, 75.4 in.

visions have two-door coupes on the full-size body, but our wrap-around backlight is unique to the corporation.

**PM: Is the backlight formed from a single sheet of glass?**

**Zimmer:** Yes, there's a filament in the glass where we want the bend to be. Electricity is run through it which heats the glass and the bend is made. In the process the filament diffuses and causes the black line you see at the bend in the backlight—but that's really part of the aesthetics. It just doesn't look that good without the line.

**PM: Were there any major problem areas in engineering this car from the ground up?**

**Zimmer:** Yes and no. There were the normal problems that relate mainly to federal safety standards and so on. But we probably circumvented more problems—problems that we encountered in previous programs—because of the computer graphics technique we call finite element analysis. This is the first time we've employed the technique

to analyze a car design before a commitment to hardware. We used it to diagnose structural problems with the Vega and used it to come up with an after-the-fact patch, but it wasn't used in the initial design. What we accomplished with the Impala using finite element analysis is quite amazing even to us who did it.

**PM: When did you complete the first prototype?**

**Zimmer:** November 1975. We were pleasantly surprised with the level of performance of the vehicle. It didn't have the kind of problems we had in the past, it didn't shake anymore.

**PM: Just how responsible was Chevy Division for Impala styling?**

**Zimmer:** There are two halves of the car at General Motors because Fisher Body makes the body for us and we're responsible for the front-end sheet metal—even to the extent that Chevrolet buys the forward piece of a side molding from one vendor, and Fisher body buys the rest of it that runs along the side of the car from a different vendor!

That's how parochial we are, and how much we protect

our own kind of parts, and that has to do with divisional profits and so on. In any event, we, my people, are responsible for the complete design of the front-end sheet metal of the vehicle. Since the front-end sheet metal is an add-on, you're always concerned with the structural integrity. Ride this car and you won't notice any sheet-metal shake, and it is quiet—not because we put in any more acoustical material to deaden the sound, because the contrary is true. We took acoustical material out relative to '76, because structurally the vehicle is so much better.

**PM: What size fuel tanks are in the new body?**

**Zimmer:** The tanks are five gallons smaller—21 gallons against 26 last year. But you have to put that into perspective: You look at tank range for a given base engine (the 250-cu.-in.Six). Then you keep the tank range up where it belongs and don't worry about what tank size.

### Metrification

Putting a car together takes a lot of fasteners. We talked about the metrification of these parts with Paul King, Chief Engineer, Passenger Car for Chevrolet Motor Division.

**PM: 1977 is the first big metric year for General Motors. What are some of the major pieces of metrification?**

**King:** All GM "B" bodies, such as our Impala and Caprice, which have been downsized will have bodies with metric fasteners. Of course most of the driveline fasteners will be English (SAE), except for those cars with the 200 Turbo-Hydra-Matic. That is an all-metric transmission

that was introduced last year on the Chevette, which is very close to an all-metric car.

**PM: What are the guidelines for when you use a metric and when you use an English (SAE) fastener?**

**King:** Any fastener that attaches to an existing piece of hardware is English. Where a new part attaches to a new part, we do it metrically.

**PM: Doesn't a mixed bag arrangement figure to be somewhat confusing?**

**King:** We're in transition, so that's true.

Even the Chevette has some English fasteners. For example, the Delcotron and its attachment to the bracket are English, but the bracket-to-engine attachment is metric.

**PM: What '77 "B" car fasteners will be metric and which will be English?**

**King:** We have a list of more than 80 areas that will continue to be English on the "B" cars. In general, the drivetrain components, brakes, steering and part of the suspension are English on the "B" cars. It's the bodies and chassis that have metric fasteners. And remember, there are metric fasteners in some applications on all '77 GM cars.

**PM: How can one tell which is metric and which is English (SAE)?**

**King:** For 1977 all metric bolts will have a bolt strength number on the head, and nuts will have a number on the face. Any blue coloring on metric fasteners is strictly for assembly identification and metric fasteners will not all be blue. So you've got to look



KING



ZIMMER

## Here's a scorecard to tell 1977 GM engines from their predecessors . . .

■ **151 Four** used on Pontiac Astre and Sunbird. This belongs to Pontiac now, but until 1970 it was a 153-cube Four used on the Chevy Nova. Pontiac engineers gave it a



complete overhaul and lightening, and gave it a bore and stroke that match the 301 V8, so it can use the same pistons, connecting rods and rings. Engine keeps its English (SAE) nuts and bolts.

■ **301 V8**, available on Buick, Olds and Pontiac. It's a cut-down version of a Pontiac 350 V8, not to be confused with 350 V8s also made by Buick, Olds and Chevrolet.

■ **403 V8**, also available on various B-O-P cars, is a rebored version of Olds 350.

■ **350 V8s**: Here's where it gets confusing, and there will

be Buick, Olds and Pontiac 350 V8s again in 1977. Each division will use its own 350 V8, but Buick and Pontiac will apparently install the Olds 350 in California and high-altitude areas. If you want to measure bore and stroke, Buick is 3.80 x 3.85, Olds is 4.057 x 3.385; and Pontiac is 3.876 x 3.75 inches. Chevy's 350 is its own. Chevy's 350 V8 is a fuel-injected Olds.

■ **400 V8**: Pontiac.

■ **425 V8**: Cadillac's, cut from 500 cubes.

■ **231 V6**: Buick's own, fol-

lowing the buyback from American Motors a few years ago. Olds and Pontiac buy it for many models.

■ **400 V8**: Pontiac's own.

■ **140 Four**: The Vega powerplant. Pontiac also offers it on the Astre and Sunbird, but with the 151 Ford now available, clearly won't be pushing it too hard.

■ **250 Six**: Chevy.

■ **350 V8**: Chevy.

The down-sizing of the full-size cars make them lighter than the intermediates, so you'll see the smaller engines on many models.

## GM service tips

■ **Sparkplug replacement** interval of 22,500 miles on GM cars may be increased to 30,000 for some models. GM already has certified the '77



California Chevette, all '77 Cadillacs except California and is trying for others. Check dealer for latest certifications.

■ **All '77 GM "B" body cars** (The down-sized group) will incorporate three major serviceability improvements:

■ **The dashboard gauges, switches and radio** can be serviced from the driver's seat. Bezels are held by accessible screws and spring clips, and once they're off, everything can be removed from the front.

■ **Two test sockets**, introduced for general electrical-ignition and airconditioning electrical on the 1976 Chevette, will be used. The general electrical-ignition socket is of particular interest to Saturday mechanics, who can probe its terminals with a

voltmeter or test lamp. A special tester for both sockets is available, priced at about \$100.

■ **The heater and air conditioner** are combined into a single module that has an underhood cover you can remove with no difficulty. There are lots of screws to take off, but all are accessible, and once the cover is out, you can easily replace a leaking heater core, normally an impossible job for Saturday mechanics.

■ **GM's new fuses** take up a lot less room and, because the metal link is sealed inside plastic, are less subject



to vibration failure. However, unless they blow quickly, which causes some discoloration of the plastic, you must pull a fuse to see if it's good. The new fusebox, above, is about the same size as the old, but holds 18 fuses instead of the previous 11.

for the numbers as well.

**PM: Have you done anything to reduce the in-the-field problems?**

**King:** GM has handbooks of preferred fasteners, and the engineers are told to specify these standard fasteners wherever the design will allow it. The dealers get a list of standard fasteners and are expected to stock them.

**PM: How about foreign car sources for fasteners?**

**King:** No. The metric system is not standardized on fasteners. GM and other North American industries are using the ISO (International Standards Organization) sizes, which are expected to become the world standards. But now there are some significant differences between ISO and European or Japanese parts. Not all imported metrics have the same thread pitch for a given size.

**PM: To some degree a Saturday mechanic can get around the metric availability problem with a nut and bolt by just replacing with both an English nut and bolt of a size that will fit through the hole. But he will face a problem in many cases.**

**King:** Yes, he can replace the nut and bolt in some cases, such as in an exhaust system. But many bolts and nuts have to be serviced specifically. If you lose one, you just can't pick a bolt off a shelf. For example, a door striker bolt has a special shoulder, it may have a sleeve, and it's a specific part that is involved in crash-worthiness. We're confident that we'll have the metric fasteners in stock at the dealers, and that will be the best source for the present.

## Fuel economy

In 1976, car buyers appeared not to be concerned with fuel mileage, as evidenced by their swing back to big cars. Why should they worry? Uncle Sam is worrying for them: It's the government who dictated mpg standards to the manufacturers (18 mpg in '78, 19 in '79, 20 in '80 and up to 27.5 in '85).

On the subject of fuel economy, we spoke to Hugh Miner, Senior Project Engineer, Fuel Economy Development, Buick Motor Division.

**PM: Your new Buick LeSabre with the V6 and the Highway Economy Package is expected to get EPA highway numbers approaching 25 mpg, and even PM tests produced 19 mpg in secondary highway**



MINER

**operation. What did you do to the engine to get these results?**

**Miner:** Of course the down-sizing of the cars improves fuel economy even with the base LeSabre, but this package should do 1.5 to 2 mpg better than that. The carburetor is calibrated slightly richer, we put in more vacuum spark advance and we recalibrated the exhaust gas recirculation to match the new carburetor and spark advance. Remember, we're trying to do two things: pass emissions first and still get fuel economy.

**PM: You recalibrated carburetion richer for better gas mileage?**

**Miner:** Yes, for emissions reasons our base carburetion is on the lean side and that hurts fuel economy.

**PM: But you're still meeting emission regulations with the Highway Economy Package?**

**Miner:** Yes, but we're de-

signing closer to the limit. We're holding tighter tolerances, which is some of the reason for what will be a higher price. Also, this is a limited production option which we're projecting at perhaps 10 percent of V6 sales. As such, it doesn't present major production control problems. It's also valuable as an experience and in another year we might learn enough to go with greater usage of components in the package.

**PM: Is it all recalibration under the hood or is there new hardware?**

**Miner:** The only hardware is a vacuum advance modulator, which reduces the vacuum advance at idle. In order to get the amount of advance we need for economy at other throttle positions we were overadvanced at idle and we had some light detonation without the modulator.

**PM: What modifications were made for next year other than engine were made?**

**Miner:** On the transmission we put in a tighter torque converter to reduce slippage. That alone represents 0.3 to 0.4 mpg. We changed the transmission vacuum modulator and some valve body springs to get the transmission upshifted at lower car speed. There is a few miles-per-hour reduction in upshift speed throughout the range. The rear axle ratio is down from 2.73 to 2.56, and that alone accounts for about a half mpg on the highway.

**PM: What about performance, compared with the standard V6 LeSabre?**

**Miner:** There's less than a second difference 0-55 mph,

*(Please turn to page 180)*

## Caddy tech brief

The increasing use of in-car electronic communications, CB and telephones, plus the widening use of automotive electronic controls, has put a premium on interference suppression systems.

If an original equipment system isn't serviced carefully, or if an aftermarket system is not fitted with the necessary suppression, major problems can result, according to Bob Templin, chief engineer of Cadillac, whose division has GM responsibility on electromagnetic components.

With inadequately suppressed electronic fuel injection, he points out, a powerful transmitter in a car stopped alongside, such as at a traffic light, could stall the engine. This won't happen with a standard CB, he says, "but some of these guys have booster amplifiers that go up to 500 watts.



# Solution to your stickiest repair problems

Think you know tapes? Here are some with new or unexpected uses you'll find helpful around the home.

by Penelope Angell

**A**s new tapes are developed and new applications for existing ones found, more and more homeowners are turning to tapes to solve their repair problems. And for good reasons: Tapes are handy, easy to apply, do a remarkable number of jobs, present no messy cleanup problems and are generally inexpensive.

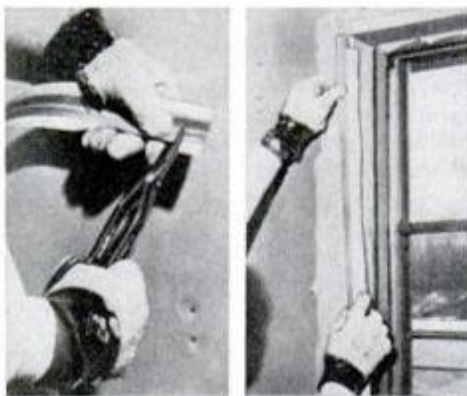
There are the old reliable standbys—plastic electrical tape, medical adhesive tape and cellophane (Scotch) tape—that are probably used more around the house than any other types. But there are also a lot of less familiar, more specialized tapes that have many important household uses. Here's a rundown on more than a dozen of the most versatile with suggestions for some useful applications you may not have thought of.

## Special drywall tape

Flex Corner drywall tape helps make clean inside or outside corners. The tape has two 1/2-in. galvanized-steel reinforcing strips that are placed on either side of the corner to form and reinforce the angle. Flex Corner can be cut to length and applied with a standard three-coat, cement compound process (metal strips facing toward the wall), the

same as with perforated tape. However, Flex Corner has the strength to prevent the seam from opening.

Drywall tape can also be used to reinforce joints, finish curved surfaces and arches, join drywall par-



**Cut the drywall tape** or score with a knife and bend, fold it in half and press over joint cement. Later, apply the finish coats and feather out the edges.

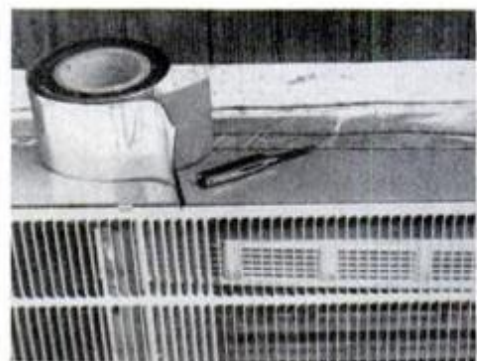
titions to plastered walls and repair chipped or cracked plaster walls. Goldblatt Tool Co., 511 Osage, Kansas City, Kans. 66110.

## Aluminum-faced tape

Flashband, an aluminum-faced tape with a layer of self-adhesive

asphalt, helps seal and waterproof your home. It is flexible enough to seal gutters, downspouts, irregular-shaped metal flashing, airconditioners, heating ducts and the like. Flashband is also available with a gray vinyl coating over the aluminum for situations where the aluminum might corrode (such as in a cabin at the seashore). Both types can be painted with water-base paint and can be purchased in 20-ft. rolls, ranging from 2 to 9-in. widths. The aluminum-faced type also comes in a patch pack.

Flashband was developed for use by professional roofers and has many roofing applications, but can



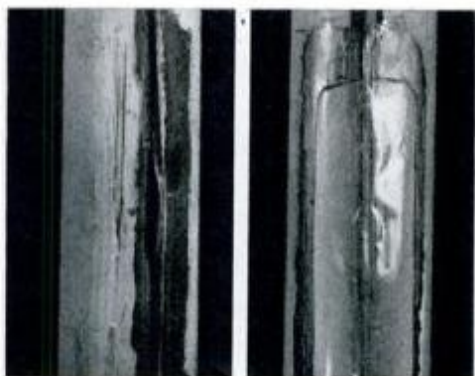
**Flashband self-adhesive tape** is a permanent sealant for this airconditioner.

also be used to repair swimming-pool covers, garden equipment, awnings and aluminum siding. Evode, Inc., 401 Kennedy Blvd., Somerdale, N.J. 08083.

### Fiberglass repair patch

A fiberglass cloth patch that cures in the sunlight or when exposed to an ultraviolet lamp has many applications around the home. The "Auto-Pak" lay-it-on body patch is made by 3M. A patch cut to cover the damaged area adheres on contact and hardens to make a permanent, waterproof repair when subjected to the proper light. The top covering is peeled away and the patch can be sanded and painted to match the color and finish of the surrounding surface. The patch repairs metal, wood or fiberglass surfaces.

As its name implies, the "Auto-Pak" patch was designed to be used on cars—to repair rust-outs. But it is also helpful in repairing cracked fiberglass shower stalls and laundry sinks, wood or metal gutters and downspouts, plus many other damaged wood, metal or fiberglass surfaces.



This downspout damaged by expanding ice was repaired with an "Auto-Pak" fiberglass patch which cures in the sun. It is invisible when covered with paint.

### Keep pipes from freezing

This "Heater Tape" from Smith-Gates is used to eliminate frozen water pipes. It is a heating wire wrapped around a glass-fiber core and encased in a vinyl jacket. The tape can be equipped with an automatic "Press-to-Test" thermostat as shown and a pilot lamp that lights when the tape is heating. The length of Heater Tape needed depends on the pipe size, length and lowest temperature expected. For example, according to the Heater Tape chart a 1-in.-diameter pipe 10 ft. long would need 15 feet of tape (wrapped three times per foot around the pipe) to keep it from freezing at 11° below zero. An additional fiberglass blanket with outer wrap for extra protection is available. A waterproof cover can

also be purchased. Smith-Gates Corp., Farmington, Conn. 06032.



Flexible Heater Tape is wrapped around a pipe to prevent it from freezing.

### Seal threaded pipe joints

Wrap Chemplast Ready-Seal Thread Tape around threaded pipe to insure a leaktight joint. It is made of soft, pliable Teflon that conforms to any type or size of thread. It also seals hose fittings, sprinklers, nozzles and fire extinguishers. Chemplast, Inc., 150 Day Rd., Wayne, N.J. 07470.



The Teflon tape is wrapped around male pipe threads to lubricate and seal.

### Experimental concrete patch

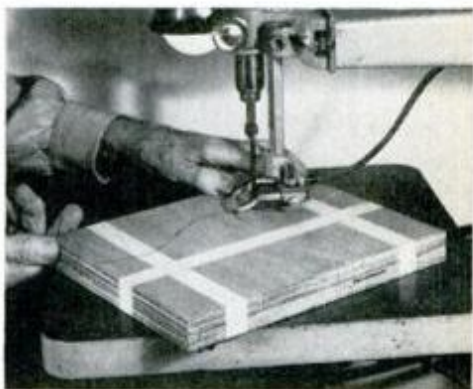
A wide range of concrete repairs will be possible for the homeowner with Rok-Rap, a tapelike material still in the experimental stages. Manufacturers propose that it can be used to patch concrete basement leaks, protect pipework and posts from corrosion both above and below the ground, repair spalled concrete, join and repair concrete pipes, face concrete structures and solve other problems. The tape is activated by wetting with a special activator or cold water. After drying out, the tape forms a dry, rugged rocklike, but resilient, protective covering. Evode, Inc., 401 Kennedy Blvd., Somerdale, N.J. 08083.



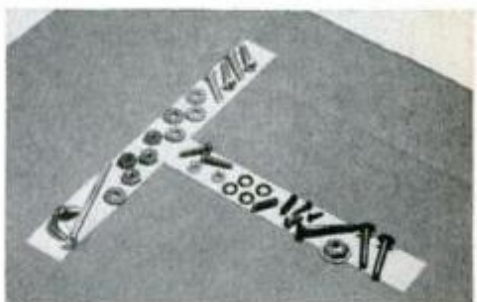
Rok-Rap is used to patch a basement crack where water was seeping in.

### Tape 'staples' with many uses

Saw duplicate shapes in one operation. Join two pieces of wood together with Mystik masking tape. Then saw the pattern marked on the top piece through both pieces. Also use masking tape to cover trim while you're painting around it, and to wrap around plumbing fixtures to protect them from wrench marks.



Masking tape is wrapped securely around boards at right angles to stop shifting.



Masking tape used sticky side up holds small parts in place until they are needed.

With masking tape you can also keep small parts in order and in

(Please turn to page 188)

# How the new instant-picture cameras compare

by Ivan Berger PHOTOGRAPHY EDITOR

**T**he biggest news in photography this year is Kodak's new instant-picture system. Pop in a 10-picture pack, and each shot comes out blank and dry, developing before your eyes over a 10-minute period, and with nothing to time, peel or throw away.

If that sounds familiar, we're not surprised: It could serve, word for word, as a description of Polaroid's SX-70 film system. But there are differences—some in the films and some in the cameras. To find out how those differences would affect your shots, we tested Kodak's new \$69.50 EK-6, Polaroid's \$66 Pronto! (that exclamation point is part of the camera's registered name) and

Keystone's \$60 Wizard, which uses the same XL-70 film as Pronto! does.

All three cameras give you about the same picture image area (9.4 square inches for Kodak, 9.8 for the other two). All three cameras have electric-eye exposure control, manual focusing, multiple-bulb flashes that don't have to be rotated or replaced after each shot, and an electric motor drive to push the film out after each exposure.

## Differences in film

As to differences, the biggest and most obvious are between the two films. Kodak's emerges with a featureless white surface whose central portion gradually develops into a

rectangular picture that is, for my taste, a bit too blue, but fades to pink if left in sunlight. The SX-70 film emerges with a white frame around a turquoise surface that gradually turns into a square picture that's equally off—but on the red side—and it doesn't fade.

Internally, the differences are even greater. Kodak's film picks up light on its back surface; the image migrates toward the front as the film develops. Polaroid's image starts out on the front surface, the side you see. (We'll see in a moment how this affects the cameras' designs.) Since the lens projects its image onto the back of Kodak's film, its front, viewing surface can be



**Keystone Wizard**, at \$60, is least expensive of the three. It takes Polaroid SX-70 film and has a 115-mm, f/8.8 lens, electric-eye exposure control, and shutter speeds from an action-stopping 1/300 second to a 10-second time exposure—a wider range than either of the other two. Film emerges when you release the shutter.

**Polaroid Pronto!** is by far the smallest and the lightest of the three, and costs \$66. It also uses Polaroid SX-70 film, and has a 116-mm, f/9.4 lens, electric-eye exposure including flash fill, and shutter speeds from 1/125 to 1 full second. Film lies face up at the bottom of the camera, emerges from the front as soon as shot is taken.



pebbled slightly to reduce fingermarks and diffuse reflections, without reducing the film's potential sharpness. (Current SX-70 films have antireflective treatment, but still show fingermarks.)

Mirrors in all three cameras fold the light paths to make the cameras more compact—but in Pronto! and the Wizard, the mirrors serve a more important function: to keep the image unreversed. Because the image migrates through Kodak's film, it is, in effect, a window through which you see the image from the lens—rather like a ground glass, except you look through this window minutes or days after the lens has had its look. Polaroid's SX-70 film is like a mirror, reflecting the image back from the same surface that received it from the lens originally; like any mirror, it reverses images from side to side, and a second mirror is needed to flop them back again.

### It's done with mirrors

Mirror placement in these cameras governs their shape. Pronto! and the Wizard look similar because, in both, the film lies along the camera's bottom, picture-side up, with the mirror angled to re-

flect the lens's light down onto it. (The outer shell on Pronto! follows the mirror's angle more closely than Wizard's.) But you need an even number of mirrors (or none) for unreversed images, so Kodak's cameras (whose films don't mirror as Polaroid's do) have their film plane in the front of the camera, with one mirror reflecting light from the lens down onto a second mirror that, in turn, reflects it forward to the film.

### Speeds vary

Higher top shutter speeds are available in the Kodak and Wizard—1/300 second to 1/125 for Pronto! but since the Wizard's f/8.8 lens is about 50-percent faster than Kodak's f/11 one, it's more likely to give you that maximum speed in practice. (The f/9.4 lens on Pronto! is about a third faster than Kodak's.)

But camera shake due to long shutter times is least likely in the Kodak, whose slowest speed is 1/20 second (Pronto! takes 1-second time exposures, and Wizard can take 10-second ones). That's probably just as well, since the EK-6's stiff shutter release made it a bit harder to avoid camera shake than we'd have suspected from the opportuni-

ties its shape provides for bracing it against your face. The Wizard's release was better, but the best was Pronto's soft electric pushbutton which required a light touch, with very little travel, and which you squeeze toward your forehead, the direction in which the camera is best braced.

For focusing, Kodak has an aid,

*(Please turn to page 192)*



### Coming: Giant Polaroids

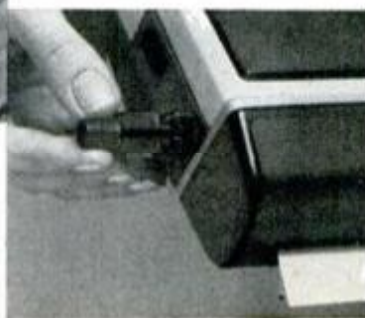
That's not Renoir's famous *Bal a Bougival* behind Polaroid's founder, Dr. Edwin Land, above. It's a lifesize, Polaroid copy, from a one-of-a-kind camera in Boston's Museum of Fine Art.

One week after Kodak's announcement of its instant-picture system, Polaroid showed stockholders and the press handmade equipment for making Polaroid pictures in 8x10-inch, 20x24-inch and larger sizes. The 8x10 size should find a ready market, both for quick color prints from slides and for use in 8x10-inch professional studio cameras. (Professionals have been clamoring for 8x10 Polaroid for years.) The 20x24 size, which requires a special camera, may take a while to show up, if it ever does. But the big, art-reproduction camera could become available quickly, if there's enough demand; since it will always be a handmade item, there won't be any delays for production tooling to be made. And how's the color? Impressive.



PM photos: Steve Fay

**Kodak EK-6** (\$70) is the only one to take rectangular pictures, but it's the biggest, heaviest, and has smallest range of lens and shutter settings: Its 137-mm, f/11 lens stops down only to f/16, and its shutter speeds range only from 1/300 to 1/20 second. But you may prefer its silk-finish prints and deeper, cooler colors.



**Hand-cranked Kodak EK-4** is economy model at \$53.50. It's otherwise identical to EK-6 in every respect. For added economy, its batteries, with no motor to drive, should last longer than those in the EK-6 model.

# Check your drive belts— don't take them for granted

by Paul Weissler

**D**on't ignore drive belts until they snap—it makes a lot more sense to give them some reasonable maintenance. A belt failure on the road can mean loss of engine cooling, charging, power steering, air-conditioning and loss of your temper if you don't have spares.

Belt maintenance is a lot more than a thumb on the belt to check tension and a spray of dressing when the belt squeals. The first way is an inadequate check and the second is a sure way to shorten belt life.

## Thorough inspection

Whenever you do underhood service, take a few minutes to inspect each drive belt. Twist each belt over and look for all of the following; any one is cause for replacement:

■ **Cracks in the underside** (the surface that rides flat against the surface between the pulley rims). Cracks create hinge points that allow excessive flexing. The belt can split apart at any crack

■ **Peeling from the underside.** This results in a rough surface, and the belt will transfer power unevenly. Belt failure will be sudden.

■ **Split in the sidewall.** A drive belt is something like a tire in that there is a supporting layer of cord between the rubberized surfaces. If there is a separation in the sidewall, often at the cord layer, the belt will not ride the pulleys properly and may fail at any instant.

■ **Glaze on the sides or underside of the belt.** A slick, hard glazing on the sides or underside of the belt is caused by belt slippage. The accessories are not driven properly, resulting in a low battery, engine overheating, poor airconditioning performance and erratic power steering. The slipping belt itself overheats and will fail. Any attempt to tighten the belt will be futile, and if you really snug up the belt, you'll accomplish little more than place an unusual stress on bearings.

■ **Oil-soaked belt.** A belt that is oil-soaked has been softened and will come apart. Because all belt dressings contain some oil-base penetrant that ultimately softens the belt, they are no solution to belt squeal, even if they temporarily eliminate this noise which is normally caused by looseness.

## Checking tension

Thumb pressure on a belt, midway between pulleys, has been the traditional way to check belt tension, and on older cars, up to a half-inch deflection under the pressure has been standard "rule of thumb" for an adequately tightened belt. On today's cars, however, this is not acceptable for these reasons: 1. There is a substantial variation in the deflections under the thumbs of almost any two people. 2. Accessibility is such that you could never measure the deflection accurately even if you have a calibrated thumb. 3. Deflection is not a positive indicator of tension.

It's one thing to be casual about tension on an older car, where the belt only drives a 30-amp generator and water pump. It's another thing when belts are driving 60-amp alternators and high-output water pumps. When belts have to handle demands like these, plus a big air-conditioning compressor and a power-steering pump, thumb pressure deflection is primitive stuff.

The belt-tension gauge is the simplest way to test tension accurately. It hooks over the belt and when released provides a number—pounds of tension—to compare with specifications developed by the carmaker. The belt can be adjusted to specs in a single operation on most cars. Price of the gauge ranges from under \$10 for some basic models to more than \$20 for elaborate ones.

## Adjusting tension

Most drive belts are adjusted by loosening mounting bolts for the ac-

cessory or loosening an idler pulley (belt guide), then applying tension on the component with a pry bar, and tightening the adjusting bolt.

There are some exceptions. The simplest is an access hole in the adjusting bracket, so that the pry bar is positioned precisely, and not against something delicate, such as the air-cooling fins of an alternator. The Chevette is an example.

A square hole in the accessory, or idler pulley that accepts a 1/2-inch drive breaker bar is another popular design. Again, the object is to make sure you don't pry against a part that can't take the strain.

A cam-type adjuster on an idler pulley is used on the Dodge Colt. You slacken the retaining nut, put a wrench on a partial hex section of the pulley and turn (one way to loosen the belt, the other way to tighten). When tension is correct, you tighten the retaining nut.

A stud-nut adjuster used on Ford power steering pumps eliminates the need to apply tension with any kind of bar. The pump is mounted on a bracket with studs through elongated bracket holes and retaining nuts. You slacken the retaining nuts, then turn a separate stud-nut adjuster. This moves the stud in or out, repositioning the pump along the elongated holes in the mounting bracket. When tension is correct, tighten the retaining nuts and you're done. Ford went to this arrangement after untold thousands of power-steering pumps were ruined by pry bars against the pump reservoir.

Even if a pump doesn't have this convenient adjuster, look for a boss with a square hole for a breaker bar, or at least some sturdy section to pry against.

## One-of-a-kind arrangement

The Volkswagen Beetle is an exception to just about all rules regarding drive belts. On the VW, you can check tension with your thumb, and the belt is so wide open, you can

even get a ruler into position to measure the deflection (10 mm or  $\frac{3}{8}$  inch is the spec).

The adjustment is with shims on a generator/fan pulley that comes apart. You wedge a screwdriver through a slot in the inner pulley half and against the engine to hold the pulley, then remove the nut holding the halves together. To increase tension, you remove some shims from between the pulley halves so the halves will come closer together when tightened, forcing the belt to ride higher between rims of the pulley halves. To reduce tension, add shims, which are stored between the outer pulley half and nut. It's a pure cut-and-dried operation.

This design violates a cardinal rule for a drive belt, namely that it fit in the pulley so that the two sides and underside are in contact for smooth power transfer. By pushing the belt up to increase tension, VW eliminates pulley contact with the underside of the belt. The Beetle has been able to get away with its design because the power draws of the 25-amp. generator and air-cooling fan are relatively modest.

A more conventional car needs a belt that has good contact at both sides and the underside. If the belt is just a bit too wide, it will ride high in the pulley, not making good contact at the underside. If too narrow, it won't make good side contact at the sides. Therefore, always check the manufacturer's catalog and don't try to match up belt just by comparing the old and the new, even if the old is intact.

### Belt replacement

When a new belt is called for, double-check others for possible replacement, particularly if you're changing an outer belt.

Push the idler pulley or accessory all the way in (in the case of the stud-nut adjuster, back it all the way out), and the new belt should just fit onto the pulleys. You may have to pry a new belt over a pulley rim with a screwdriver, but a new belt should never fit so easily that you are near the outer limits of proper tension adjustment. A belt stretches in use; unless there is a good margin for adjustment left, it may have to be replaced long before its working life is over. This occurs most often when you get the wrong part number and then try to pick a new belt by matching it with the old one.

Set belt tension to new-belt specifications, and after the engine has run for 10 minutes or more, recheck tension to assure it meets used-belt specifications. ★ ★ ★

## HOW TO TAKE CARE OF YOUR CAR'S DRIVE BELTS



Belt tension is best checked using the type of tension gauge shown here.



Studnut adjuster on power steering pump is tensioning device on some Fords.



Bracket with curved slot is most common arrangement for belt-tension adjustment.



Pulley nut is loosened on VW while screwdriver is wedged to hold pulley.



Pilot hole for the pry bar, as used on Chevette, is accurate and convenient.



Pulley halves are separated to remove belt with unique arrangement on Beetle.



Adjuster is turned to tension idler pulley as seen here on the Dodge Colt.

# IT'S NEW NOW



## Flat country ski brush-up

Bridge ramps provide most of the steepest hills in Belgium. So to accommodate skiers, Antwerpens built a "hill" about 300 feet long and 75 feet high, surfaced with 90,000 brushes (left). Skiers now can brush up for Alpine winters.

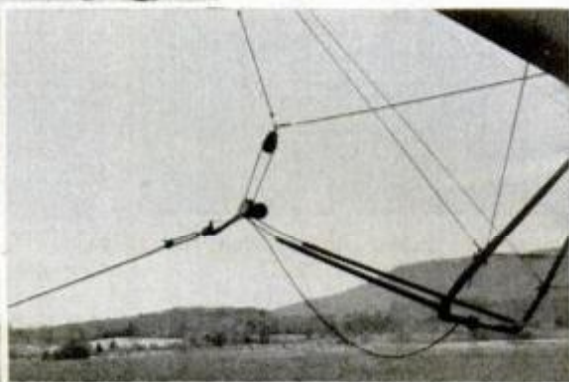
## Gearshift training by computer

Student truck drivers often find gearshifting tough as big rigs have 13 to 30 speeds. At Driver Training Institute, 50 Greenpoint Ave., Brooklyn, N.Y., beginners are taught proper technique in a computer-controlled simulator that speeds learning and reduces mistakes. It monitors gear selection and clutching proficiency, simulates changing grades, loads, wind and other factors, will even "lug" and "stall" realistically under improper handling. Students get a printout, learn shifting in only two hours.



## Automatic glider tow

Hang gliders are usually towed by a single fixed point on the glider frame. This can put up to 400 pounds of stress on the fragile "kite" at certain steep climb angles. Now a special bridle using an arrangement of pulleys automatically keeps the glider at the smallest angle of attack necessary to gain the desired altitude before release. This is said to impose no more than 50 to 75 pounds of stress on the glider at any time. Maker is Solar Aircraft, 1416 Williams St., Chattanooga, Tenn. 37408.



## Spherical telescope

New look in telescopes gives this 4½-inch Newtonian reflector type more than mere eye appeal. The unique shape permits it to be used on the lap, over the shoulder (on carrying strap), on a tripod, or rotated in its own mount on table or car hood. Magnification is 15 power and the field 3½°, said to give a wide-angle view of the sky ideal for stargazing. Price is about \$130. Edmund Scientific Co., 300 Edscorp Bldg., Barrington, N.J. 08007.



## Handy pushbutton tape storage

Self-stacking storage boxes for cassette tapes feature pushbutton drawers. When a red button on the right side of each box is tapped with a fingertip, as shown, the drawer pops open for quick tape access, then snaps shut. An index label on each drawer front provides tape identification. The boxes interlock by means of sliding, keyed grooves, can be stacked to any height. The 3M "C-Box" units can be purchased empty or with blank recording tape. A pack of three empties is about \$2 at most audio stores. A wall mount and handle are accessories.

# New go-anywhere, mount-anyplace mobile CB

by Bill McKeown

**N**ow you can broadcast with your hands full of handlebars, steering wheel or control stick at almost any speed. For sportsmen on the go, one of the newest and most versatile communications aids to come along is a rugged little citizens band unit called the Beltek Enduro 23. It's made by Beltek Corp., 1093 Bedmar St., Carson, Calif. 90746, and available from CB outlets for about \$230. The original model, Enduro 5, first marketed for motorcycles three years ago, is still available. It proved so rugged and successful that the new 23-channel transceiver was introduced for a variety of mobile users.

*(Please turn to page 156)*

Photo: Robert Honke



**Pick your place,** this new Beltek Enduro 23 seems to mount anywhere: on a bicycle (top) with transmit button behind the seat; on a Viking deck boat (upper left); snowmobile (left) with boom mike clamped on a helmet; or in a motor home.

# New handloads for bargain hunting

Inexpensive accessories can customize cartridges better and cheaper at home.

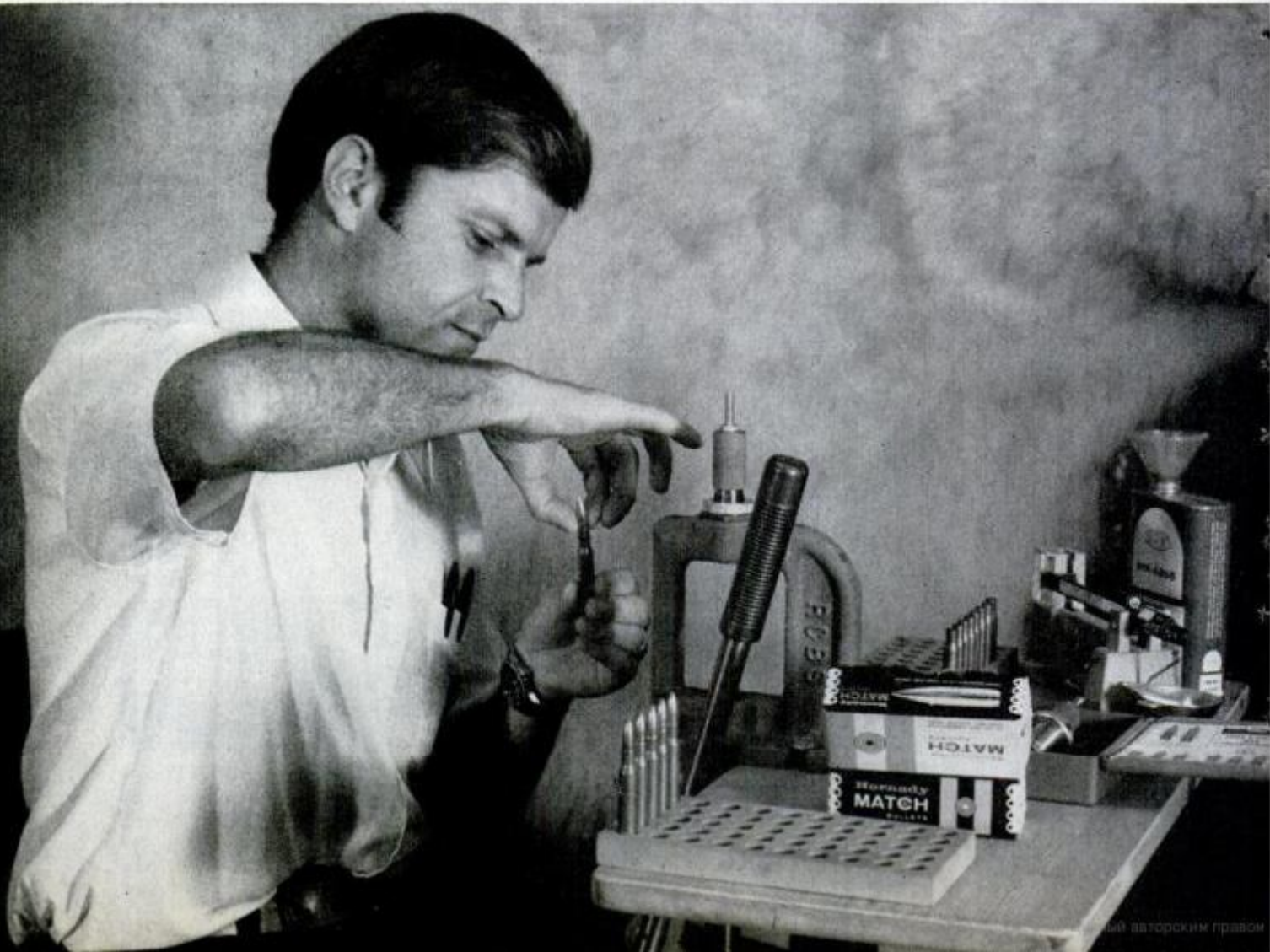
by George C. Nonte Jr.

**Big results** require only the basic equipment shown. A press, resizing and bullet seating dies, empty brass cases, powder, primers, bullets and data handbooks are the simple essentials used here for customizing cartridges.

**S**hoot four times as much for the same cost, and shoot better to boot? Yes you can, and the procedure is a snap for any mechanically minded person. The tools don't cost much, but even if they did they could be amortized over a few years since they hardly ever wear out.

Reloading (handloading to some) is the name of the game, and it is as old as the breech-loading rifle. Several million U.S. shooters reload. It's basically an American hobby because foreign governments restrict it closely—perhaps fearful of citizens able to make their own ammunition.

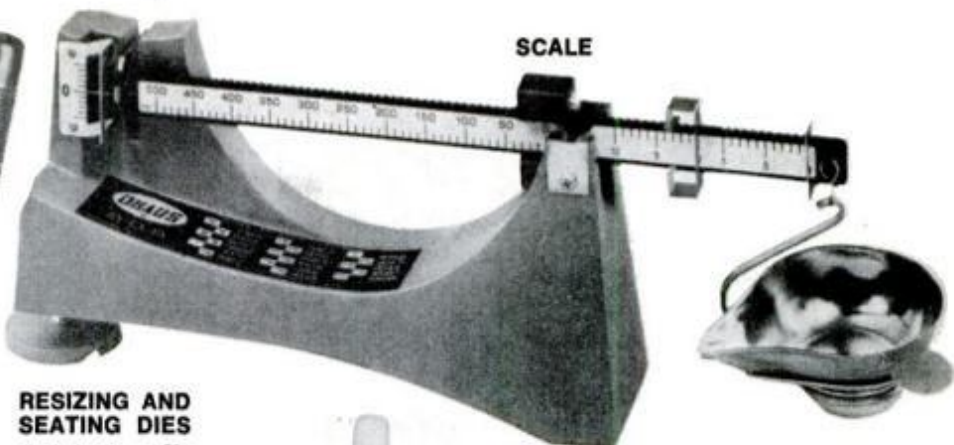
Reloading is possible because the brass cartridge case is not harmed



PRESS



SCALE



RESIZING AND SEATING DIES



LUBE

DECAPPING STEMS



For less than \$100, a reloader can select quality equipment such as the RCBS O-frame Rock Chucker Press with compound linkage that can handle up to magnum cartridges, Ohaus 5-0-5 Scale for weights from 0.1 to 511 grains, decapping stems like these from C-H Tool & Die with pins to remove fired primer and ball above to expand case mouth. Typical rifle-caliber die set punches out primer and resizes case neck (left), seats bullet (right). Lubes available are high-film-strength types to aid resizing used cases in press.

Each new cartridge is made small enough to enter the rifle chamber freely and expands upon firing, with internal gas pressures as high as 55,000 p.s.i. making the case tight against the chamber walls. Then, as pressure drops, the brass contracts and loosens its grip, allowing it to be extracted. But it does not contract all the way back to its original size. For reuse, it must be resized in a die made to close tolerances for the caliber involved so that it will again enter the chamber freely.

First the case must be wiped clean and lubricated sparingly. Special lubricants are furnished by die suppliers, but service station STP works fine. Moisten thumb and finger with it and roll the case between them to pick up a very slight amount. Without lube, the case will stick in the die; with too much, it will be damaged by "oil dents."

### Press the case

The case is resized by pressing into a shaped die; most are fitted with a decapping rod and pin for simultaneously pushing out the fired primer. Place shell holder in the press ram, screw the die into the press until it contacts the holder solidly at the top of the ram stroke. Tighten the die lock ring and adjust and secure the threaded decapping rod so the pin protrudes  $\frac{3}{16}$  to  $\frac{1}{4}$  inch.

Next, place case in the shell holder and operate the press handle to run the case all the way into and out of the die. As the case is withdrawn,

(Please turn to page 154)

at all by firing, is recoverable, and represents over half the cost of the original cartridge. By first rejuvenating the case and then adding a new primer, a powder charge and a bullet, you can recreate the original cartridge. Since the original case is good for 10 or more reloadings, the cost keeps going down as you shoot. By selecting loads especially designed for your own type of hunting or target shooting, you can now work toward greater accuracy as well.

Your basic tools are a reloading press, a set of reloading dies and shell holder of the proper caliber, and a powder scale. Add a supply of fired cases, primers, powder and bullets and you're ready to get started—almost. But first, you'd better obtain and study one of several reloading manuals available. Probably most practical for the beginner is the *Lyman Reloading Handbook*, published by Lyman Products, Route 147, Middlefield, Conn. 06455. It's \$6.95 from your dealer or \$7.95, including postage and handling, from Lyman. It covers tools and operations, plus a wide variety of powder charges and bullets from which you may select the best combinations for your needs. A much more extensive reference for a serious student is *Modern Handloading* from Winchester Press.

Finger-touch of lubricant, and careful examination and cleaning of used brass, above, readies the cases for resizing to proper original dimensions (upper left).

Bullet is chosen according to shape, type of metal and weight for shooting purpose, and is seated (below) in case fitted with new primer and exact charge of powder.



# 10 worst heat thieves in your home - and how to halt them

Energy experts have pinpointed 10 'fuelish' areas in the average home. PM answers with 21 ways to beat heat loss and get the most out of your fuel dollars in this energy-saving update that could cut your fuel bill in half.

by Richard F. Dempewolff

**Y**ou don't hear much about the energy crisis these days, but you should be prepared for the worst. According to the Federal Energy Administration, price controls on all energy sources will be removed by 1979. In addition to regular rate increases this could tack an extra 4 cents a gallon onto the cost of fuel oil and raise your annual heat bill at least \$50, maybe as much as \$150!

Low-cost solar or atomic energy may provide long-range answers, but you can beat the high cost of heat

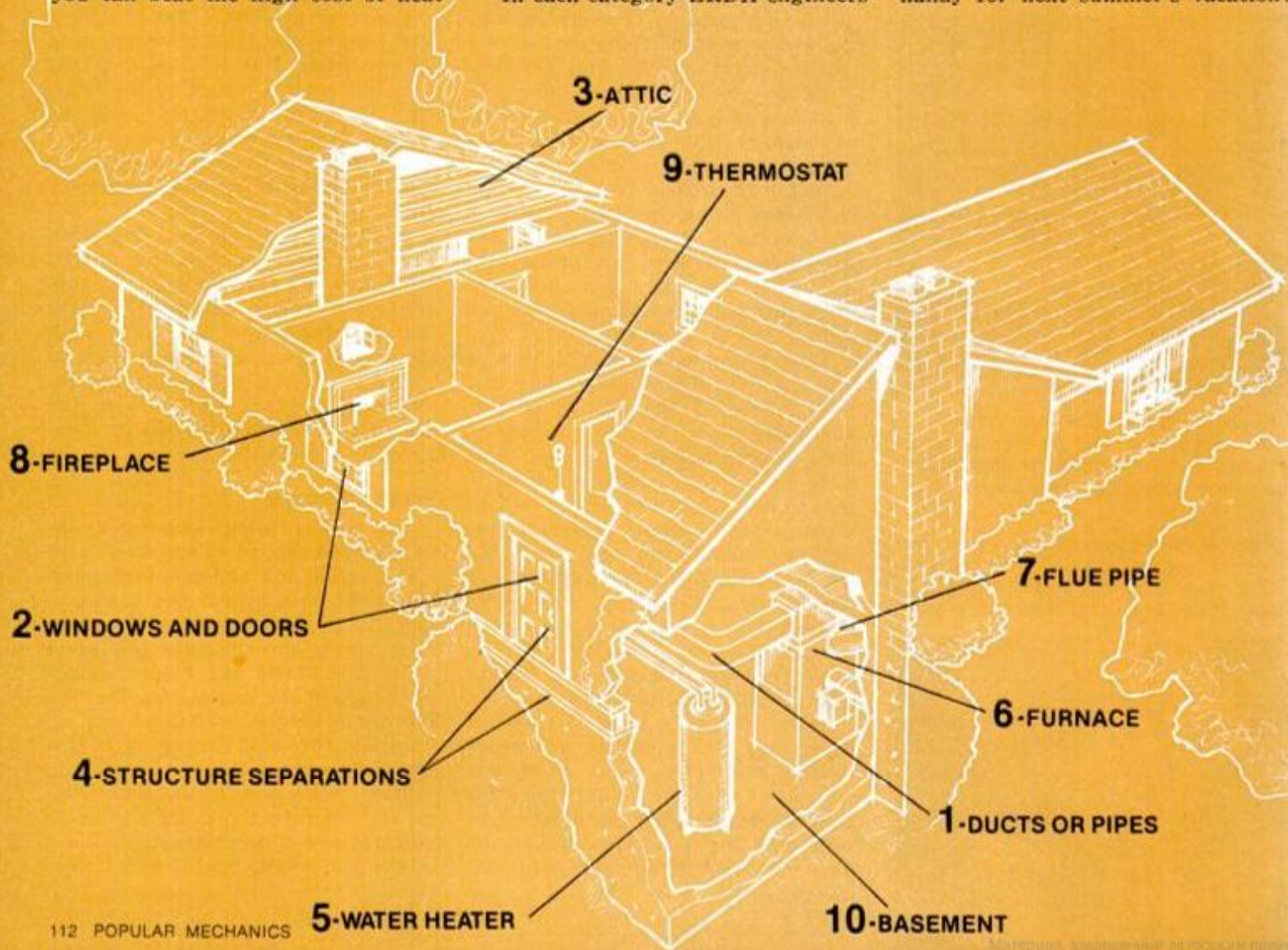
right now by squeezing every last calorie out of your fuel dollar.

Recently, five engineers at the Energy Research and Development Administration (ERDA) met with Popular Mechanics and spelled out the 10 most common heat-loss areas. You're probably familiar with the big losers like an uninsulated attic and uncaulked openings around windows and doors. But some thieves on ERDA's "10 most-wanted" list may surprise you.

In each category ERDA engineers

have estimated a range of dollar savings you can get by following PM's heat-saving plans. The figures are based on an average, 1750-square-foot house in a northern state.

Savings will vary. You'll get high-range savings in categories where your house is totally deficient and low-range savings where you're improving protection you already have, like adding insulation in your attic. It's not too late to start saving your winter fuel dollars—they'll come in handy for next summer's vacation!



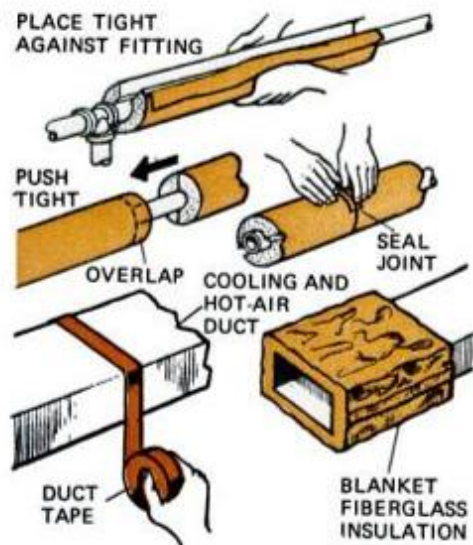


# 1 Duct/pipe insulation

Saving per yr., \$20-\$160

Sheet-metal heat ducts and copper hot-water supply pipes are the two most common types of heat supply. Unfortunately, both act as heat exchangers as well as suppliers. For example, if a duct pipe runs through an unheated area like a crawl space, a substantial amount of heat will be lost through walls of the duct before it reaches the register. ERDA investigators have found extreme cases in contemporary houses with cantilevered upper stories, where hot-air ducts were actually exposed to the weather. One engineer noted: "They lose more heat to the outside air than they convey to the rooms they were installed to serve."

The solution is duct insulation, available in one and two-inch-thick blankets. For cylindrical ducts, butt collar-like sections of the insulation and secure them with tape. For rectangular ducts, cut sections to fit snugly all the way around, but don't



compress the mineral filler. The cut end should be butted flush by the end you bring around to meet it, and then you should seal the entire joint with a sufficient wide tape. Avoid squeezing the batt. Be sure to check for—and repair with duct tape (see sketch—all loose joints and split seams in the ducting before insulating.

Asbestos-honeycomb insulation sleeves are available in heating supply houses to fit a variety of steam and hot-water heating pipe diameters. Metal band clamps secure them in place (see sketch) and cover the joints at the same time.

Note: The ERDA engineers con-

cede that exposed ducting and piping in full basements and crawl spaces help warm the ground floor and, in some cases, serve to heat usable basement areas. If this reasoning is followed, they suggest that the basement itself should be insulated as specified under section 10 of this report.

If you have a full basement with laundry, family room, shop or other facilities that require heat when they're being used in winter, it may pay you to insulate the ducting anyway—but also to run small ducts (insulated) to the areas in question—with terminal registers that can be closed when any of the spaces are not being used.

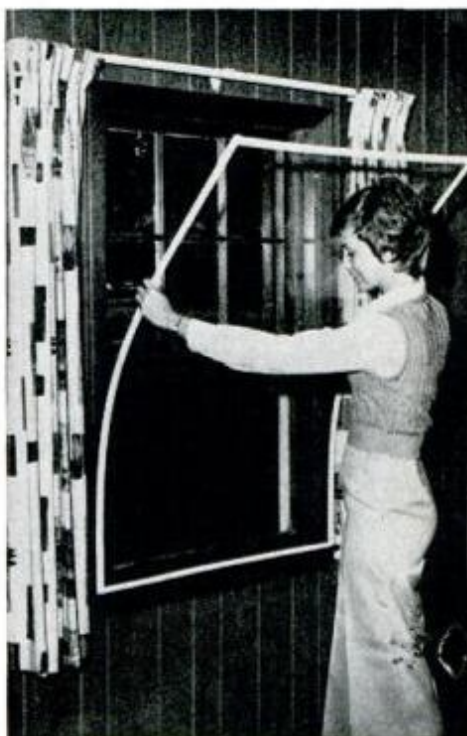
# 2 Storm windows and doors

Saving per yr., \$76-\$146

Glass acts as a heat exchanger to the outdoors. Single panes in a home with about 18 windows and two glass-lighted doors can lose more than 20 percent of your heat during an average northern winter. This is a "heat leak" any do-it-yourselfer can plug easily. While triple-track combination storm-and-screen sash is convenient and efficient, it costs \$30 and up per window, installed. Dead air space is what counts. You can now buy transparent plastic sash in a kit made by Plaskolite, Inc. (see photo). The 1/16-inch polyethylene sheet fits a vinyl mounting frame with pressure-sensitive tape on one side that seals it to the inside of the window casing—no ladder acrobatics necessary. The frame, white but paintable to match your color scheme if desired, remains permanently attached to the window. The clear plastic sheet is removable by unsnapping the lip of the vinyl frame—a fingertip operation. The unit comes for basic window sizes, priced accordingly.

Standard single-pane storm sash, which you can make yourself from aluminum framing and regular glass sizes available in hardware stores—or standard wood-framed storm sash available in lumber yards—runs about \$10 and up per window. Energy experts point out that all types are about equally effective. The more expensive ones are simply more convenient and generally more attractive in appearance.

Combination storm and screen doors also are available from build-



ing supply yards in metal or wood. It's better to buy them complete since parts are precision cut in order to provide a snug fit for the storm insert, and the better the fit, the less heat will be lost.

# 3 Maximum attic insulation

Saving per yr., \$35-\$120

One of the most effective ways to cut fuel costs is to insulate your attic. While most homes today have some insulation in the overhead, few are equipped with enough, say the experts. ERDA authorities now recommend blanket or batt-type insulation rated R-30 for oil or gas-heated homes in cold winter zones. That's about 10 inches, made up in two layers since batts don't come that thick. Electrically heated homes in cold climates call for R-38 (about 12 inches). Heat engineers point out that if you already have six inches or more, additional thicknesses won't pay off in dollar savings over a reasonable length of time, except in the coldest areas or if you have electric heat. There are three basic systems for insulating types of attic:

- **Unfinished, unfloored.** Batts can be layered one atop the other between joists, extending above them as needed.

- **Unfinished, floored** (with no insulation beneath the boards). Remove the floor, lay batts between and to full depth of joists, and replace

floor. If more insulation is needed for maximum protection, staple batts between rafters as well.

■ **Finished attics.** Lay batts between joists above the ceilings of the finished rooms (you may have to cut a ceiling trapdoor to do this). Staple additional batts between the outer roof rafters (see sketch) beyond the knee walls of the rooms. Engineers also recommend that the attic gable-end walls in these triangular spaces also be insulated between studs.

What about sidewall insulation throughout the house? ERDA's experts disagree with some other agencies on retrofitting existing buildings. Their studies have shown that injection of wall insulation must be



done commercially; that it is far too expensive for dollar pay-back in a reasonable time and usually proves inadequate.

An energy agency in Minnesota foam-insulated a test wall and later removed interior panels to check the coverage. "There were voids all over the place," reports an ERDA scientist. "Wire cables, electric boxes, fire stops and 'cats' set up barriers that completely blocked the foaming urethane as it tried to spread out."

But attics are another matter. Even if yours is insulated, check to see how much you have. If another 4 to 6 inches would bring you up to R-22 or R-30 rating, the investment will pay off if you install it yourself.

## 4 Caulking and weatherstripping

Saving per yr., \$30-\$70

In many homes, ERDA investigators found that up to 70 percent of heat loss was due to infiltration of outside air coming through window and door casings and building sills.

Wherever different materials or parts of a building join, caulking should be applied and regularly renewed. Tube cartridges and a gun are the basic tools, and anyone can do the job. Places to check and caulk if needed:

■ All joints between door and window frames and siding.

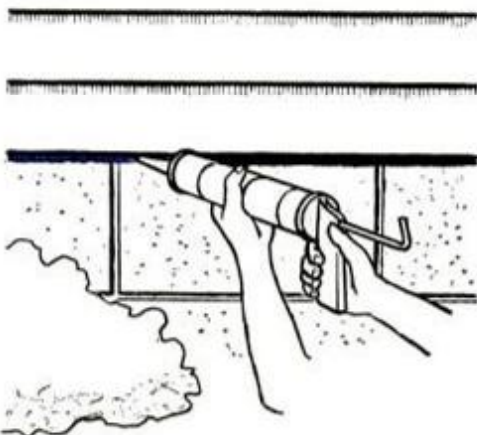
■ Along bottom edge of siding where it laps the foundation wall, as well as inside the basement where the sill rests on the foundation.

■ Outside water faucet plates and other penetrations of the outside walls.

■ Joints between wing extensions, porches and main body of the house.

■ Where outside chimney or other masonry joins the house wall.

Large gaps, often found between foundation wall and back of siding, should be packed with oakum, caulking cotton or similar filler before caulking is applied. Most cartridge-type caulks today will do an adequate job. Butyl and silicone types will stay resilient and resist cracking.



Weatherstripping windows and doors—an obvious heat-leak stopper—can be done by amateurs nowadays, using any of the wide variety of materials.

■ **Foam-rubber stripping** backed with adhesive is easiest to install, and least expensive. Applied against door jambs it's good for a year or two but should be replaced when worn. It can't be used on double-hung sash except as a top and bottom stop seal, since it won't stand up under friction of the sliding sections.

■ **Rolled vinyl**, tacked to door jambs and window frames of any type, also is simple to install and provides a long-lasting seal. The only disadvantage is its visibility. On double-hung windows the "roll" should press lightly against the wood frame of the sash at sides, bottom and top. A strip nailed to the underside of the top sash laps and seals the joint between upper and lower

window halves. On casement windows the strips are tacked so the window compresses the "roll" when shut.

■ **Thin spring metal** makes a highly durable seal for doors and most types of window, and is invisible when properly installed. It can be handled by do-it-yourselfers, but is difficult and somewhat exacting; doors are much easier than double-hung windows. The strips must be installed by opening the sash and sliding the side strips into the channel behind the sash frame, where it is tacked under the sash cords. Full-width strips are fastened to the underside of the bottom rail on the lower sash, and top of the upper sash top rail, and a full-width strip goes on the inside of the bottom rail of the top sash, with nailheads hammered flush so the window will close easily.

■ **Metal J-strips** for doors and casement windows call for critical alignment, but provide durability and an excellent seal.

Door-bottom drafts can be stopped with simple "sweeps" that fasten to the outside of the bottom rail, or "vinyl bulb" thresholds, which require door removal and fitting. Interlocking metal thresholds are even more fussy, and require careful and accurate alignment.

## 5 Insulate water heater

Saving per yr., \$28-\$69

You can save from \$5 to \$45 on this facility just by cutting down the water temperature. Normally, 120° F. is plenty hot. Dishwashers without heating elements, however,



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demand a 140° supply, but anything above that is wasted and can shorten the life of a glass-lined heater as well. The heat experts have determined that an additional 5 to 8 percent of water-heater energy can be saved by wrapping the unit in an outside layer of insulation. Johns Manville now has insulation kits that are designed especially for either electric or gas water heaters. ERDA engineers warn that if you wrap your gas heater, take care not to block air vents, and the top of the tank should be left uncovered.

The small cost of doing this job will pay for itself in less than a year. Another saver: drain a gallon of water from the bottom of the tank each year. Sediment that settles in the bottom insulates the water from the heating element.

## 6 Upgrade the furnace Saving per yr., \$25-\$65

According to ERDA, most of what can be done about a furnace should be handled by professionals. To check the efficiency of your setup, the amount of "fuel-in" and "energy-out" must be measured, as must the chemical content of the exhaust. Fuel suppliers may have the instruments to do this. An inefficient furnace will show low carbon dioxide and high temperature in the stack. An efficient oil furnace should run above 14 percent CO<sub>2</sub>, and less than 450°F. stack temperature. Gas should run the same for CO<sub>2</sub>, but under 330°. Besides the usual filter changes (in forced hot-air systems), air bleeding (in hot-water systems), cleaning and adjustments, several other things can be done to enhance performance of any heating system:

■ **Steam and hot water.** Installation of a "baffle" in the firebox will spread the flame to the sidewalls and heat the medium more quickly. Heat engineers caution that installation should be made by specialists, since exhaust gases are slowed by the device, and it may create a hazard unless properly fitted.

■ **Forced hot air.** Up to 10 percent of a home's total heat loss may result from faulty cyclic operation of the furnace. This can be decreased by setting the fan switch to turn off the fan at five degrees above the thermostat setting, and turn it on as near above that setting as the switch permits.

The old controversy over whether it's better to feed the furnace combustion chamber with preheated inside air, or introduce cold air from outdoors, is settled, according to

ERDA. An enclosed duct system bringing cold air directly from outside to the furnace has proven to be the most efficient system. One engineer explained, "A furnace operating on inside air pulls cold air into the house all the time and a significant amount of the warm air it uses is shot up the chimney."

Small-diameter ducts (usually about 4 inches) bringing outside air to the variable draft fan on oil furnaces, for example, will keep the furnace running cleaner and more efficiently.

## 7 Flue-pipe retrofits Saving per yr., \$60 plus

A distressing part of any fossil-fueled furnace is that a significant percentage of the heat it produces goes up the flue. Some interesting new devices, however, now recapture some of that lost energy. A typical device is the heat pipe.

■ **Heat pipe.** This compact heat exchanger can be attached to either a vertical or horizontal flue pipe run. What it does is intercept the waste heat on its way to the chimney, extract it from the gases and redirect it to wherever it's wanted—to warm the basement, a particular upstairs room via extra duct, or it can be fed into the house duct system. A danger, scientists point out, is that removing too much heat from exhaust gases can decrease their buoyancy and result in a reverse flow. Hence, heat pipes, too should be installed by specialists, says ERDA.

Lack of proper draft in the chimney, besides producing toxic gas in the house, could also ruin the furnace.

## 8 Fireplace damper Saving per yr., \$60

No builder today would install a fireplace without a damper, but many that are installed fit poorly and don't close snugly. In many old houses, the fireplace chimney is wide open, drawing warm air to the outdoors as effectively as an open window.

While the installation of an effective damper in an existing fireplace is an expensive business, extremely attractive glass fronts for fireplaces are readily available. The glass doors can be opened when a fire is blazing, and closed to seal off the entire opening when the hearth is not in

use. Vents across the bottom can be opened to provide a draft if you like your fire behind glass. The units run about \$125 up, depending on quality and size of opening. They can save up to 6 percent of the annual heat you put into your house, and will pay for themselves in about two years with the protection that they provide.

## 9 Thermostat controls Saving per yr., \$24-\$48

Slide-rule wizards have calculated that if everyone in the country set back his thermostat about 10° at bedtime and turned it up at about 5 a.m., the result would be a saving of about 4 percent of the country's total yearly fuel consumption. For each homeowner it would amount to about 10 percent annual saving in the North; 30 percent in the South. Well, now a number of devices on the market will do the work for you.

■ **Clock thermostat.** Several versions are being produced by well-known companies, and most heating supply outlets carry them. They range from about \$100 to \$150. You set them to drop a given number of degrees at 10:00 or 11:00 p.m., and move up to the desired room temperature again in time for your morning shower.

■ **Clock-triggered resistor.** This device does the same job by fooling the thermostat into shutting down the furnace at night and returning it to normal operation before you wake up. Some four manufacturers currently are producing them. They cost from \$10 to \$30 and are easy to install. The timer unit is simply plugged into a nearby outlet and the unit is mounted directly below

*(Please turn to page 190)*



**Resistor-type control** plugs into wall outlet to run clock that triggers heat unit under thermostat. Called "Fuel Sentry" it's \$22.95 from Popular Mechanics, Dept. PMFS 106, Box 888, Teaneck, N.J. 07666.

**Built-in fluorescent lamp,** housed in a light-box shelf that is adjustable up or down, adds supplemental light in a most dramatic way to potted plants displayed in waterproofed base of this handsome table/planter. Complete plans for making it are shown on a following page.

# The way to grow

Plants thrive indoors when grown and shown in these specially lighted furniture/planters.

by Michael Ray August

PM color photos: George Flitkai



**G**rowing plants indoors is a fascinating hobby. Attractive flowering, trailing and foliage plants can be nurtured successfully inside the house with the aid of fluorescent and incandescent lamps.

Plants need light to grow. Daylight in your home is neither uniform or abundant. Fluorescent or incandescent lamps can be used alone or to supplement daylight. They make growing and showing healthy plants possible at all times.

The dual-purpose planters shown here—a lamp table and room divider designed by the General Electric Co.—use GE's "Gro and Sho" fluorescent lamps to get perfect balance of red and blue light needed for plant propagation and reproductive growth.

Mounting heights of fluorescent lamps above plants vary depending on the number of plants used and their light requirements. Lamps are normally 6 to 8 in. above plants, and most plants need 14 to 16 hours of light a day to grow satisfactorily.

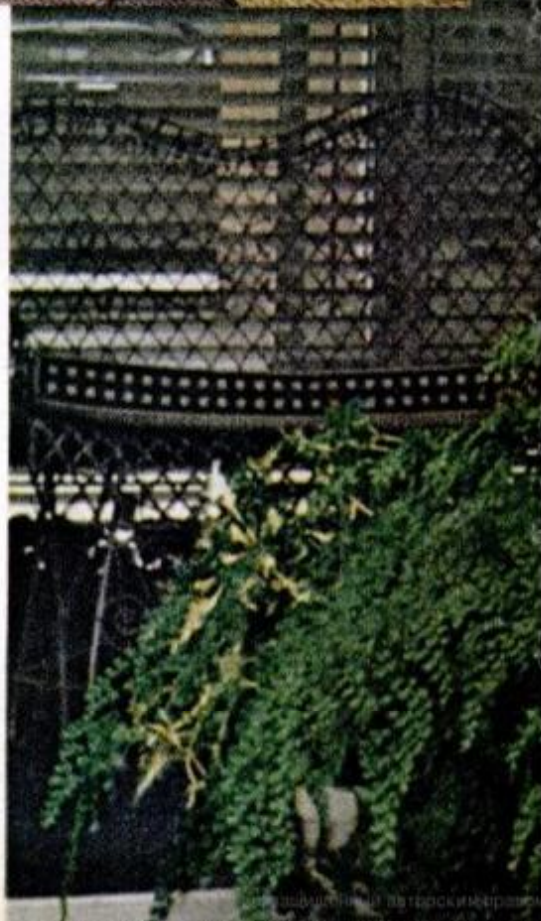
Fluorescent lamps are the best

and most popular light sources for growing plants. However, incandescent lamps can supplement natural light or be used where fluorescents are not practical. Flowering or foliage plants needing no high light, do best under incandescent lamps.

### TABLE PLANTER

Movable pegs in the table-planter legs let you place the light box in three locations to adjust growth-promoting light and warmth for the plants, whatever their size. Overall sizes of adjustable and fixed "boxes" are identical, so all parts should be cut in duplicate. The top of the light-box unit has notched-out corners cut by making two intersecting saw cuts on the table saw. Set the blade high to limit the amount of overkerf on the underside.

Assemble the lamp and plant boxes with No. 2 common nails and glue; use waterproof glue for the plant box, white glue for the light box. Drill pilot holes for nails and counterbore for wood plugs. *Special*





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room divider with its  
built-in growing lamps  
provides your indoor  
plants with their own  
grow-and-show display  
case. Plants on top shelf  
get their turn under the  
lights as part of a weekly  
rotation. Cabinet is  
useful for storing extra  
pots and other equipment.



of notched clamp blocks. Attach the 2-in.-long leg extensions with glue and fh screws in counterbored holes.

Two or more boards are glued together to build up the 18-in.-square top which is cleated (across grain) on the underside to prevent warpage. Facing strips,  $\frac{1}{2} \times 1\frac{1}{16}$ -in., are mitered and applied to the four edges, then the top corners are

rounded with block plane or router.

The legs are glued to the top in  $\frac{1}{4}$ -in.-deep wells formed by gluing and nailing 3-in. squares of plywood to each corner. Wait until later to glue the legs to the top.

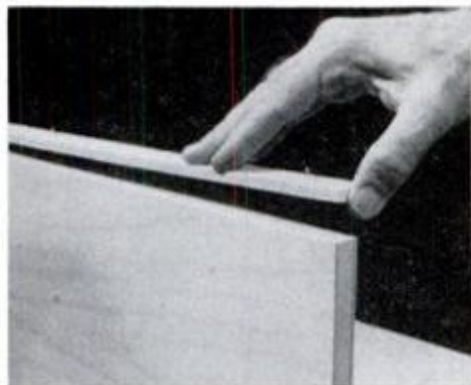
Mount a standard circular fixture to the center of the light box with a pipe nipple and a fixture crossbar. You'll have to drill a hole in the side

of the fixture for a rubber grommet, lamp cord and switch.

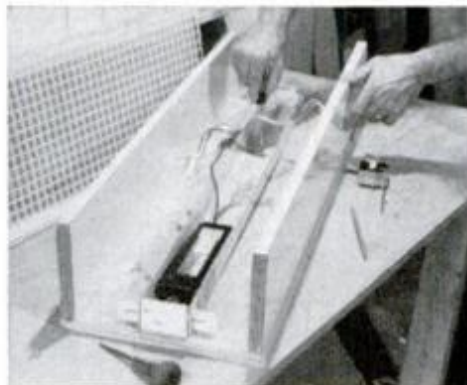
Finish table with a coat of sanding sealer and two coats of satin-drying varnish. Apply two coats of bartop varnish to the inside of the plant box, and paint the inside of the light box matte white.

Now you can glue on the top. Place it upside down on your bench,

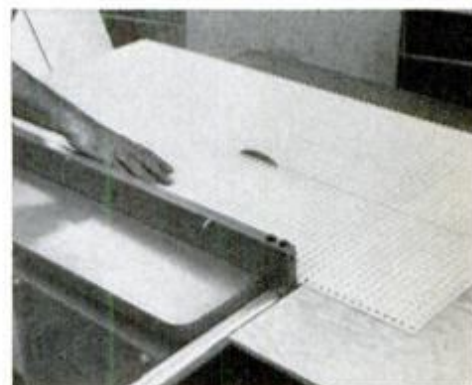
*(Please turn to page 134)*



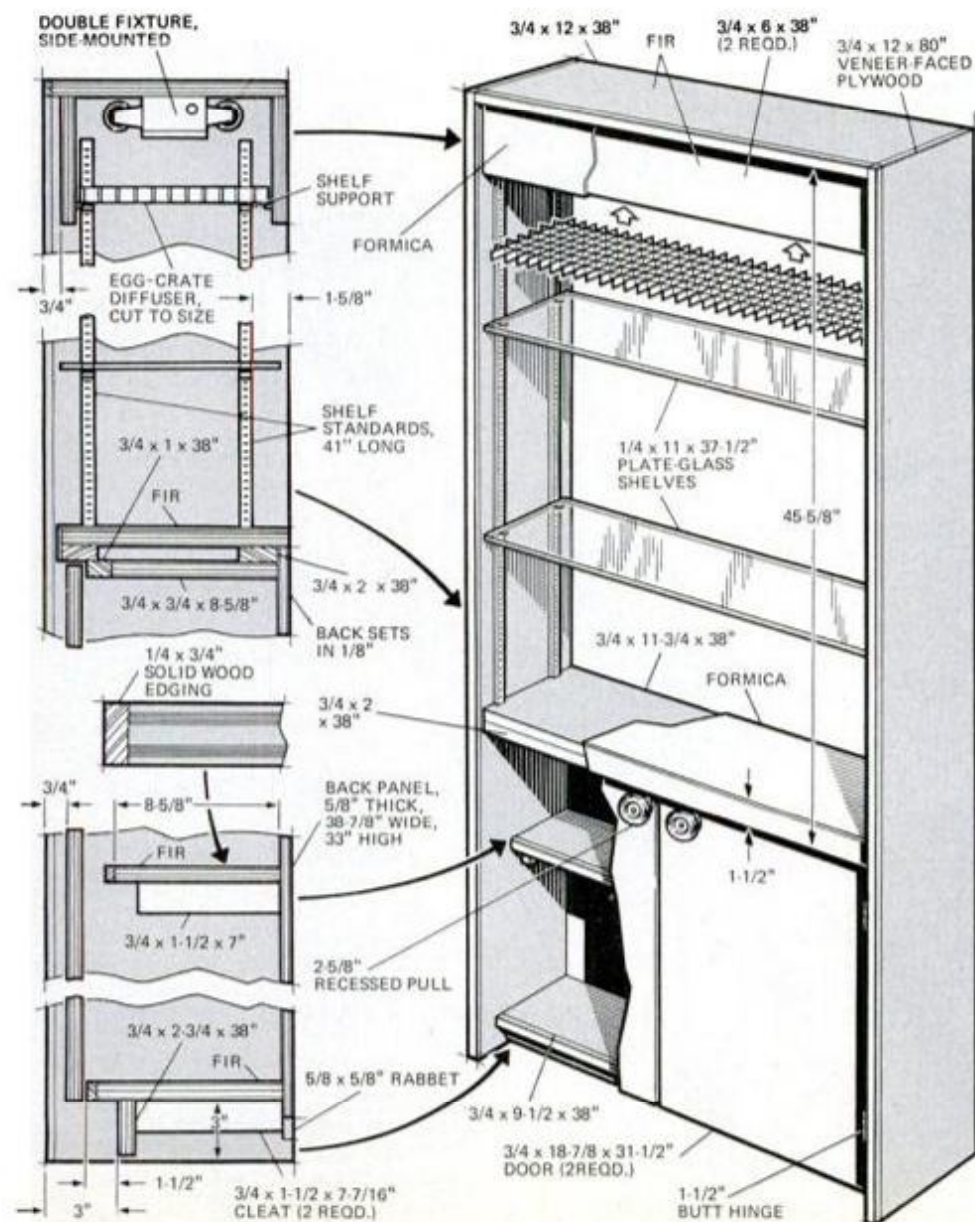
Face exposed edges of plywood with  $\frac{1}{4}$ -in. strips of solid wood. Use glue only and clamp with masking tape until glue dries.



Install side-mounted fluorescent lamp fixture as shown here; regular bottom-mounted type can also be used if you wish.



Use fine-tooth plywood blade to cut "egg-crate" lamp-diffusing grid. Material comes in 24x48-in. panels, must be cut to fit.



## GROWING TIPS

by J. A. Buck

**Light intensity.** Most beginners do not give plants enough light. As a result, their plants often grow and bloom poorly or have pale-colored foliage and leggy new growth. For more light, you merely bring the fluorescent tubes closer to the plants or add more lamps.

A good plant-lighting rule of thumb is to "provide 15 to 20 watts of fluorescent light for each square foot of plant-growing area." When growing seedlings, cactus or orchids, keep fluorescent tubes 6 to 8 in. above the foliage for strong light exposure.

**Medium-intensity-light plants**—African violets, gloxinias and begonias—should have tubes 8 to 12 in. above the foliage. Ferns and cuttings, the low-light-requirement plants, can be lighted 12 to 18 in. from above.

**Duration of light.** Flowering of many plants is controlled by the length of the daily light and dark periods. In general, short-day plants, such as poinsettias, chrysanthemums and Christmas begonias, need 10 to 12 hours of light a day. Long-day plants, such as the China aster, dahlias and annuals, need 14 to 18 hours of light to flower.

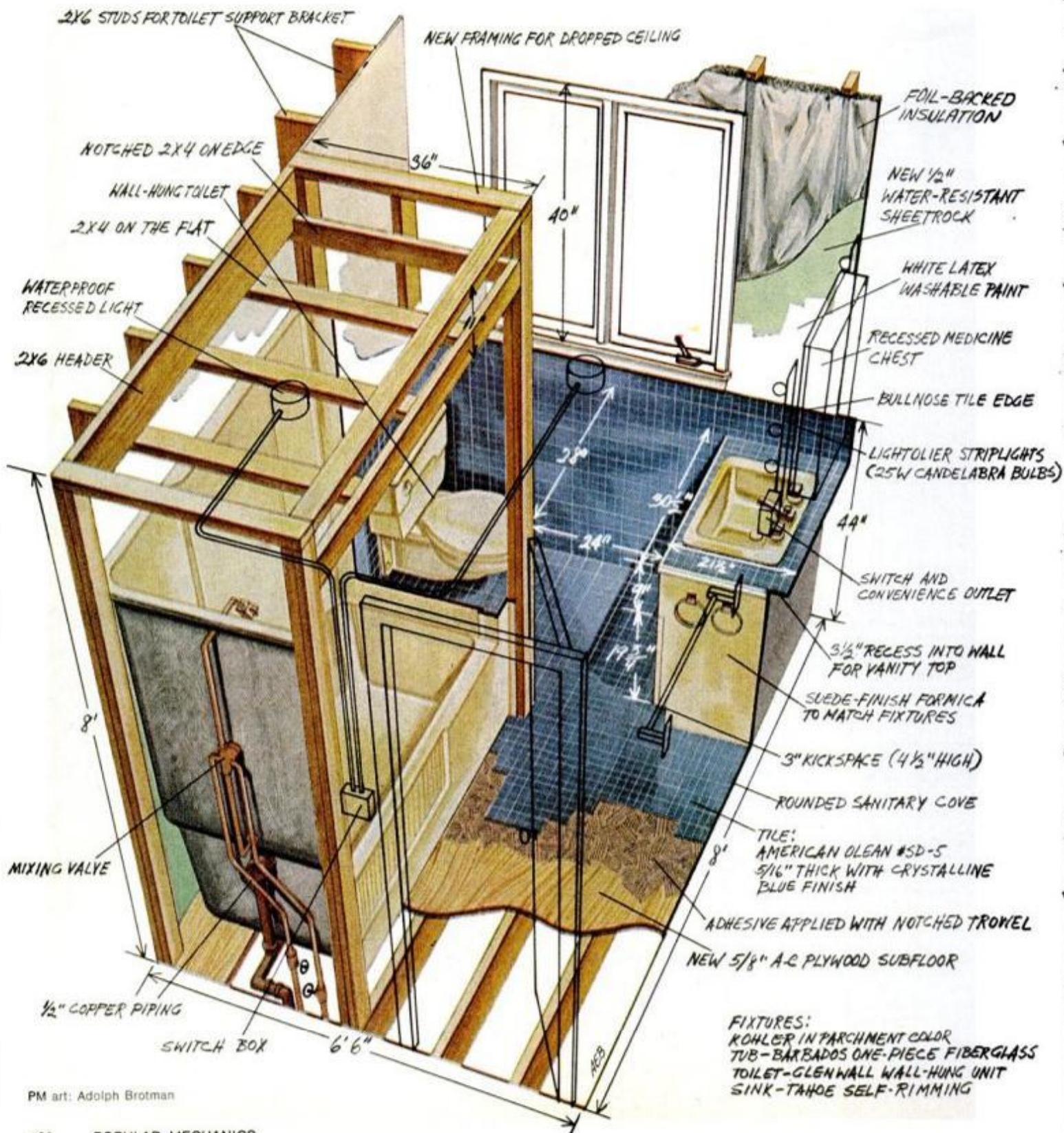
The indeterminate plants (12 to 18 hours) will produce flowers at all seasons. This group includes most household plants such as African violets, gloxinias, coleus, roses and carnations.

*(Please turn to page 134)*

# Remodel your bath for easy care and good looks

PM designs out the trouble spots that trap moisture, dirt and germs.

by Mike McClintock HOME AND SHOP EDITOR



PM art: Adolph Brotman

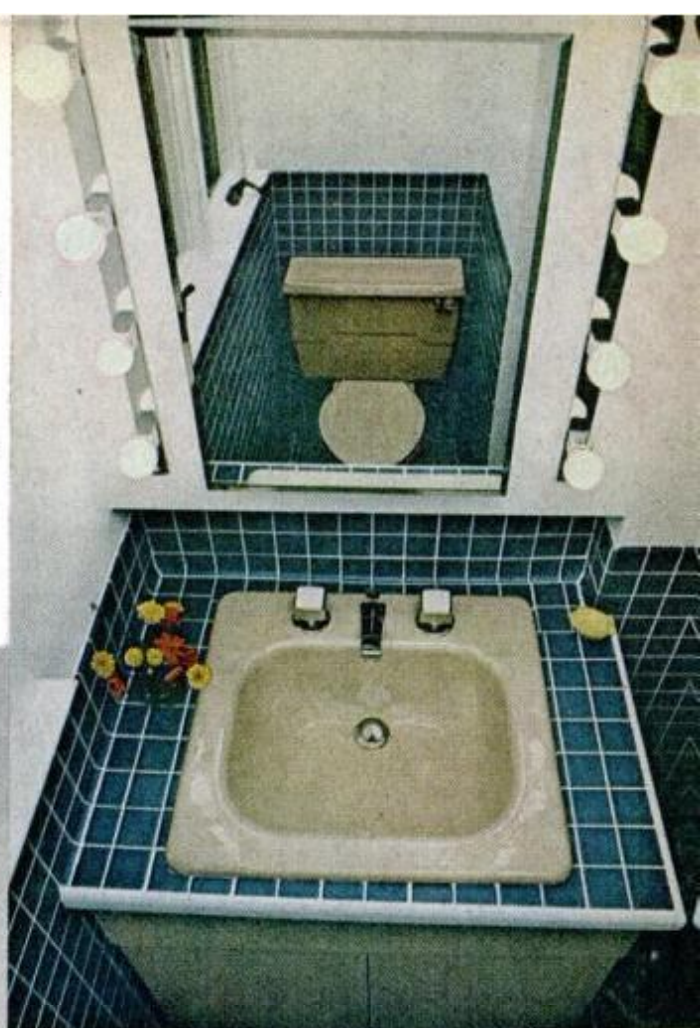


**A** lot of bathrooms are designed to look nice, but few are built for easy maintenance. In PM's remodeling, easy care is built into the design. It was obvious that the shiny new installation would look great in the beginning, but we wanted it to stay that way over the years with minimum cleaning. Here's how we went about eliminating those nooks and crannies that can trap dampness, germs and dirt that make a bathroom look old before its time.

### Make way for the new

The first job was a real pleasure—getting rid of the old fixtures, cracked vinyl tile and wallpaper. Underneath this old skin were mil-

**Easy-cleaning tiles** on the vanity are recessed in the wall. In a small bathroom you need all the floor space you can get. The white, dry-cure grout is sealed with liquid silicone. Combined with a crystalline finish on tiles, it forms a waterproof barrier to stand years of heavy-duty use. Light strips on either side of mirrored medicine chest add a touch of elegance. The Kohler toilet reflected in the mirror is wall-hung. It will eliminate hard-to-clean unsanitary areas.



**The one-piece tub and shower enclosure** is made of fiberglass by Kohler. The smooth surface has many advantages; no hard corners, no seams or joints to crack, and the whole installation is a one-step operation. The only notable drawback is that there are no stock-size glass shower doors made to fit these modern units. If you want them, they'll have to be custom-made.

PM photos: George Ancona

dew, stains and soft spots from years of typical bathroom spills and splashes—not a good foundation for the new fixtures and tile. So we went farther. Old, moisture-ridden wallboard was easy to pull off the studs and the water-logged plywood subfloor came up in pieces. We replaced insulation batts that had settled in the outside wall with new 3½-in. foil-backed fiberglass insulation.

With the walls totally open, it was a simple matter to run a new BX cable for the built-in light over the new tub enclosure. Good access also made it possible to solder a copper cap onto the toilet waste drain below the floor and extend the line to meet the in-the-wall drain of the new wall-hung toilet. (This is a good time to snake through your drains to avoid septic blockages later.)

After we coated beams and sills with Woodlife (a moisture-resistant sealer), we laid 5/8-in. A-C exterior-grade plywood down to make a new subfloor. Rough carpentry included adding two 2x6 studs at the corner of the room to give extra support for the steel hanger that carries the weight of the wall-hung toilet. We measured the rough opening for the new tub and shower enclosure and framed a 3-ft.-wide 2x4 partition to separate tub from toilet. Using 2x4s on the flat, we framed a dropped ceiling over the enclosure.

For the new skin for the bath we re-covered all walls with ½-in. moisture-resistant Sheetrock. You can identify this special board at the lumberyard by its light green color. Its surface is ideal for ceramic-tile installations. A three-coat taping job completed the new surfaces.

### The tub enclosure

We wanted a one-piece, fiberglass tub and shower unit. The only problem was how to get it into the room. The existing door was 32 in. wide; the tub, 34 in. wide. Although it meant removing the door and jamb, getting the maintenance-free unit into the bathroom was definitely worthwhile. There are no hard corners on the smooth, glossy-surfaced enclosure; no seams to caulk, no tiles to fall off the walls and no nooks and crannies to collect dirt.

Our unit is made by Kohler in a new off-white color called parchment. We opted for this more subdued tone and added color with the tile, shower curtain and towels. It's easy to change if you tire of the color, but fixtures are there to stay.

The only other fixture to install was the vanity. We saved space here by recessing the vanity in the stud wall 3½ in. Front and side were

*(Please turn to page 124.)*

## CARPENTRY AND AN EASY-CLEANING TUB



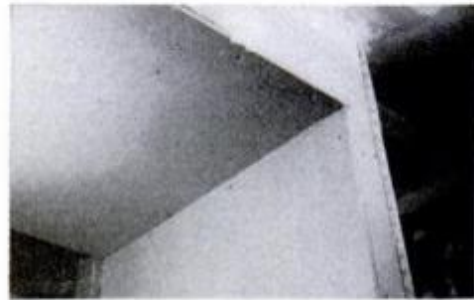
**Resurfacing.** A new 5/8-in. A-C exterior-grade plywood subfloor provides a durable and solid surface for the ceramic tile.



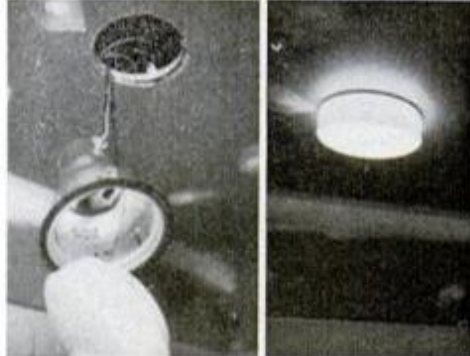
**More strength.** The wall-hung toilet is supported by a steel hanger that must be bolted through two new 2x6 studs.



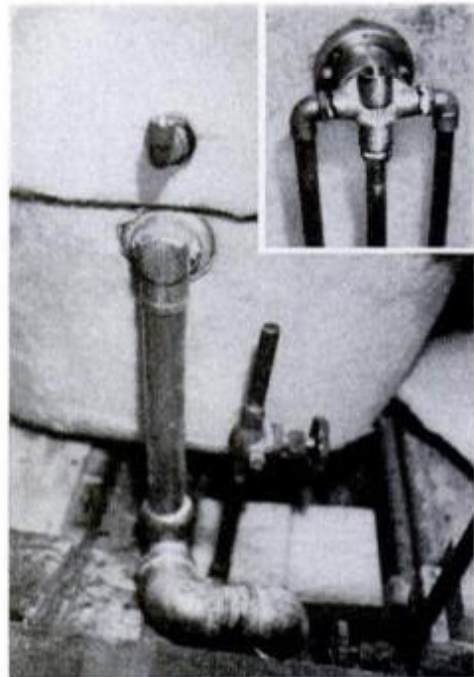
**Framing in.** A new dropped ceiling joins the partition separating the tub and the toilet. The one-piece unit fits inside.



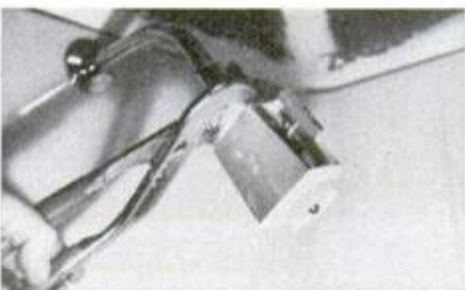
**A new skin.** Moisture-resistant Sheetrock ½-in. thick is a durable wall surface that's ideal for ceramic-tile applications.



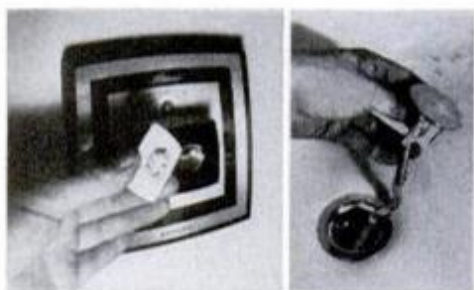
**Lighting.** The built-in "highhat" fixture has a rubber washer between glass bowl and the bulb inside to lock out moisture.



**Tub plumbing.** Install the drain first. You can work the copper supply pipes around it to the single mixing valve (inset).



**Showerhead.** Kohler's unit has a water-saving lever to cut down the flow. A rag will protect the finish from the wrench.



**Details.** Four optional cover plates are provided for each faucet. The drain flange was sealed with a thin silicone bead.

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*Nancy Davis of Houston, Texas, shown here with husband, Glenn: "We wanted a big, financially sound insurance company with a good reputation. And a nearby agent who was known for taking good care of his policyholders. With Rod Mace, we have both. He provides all the different kinds of coverages we need—life, health, homeowners and car. And he's right there in the neighborhood to give us personal service on all our different policies. He really cares, and he's backed by State Farm. We have the best of both worlds..."*

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## REMODEL YOUR BATH

(Continued from page 122)

covered with a suede-finish Formica colored like the fixtures. We used the paper template supplied to make the vanity-top cutout.

### Maintenance-free tile

We chose a crystalline-finish, deep blue tile made by American Olean. Although you can find less expensive imported tiles, in general they are not as uniform in finish and size as American-made tiles. Even seams from one end of the bath to the other are essential for appearance.

First we established the tile height on the walls. For convenience, adjust height to accommodate the nearest full tile. We used a bullnose-edged tile to form the top border and a rounded cove tile at the base. We started work on the walls by spreading 3 or 4 square feet of adhesive with a notched trowel and placing the tiles next to each other with a firm press of the hand.

Chances are slim that your floor dimensions will match the dimensions of full tiles, so use uncut tiles in the most visible areas and save the cut (or uneven tiles if your room isn't square) for less prominent areas. The scored tile we used appears to be individual 2¼-in.

## EASY-CARE TILE

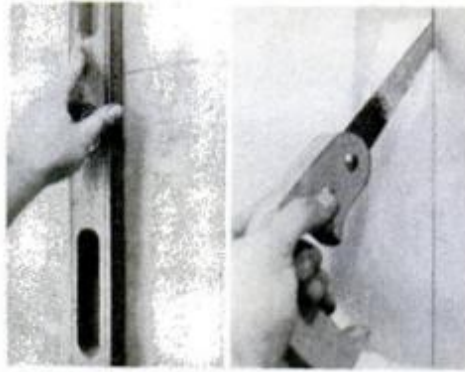


**On the wall.** Establish the wall height and lay out dry tiles to check it. We recessed the tiled vanity top 3½-in. into wall.

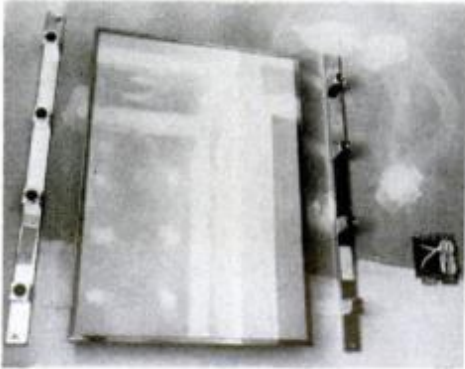


**The floor.** A coved base eliminates one more hard-to-clean crack. Make sure no nailheads protrude from plywood floor.

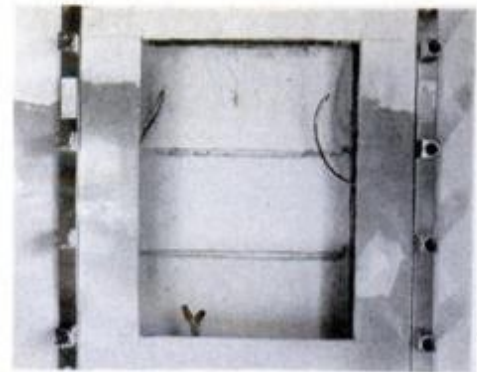
## A GOOD-LOOKING VANITY



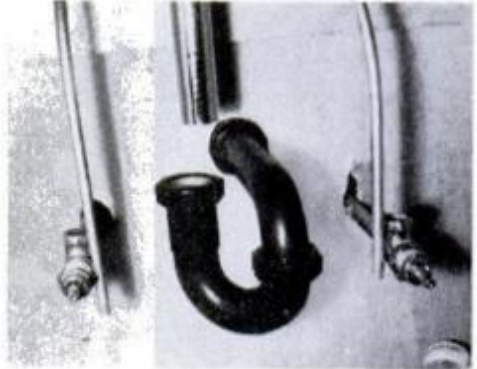
**Medicine chest.** Pencil in the cut lines with the aid of a level. A keyhole saw will make the cuts smoothly and evenly.



**Convenience.** Soft light, 25-watt bulbs throw an even light on the vanity. Install a grounded receptacle next to the switch.



**Wiring.** Light strips flanking the chest are wired to a junction box above the opening. Use wire nuts on all splices.



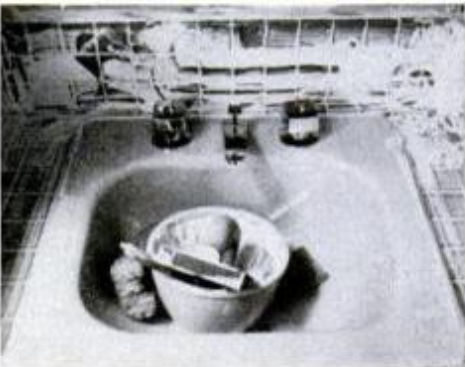
**Drainage.** We used a noncorroding PVC trap and copper tubing to connect the old pipes and new sink.



**Adhesive.** Spread out about three square feet at a time with a notched trowel and press each tile into place firmly.



**Cutting.** Most local tile suppliers can rent you a cutter and chippers. After you score the surface, the tile snaps evenly.



**Grouting.** Apply the grout liberally, forcing it into the seams by making continuous passes with a rubber-coated trowel.



**Cleaning up.** A window washer's squeegee is ideal for removing the excess grout. A rag removes the final film.

squares, but is applied in single blocks of four scored areas.

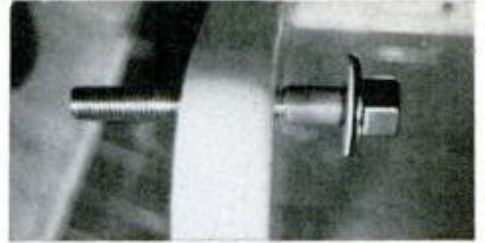
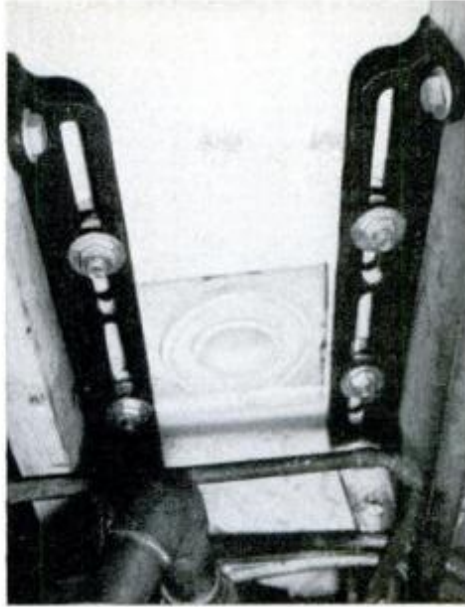
A durable finish is achieved with a two-step process. First, force the dry-cure grout into the seams with a rubber-coated trowel. Several passes over the same area will compact the grout. Don't worry about the excess. A window washer's squeegee will remove it. Follow this with a damp sponge; it will remove all but a fine film which can be "polished" away with a dry rag.

The following day we finished the tile job by brushing a liberal coating of liquid silicone on the grouted joints. This is tedious, but it will save you hours of maintenance.

Two coats of washable latex paint completed the resurfacing of our modern, efficient bath. The thorough installation will keep it looking good with a minimum of effort. ★★★

The wall-hung toilet is supported by a steel hanger. Drill holes for the bolts and remove enough tile for the waste drain connection. A plastic sleeve will protect the fixture as the threaded bolts pass through the wall. Careful layout is essential for proper alignment of the bolts and the openings in the hanger. If your measurements aren't exactly right, you can loosen the bolts to the 2x6s and insert shims. The floor tiles stay intact.

## AN EASY-MAINTENANCE, WALL-HUNG TOILET



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## RESCUE IN SPACE

(Continued from page 68)

will glide to a landing either at the Kennedy Space Center in Florida or Vandenberg Air Force Base in California. Turnaround time is projected at two weeks.

The Orbiter can carry a payload of up to 65,000 pounds—a weight equal to about 20 medium-sized cars—in its 60-foot-long cargo bay. Two big clamshell doors open outward to discharge or take on cargo.

The Orbiter will carry out a variety of missions, including the delivery into orbit of space laboratories,

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- 4 heavy duty antique brass-plated coat and hat hangers.
- Complete hardware, brads, drip pans included.
- Designed to fit over baseboard, snug to wall.
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- Easy to follow instructions.
- Mirror dimensions included. (Mirror is not included due to breakage in shipment.)
- Craftmanship and materials fully guaranteed.



Author settles into rescue ball under the alert eye of a Space Center technician.

telescopes and satellites. The craft will also retrieve satellites for later reuse, service scopes and satellites, and even make on-the-spot repairs of malfunctioning hardware. In addition, the Orbiter will function as a "taxi," shuttling technicians and scientists to and from orbiting labs.

If an Orbiter were to lose power, for example, making it impossible for the craft to return to Earth, or if a crewman became injured and required medical help, a rescue effort would be mounted immediately. Another Orbiter would blast off for a rendezvous with the first craft.

The Orbiter's pressurized crew compartment is designed for seven persons, including crew, but in a rescue up to 10 can be squeezed in. Since space is limited, only two crewmen will be equipped with space-suits with life-support backpacks.

The other crewmen and passengers will have to rely on the "personal rescue enclosure" now under

(Please turn to page 128)

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Fill 'er up  
with Champions.

## RESCUE IN SPACE

(Continued from page 126)

development at the Johnson Space Center in Houston. Deflated, it stows readily in flight, but when pressurized, it becomes a large "beachball."

### Personal rescue enclosure

The user steps into it through a zippered opening, sits and pulls his knees up to his chin to make himself as small as possible, and zips himself in from the inside.

On the first try, this can be an awkward maneuver, as I learned during a recent visit to the Johnson Space Center. A little practice, however, would make the operation quicker and easier. When the ball was inflated, I felt quite comfortable in the 34-inch-diameter cocoon.

Designed and fabricated by the Space Center's Crew Systems Div., the ball is made up of layers of urethane, Kevlar and an outside thermal skin. It feels tough and substantial, like heavy canvas. Limited visibility is provided by a small Lexan port.

Here's how the personal rescue enclosure would be used. After the crewman has closed the zipper, the ball is pressurized with oxygen

pumped from the disabled Orbiter's life-support system. This air line is then disconnected. Now the occupant has about an hour's supply of oxygen in the ball's limited life-support system. He has a small radio to communicate with his rescuers.

A crewman dressed in a space-suit carries the ball by its fabric handle and maneuvers it out through an airlock. NASA engineers are considering three ways of getting the ball over to the rescue craft:

- A spacesuited astronaut equipped with a "man maneuvering unit" who would simply carry the ball from one Orbiter to the other.

- A clothesline device to be rigged between the two craft, permitting the rescue ball to be pulled across.

- The remote manipulator arm in the cargo bay of the rescue craft to be extended, enabling an astronaut standing on a small platform to pluck the rescue ball from the disabled craft's airlock hatch.

A new spacesuit also has been designed for the Shuttle program. Technicians at Houston showed me a prototype, explaining that it was made of the same material used in the rescue ball. The suit will be an "off the rack" product available in three sizes—small, medium and

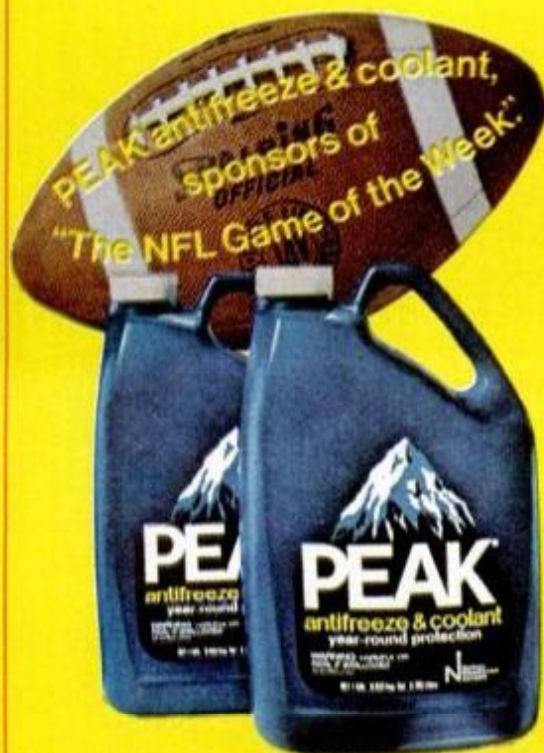
large—and will be worn by both men and women. Though alterations ("adjustments," in NASA language) will be available, the suits will not require the painstaking custom work involved in the Apollo suit.

The Shuttle suit comes in two units—one for the upper torso, one for the lower. They are joined at the waist to form a tight closure. The backpack life-support system is an integral part of the upper half, another advantage over the Apollo design. When the Apollo astronauts walked on the moon, they had to remove a bulky 75-pound life-support system from its storage location and then connect it to the suit.

Use of the tough Kevlar material has permitted technicians to construct elbow, knee and wrist joints from flat fabric rather than follow the Apollo pattern where joints were constructed of molded rubber and cables. The fabric joints provide greater mobility and reduce weight.

Though the new suit and the rescue ball constitute relatively small parts of the overall Shuttle program, they could prove vital in an emergency. The safety of space travelers in the 1980s will depend greatly on the work being done today at the Johnson Space Center. ★★

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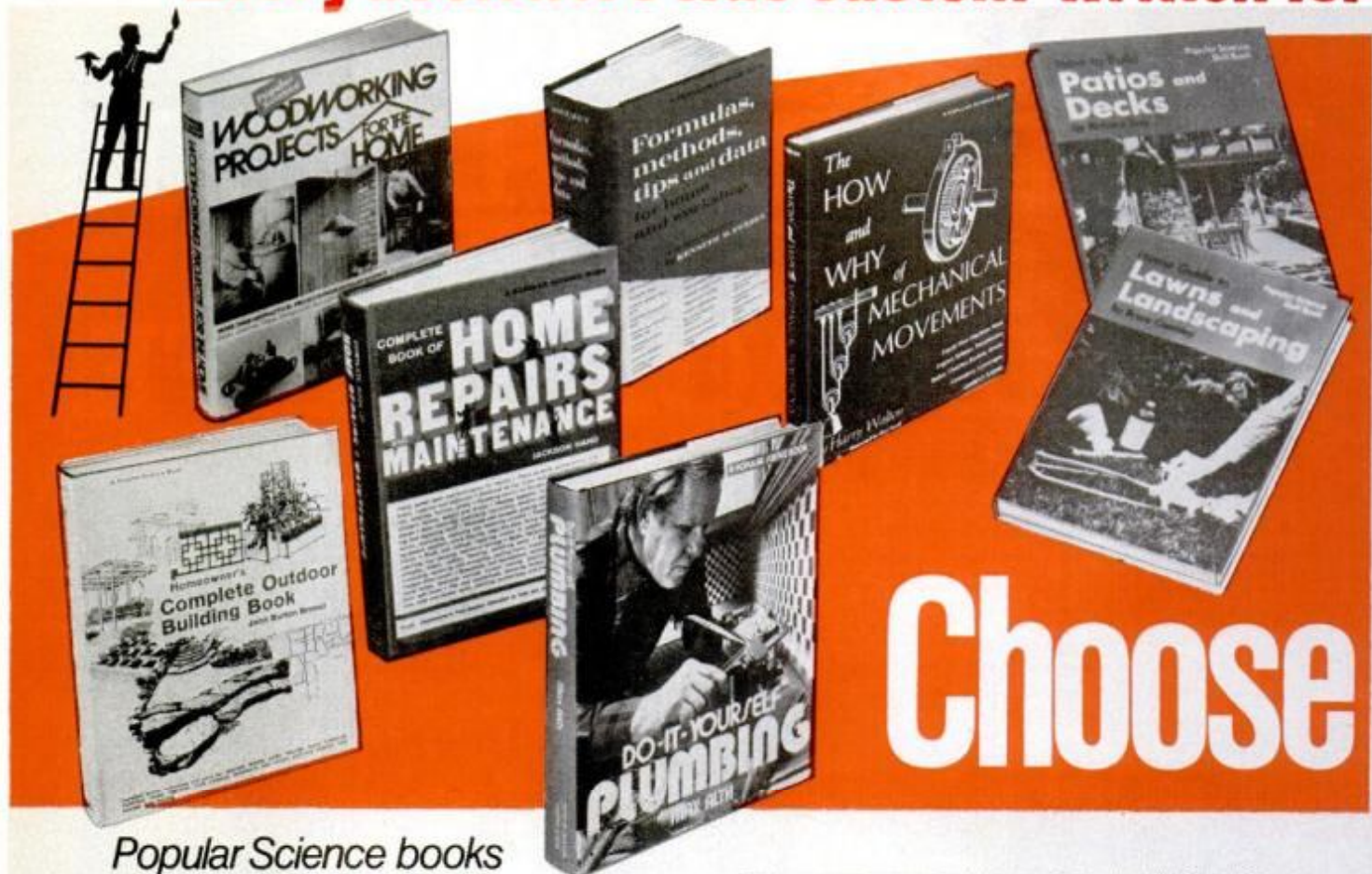
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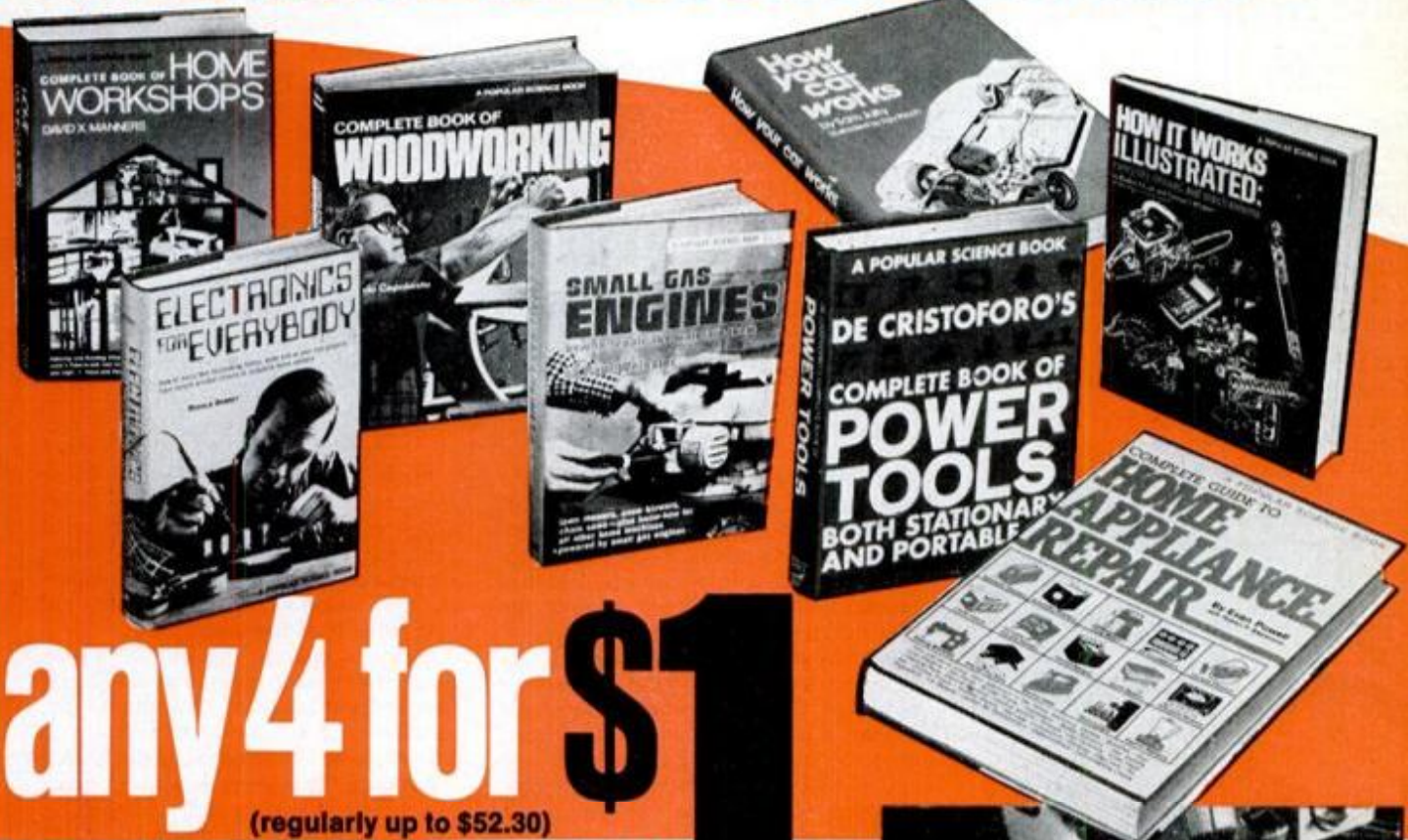
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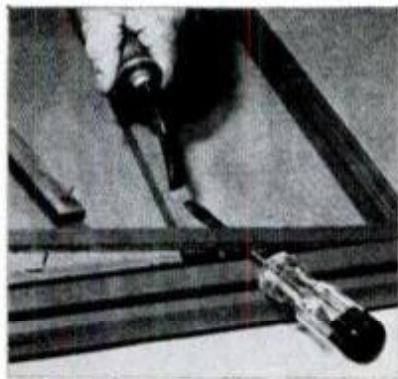
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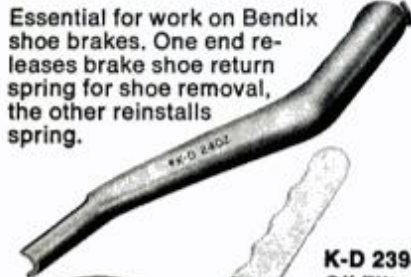
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## THE WAY TO GROW (Continued from page 119)

apply glue to ends of the legs and wells and stand legs in the wells. Weight of the table will hold it until the glue dries.

## ROOM DIVIDER/PLANTER

As a hutch or freestanding room divider, this planter makes a handsome display case for plants. Birch-faced, lumber-core plywood is used for exposed surfaces; common fir plywood and pine for the rest. Use your portable saw with a smooth-cutting blade to cut the pieces from your 4x8-ft. panel. Remember to cut with the good side face down when

using a portable saw. Guide it with a straightedge clamped in place.

All exposed plywood edges are faced with strips of solid wood, so allow for them when ripping your pieces for width. If you're planning a room divider with both front and back exposed, cut the sides 11 in. wide instead of 11 1/4 in. Cut all cross and shelf members 38 in. long, then butt, glue, nail and cleat them to the sides. Since solid wood generally measures 1 1/16 in. thick and plywood 12/16 in. thick, the slight extra thickness helps in gluing and adding

(Please turn to page 199)

## GROWING TIPS (Continued from page 119)

**Temperature.** A daytime-temperature range of 70 to 75° F., (nighttime, 60° to 65° F.) is recommended for development of quality plants. The cooler night temperature is important because plants gather their food during the day, but digest it during the night.

**Humidity.** The recommended humidity for most plants is 45 to 50 percent or higher. Often, in winter, homes have a relative humidity of only 10 to 15 percent. Cacti and succulents will do well under these low-humidity conditions, but other plant types will suffer.

You may increase the humidity by misting the plants twice daily with a water-spray atomizer, by setting the pots on trays of water-saturated gravel, or by using a portable room humidifier.

**Ventilation.** Plants lose water vapor through small pores on the underside of the leaves. Poor ventilation causes this to condense in a film on the leaf surface encouraging disease-producing organisms. To limit this, use a small fan or humidifier with its own fan to circulate air around the plants.

**Plant spacing.** Crowded plants result in long weak stems and encourage development of foliage diseases due to lack of air.

**Soil.** Since heavy clay and some other natural soils are not desirable for indoor plants, many hobbyists use commercial soils that are well aerated, provide excellent drainage and are sterilized before packaging. They contain shredded peat moss, vermiculite and perlite with added nutrients. You can purchase them under trade names such as Jiffy-Mix and Redi-Earth. Expandable containers for starting seeds and cuttings are alternatives to loose soil pots and can be purchased under the trade name Jiffy-7 Peat Pellets.

**Fertilizing.** There are many kinds of complete fertilizers on the market. A complete fertilizer has three major elements—nitrogen, phosphorous and potassium—and comes in dry powder, liquid or tablets. Follow the directions of the manufacturer, but remember, too little fertilizer is better than too much.

**Watering.** Many automatic watering systems are now available for indoor plantings, but the best method is still

to inspect your plants daily and water them by hand when needed. Over-watering is the most common cause of trouble in growing house plants. Water plants in the morning when the temperature is rising. Use tepid water, not cold water from the tap.

From experience you will learn how much water each plant needs. Differences of size and leaf area, plant type, conditions of soil, and temperature of growing area will affect your decision.

**Cuttings.** A common way to start new house plants is with cuttings. A cutting is any part cut from a plant capable of producing roots and continuing growth, thus developing into a new individual plant. The cutting allows plants to mature rapidly and closely resemble the parent plant.

Cuttings of 4 to 5 inches can be removed from a parent plant with a sharp knife. Cut the stem just below the joint. As soon as it is cut, insert the cutting into a moist rooting medium such as vermiculite, perlite or a fine grade of peat moss. Keep medium moist until the cutting has rooted. Cuttings should be transplanted as soon as roots are well developed.

**Seeds.** Sow seeds as evenly as possible in a container having good drainage; then cover with a fine soil. Or use compressed peat pots, following the maker's instructions. Small seeds should be lightly covered, while larger seeds should be covered to a depth of twice their greatest diameter. Dampen the soil with a fine spray and cover the container with clear plastic or glass to maintain the moisture of the medium.

The temperature for seed germination should be about 10° higher than that required for normal plant growth.

The small seedlings should be potted or reset as soon as they are large enough to handle.

**Hardening off plants.** Bedding plants (flowers and vegetables) started indoors are soft and must gradually get accustomed to the wind and sun. A week before transplanting the garden, move the plants outdoors to a sheltered, shady place. After a couple of days outside, the plants will become stronger and ready for the sun. ★ ★ ★

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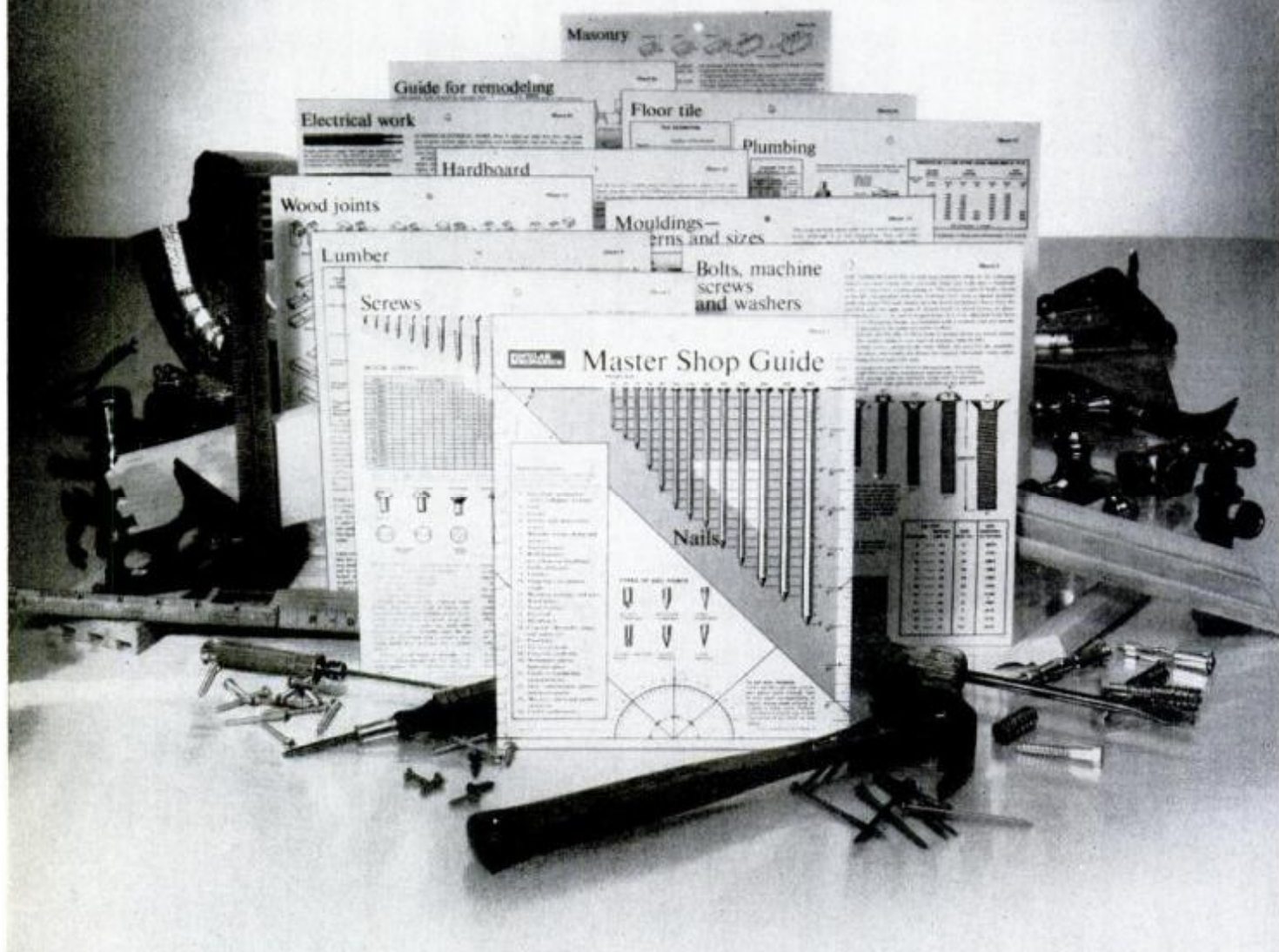
**Big, beautiful styling.** You can count on your new Dodge D100 to turn more than a few heads with its new look. If you ever build a house as well as Dodge builds the D100 pickup, you can count on it to last a long, long time.



\*400 V8 and Overdrive-Four N/A in California or high altitudes.

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You can put together the world's most remarkable scientific calculator from eight groups of components, using only a soldering iron and a pair of cutters. (Complete instructions are included.) Less than 3/4-inch thin and 3-3/4 ounces light. British-made Sinclair Scientific isn't just portable, it's pocketable.

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## Features of the Sinclair Scientific

### FUNCTIONS SUMMARY —

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 Square root, pi and reciprocal  
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 Automatic constant  
 Pocket-sized. 4-1/3" X 2" X 11/16".  
 Weight: 4 ounces.  
 Battery life. Low-cost, disposable AAA batteries (not included) operate for around 25 hours of continuous use.

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1. Coil
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KEY # PM-10WC

# For 1977 some car makers narrower, lighter full-size cars.



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The trimmer, sportier LTD II at a trimmer price.

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# will offer you only shorter, Ford has a better idea. Choice:

## Ford LTD. The full-size car that kept its size.

This year some car makers are making their full-size cars smaller. But Ford believes that people who want the traditional full-size car they're used to should have that choice. So the 1977 Ford LTD hasn't been reduced by a single inch!

You'll find Ford LTD has a longer wheelbase than cars like the down-sized Olds 98 and Buick Electra and about the same size wheelbase as Cadillac de Ville.

And Ford LTD now has a longer wheelbase than Chevrolets (both Caprice and Impala) which have come down to the same wheelbase as the mid-size Chevelle.

### Ride, room and trunkspace—unchanged

Ford LTD has retained its traditional smooth, quiet ride. Interior spaciousness, deep-well trunk, road-hugging performance, long wheelbase and 3½-ton rated towing

capacity (with optional trailer towing package) are all unchanged. Keep all this in mind when you go shopping for a new car this year.

### Will "down-sized" cars have "down-sized" prices?

As this magazine goes to press, 1977 prices are not available. When they are, compare LTD's price to its down-sized competitors. Compare with test drives. What you may really want is the quiet ride and

roominess of Ford's full-size 6-passenger car: the 1977 Ford LTD.

#### SIZE COMPARISONS

Cars with full-size wheelbase		
4-DOOR MODELS	1977	1976
Ford LTD	121.0"	121.0"
Cadillac de Ville	121.5"	130.0"
Cars with mid-size wheelbase		
Ford LTD II	118.0"	—
Caprice	116.0"	121.5"
Impala	116.0"	121.5"
Chevelle	116.0"	116.0"



Ford LTD Country Squire: the full-size wagon that kept its size.

Elegant Ford LTD Landau 2-door.

## And the new trimmer, sportier LTD II.

If you prefer a 6-passenger car that's trimmer in size and price than LTD, Ford gives you that choice, too. Ford introduces a sporty new line of cars for 1977—2-doors, 4-doors, station wagons—called LTD II.

### A new idea that's a better idea

Ford's new quiet-riding LTD II combines LTD's traditional high-level of workmanship with a unique sporty spirit that's all its own. The result: a comfortable new car that's trimmer in size and price than LTD.

### A new kind of value

Ford will price LTD II to strongly challenge all competitors. So as soon as 1977 prices are announced, compare LTD II value not only with other mid-size cars, but even with GM's cut down "full-size" cars.

And you should know that all



LTD II Squire. A trimmer wagon at a trimmer price.

Sporty, trim LTD II Brougham 2-door.

LTD II and Ford LTD 1977 prices include V-8, automatic transmission, power steering, power front disc brakes, steel-belted radials, Dura-Spark Ignition system, and more.

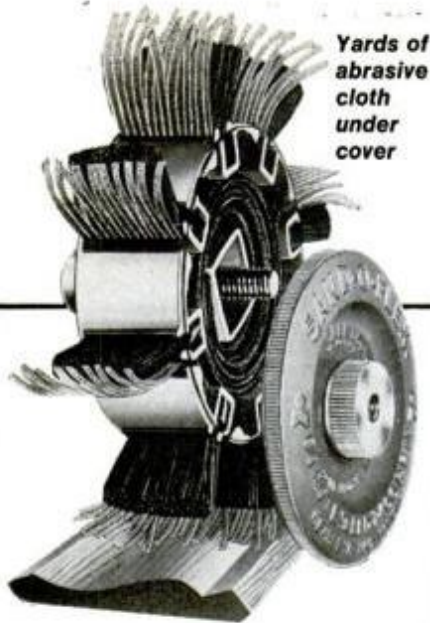
### Shop where you get a choice

Full size or trim size? Some car makers won't give you this choice of car sizes in 1977. But Ford will: full-size Ford LTD or trim-size LTD II.

So this year, before you decide on the car size that's best for you and your family, take a comparison test drive. And compare prices at a dealer who offers you a choice: your local Ford Dealer.



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PM

## TWO MILES DOWN

(Continued from page 76)

nelly calls *Lulu* on the underwater telephone to report our progress. He gives our pressure depth below the surface and our altitude above the bottom, as indicated by echo-ranging on the seafloor. While the two figures change each time, they always add up to 3500 meters (about 11,500 feet)—the total water depth at this site.

### The vital link

No matter how deep we go, the voice of Val Wilson, veteran diving pilot and expedition leader aboard the *Lulu*, comes through as though he were down here with us. As with the astronauts far out in space, this link with old friends back in the normal, safe world provides a strong feeling of security.

By 3000 feet, we are seeing larger, more luminous creatures and I am reminded of the time when a swordfish charged *Alvin*, ramming its sword between the pressure sphere and the outer padding of buoyant foam. It was hopelessly stuck and died from decompression effects as the submarine surfaced.

As my face is pressed close to my port, it seems as though Jelle de-Boer's voice is coming over a public address system. Then I remember the acoustic effect inside a dome, like that of St. Paul's in London or the Capitol in Washington, where the softest whisper is channeled to the opposite side, seemingly amplified.

Donnelly, carrying out his routine checks during descent, has found that the electrical system used to release one of our diving weights is not responding at full efficiency. We carry four such weights, each of 230 pounds. Two are to be dropped as we near the bottom to slow our descent, the others when we wish to rise.

### Suddenly the bottom

After noting on my tape recorder that this is *Alvin's* dive number 614, I begin my commentary:

"The time is 11:03. One hundred meters off the bottom. The starboard forward weight is away. This is the one we were having a little trouble with. Still descending. The STRASA shows quite a few interesting targets in the area."

The STRASA is a horizontally scanning sonar. Donnelly turns on a powerful thalium iodide lamp on top of the sub that casts a soft greenish light. Suddenly there is the bottom, showing up clearly below us. It is flat, with a coarse, granular surface largely formed—probably—from the tiny shells or "tests" that sink after their owners die. Below I can see

one of the two weights we dropped—a stack of steel plates about seven inches high that has sunk into the bottom until its top is flush with the surface, giving an idea of the latter's bearing strength.

Our mission is to drive the *Alvin* up a steep slope that had been mapped by echo sounding from the surface, collecting rock samples representative of various layers of the trench walls. Donnelly adjusts the sub's trim and ballast for the journey, then we set off at what would be a good walking pace. The landscape is rolling with steep slopes here and there, but very rounded—strikingly similar to the lunar surface observed on TV.

Jelle reports seeing a holothurian, or sea cucumber, and almost simultaneously one appears on my side and then others. They are a foot or more in length, seemingly black with a single, bayonet-shaped appendage that sticks up at about a 45° angle. I see what looks like an enormous grasshopper. Jelle says it must be a shrimp.

### Mysterious scars

We have been seeing scars in the sediment that resemble the gouges left in sand by a mired motorcycle, but we have no clue as to what kind of creature might have caused them. As we climb higher, the "tire" marks are now everywhere as though there had been an underwater motorcycle rally. The gouges are six or seven feet long.

The *Alvin* has a remotely controlled arm and claw with which to pick up samples and drop them into one of several bins in front of the sub. I record: "We are stopped, trying to pick up what appears to be a rock. Had to wait a while until sediment settled. Now trying to retrieve with the claw. Jack is crouched like a football player as he leans with his head right in the porthole trying to coach the claw out on its long arm to pick up the specimen . . ."

"We have just picked up the sample, which now appears to be wood. Put it in bin bravo [voice code for the letter B]."

Guided by STRASA, we come upon rocky outcrops and cliffs. With their whitish dusting of sediment like snow on very high mountains aglow in the greenish light, these steep rocks are breathtaking.

For two hours, Donnelly claws at fragments of the rock, trying to tear them loose. The submarine shudders and bangs against the cliff face—but gently. Donnelly knows his business.

In over 600 dives and more than 10 years of operation, *Alvin* has had an unblemished safety record. There

(Please turn to page 144)

# THE ARMY RESERVE. PART OF WHAT YOU EARN IS PRIDE.

You may join the Army Reserve to learn a skill or to earn a second income. But you could come away with something a lot more important.

It's not something you can put in the bank. It's not something you can buy either. You pay for it with your sweat, your spirit, your mind, and your time. It's called pride.

You earn it during some tough weeks of Basic Training. You earn even more during an advanced training period, where you learn a skill you chose when you enlisted.

After a few months of active duty, you start serving 16 hours a month at your local unit, plus two weeks each year of Annual Training. That's how you earn a good extra income.

A lot is asked of you in the Army Reserve. That's why part of what you earn is pride.



Military Policeman



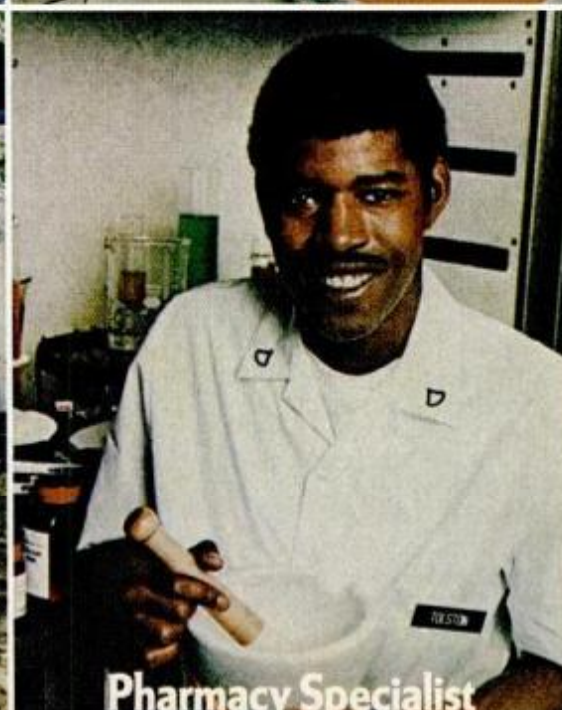
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## TWO MILES DOWN

(Continued from page 140)

have been a few scary moments, however. In 1966, while helping to retrieve a hydrogen bomb off the coast of Spain, the miniature sub apparently became briefly entangled in the bomb's parachute shrouds. A few years ago a mooring cable snapped during launching, allowing the sub to slip out of its cradle with the hatch still open. The crew scrambled out to safety, but the craft filled with water and sank. Not until a year later was it raised and repaired.

The most hair-raising episode occurred in 1974 during Project FAMOUS—the French-American Mid-Ocean Undersea Study—when the craft became trapped on the bottom. The sub carries sufficient oxygen to sustain its three occupants for 72 hours, but no more. If they cannot regain the surface within that time, suffocation is inevitable. For two agonizing hours, such a fate threatened the *Alvin's* crew.

The pilot on that dive was our same Jack Donnelly. The exploration was into the mid-Atlantic rift to see if, as suspected, there were hot, geyserlike eruptions in fissures that cut deep into the valley floor 9200 feet below sea level. Such hydrothermal activity is thought to play a key role in laying down veins of metallic ore.

### Sub won't rise

Jack eased the *Alvin* down into a long, narrow fissure, then settled on a jumble of boulders to make water-temperature measurements. He then attempted to move on to another site, pumping water from his ballast tanks and aiming his small maneuvering propellers to drive the craft upward. Sediment thrown up by the prop wash swirled around the portholes, but the altimeter was not changing. An observer remarked in a matter-of-fact tone: "Jack, we're not rising."

Donnelly immediately called the chief pilot aboard the mother ship *Lulu*—the same Val Wilson monitoring our present dive. He quietly said, as did the astronauts of Apollo 13 after part of their spacecraft blew up, "We have a problem."

Wilson's first advice was to avoid futile struggling and economize on power. Donnelly had already shut down all unnecessary circuits, including most of the lighting. The most plausible explanation for their predicament was that the current had carried the craft under an overhanging ledge, pinning it underneath. Donnelly took on ballast to make sure that the sub didn't push up against the ledge, jamming it even

more tightly below the overhang.

In a frantic struggle for freedom, Donnelly thrust forward on the starboard propeller and backward on the port one, slewing the sub to the left. Nothing happened. He reversed his propellers and tried slewing the craft to the right—still nothing. Finally, with one prop aimed up and the other down, he attempted to roll the sub sideways, first in one direction, then the other.

### Methods of escape

Val Wilson from *Lulu* came on the underwater telephone to ask if they had made any progress. "One inch," Donnelly replied sardonically.

The *Alvin*, as we were told in our pre-dive briefing, has several modes of escape from entrapment. Assuming that blowing ballast doesn't produce enough buoyancy to tear loose, the diving weights can be dropped. Also droppable are the heavy sample-collecting arm and the specimen basket in which samples are placed.

If this still fails to free the sub, one or more of the three batteries, each weighing 580 pounds, can be dropped. But if all three are dropped, the sub is helpless with no propulsion and only emergency communications and lighting. The final alternative is the release of the sub's afterbody which might send the pressure sphere shooting upward in a violent, uncontrollable, topsy-turvy ascent. Since all these are extreme emergency measures, the release buttons are carefully covered by guards to avoid accidental activation.

### Finally, success

Wisely, the occupants of the *Alvin* refrained from resorting to such risky procedures. As was proved later by gouges on the fore and after decks, the craft had been clearly wedged under an overhang and any increase in buoyancy would only have made matters worse, increasing the force of the trap. Instead, Val Wilson on the *Lulu* asked the crew to describe in detail what they could see through their ports. From their examination they concluded that the sub was no longer parallel to the fissure walls but had swung about 30°. They decided to bring it back parallel to the fissure walls, then drive hard with the main propeller on the stern.

This time, after more thrusting with the side propellers, they were successful. The submarine quivered as it drove forward. With a lurch it broke free—two and a half hours after becoming trapped. Although exhausted and drenched with perspiration, the crew continued their exploration for another two hours

(Please turn to page 146)

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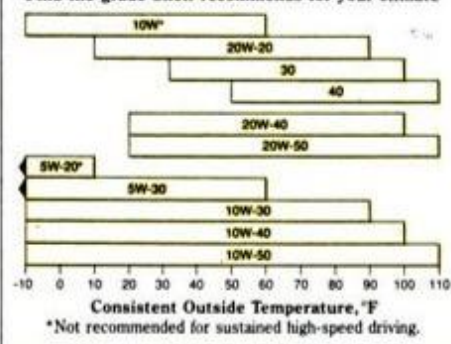
So don't rely on the appearance of the oil. Stick to the oil change schedule in your owner's manual. Don't change more often — or less often — than recommended there.

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*Fact or Myth?*

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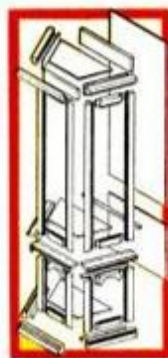
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## TWO MILES DOWN

(Continued from page 144)

before returning to the surface—an example of "real courage," as one expedition member later commented.

In our own briefing, we were shown more recently installed closed-circuit television cameras that enable those in the sphere to see the otherwise invisible fore and after portions of their craft. Had these cameras been available in 1974, the trapped men could have seen what their problem was.

We were also warned not to bring lipstick or other highly flammable material aboard our submersible because of the danger of fire. We wondered at the reference to lipstick, but it was explained that at least one woman has made an *Alvin* dive.

As we claw our way up the jagged walls of the trough, I recall that near-catastrophic incident in 1974 and am glad we have the same Jack Donnelly as our pilot and the same Val Wilson guiding us from above. Their experience and expertise would be invaluable should we encounter a similar emergency.

Now, trying to jar loose rock specimens, we set miniature avalanches in motion. Slabs slide down the steepest slopes, throwing up powdery clouds as in a mountain avalanche. Jelle jests that if he gets frustrated enough he might open the hatch, get out with a hammer and knock off a piece. Indeed, looking out at the lovely scenery around us, it is hard to believe that the weight of two miles of water bears down on us from above. Opening the hatch would, of course, be impossible because it is sealed shut by the pressure.

Donnelly finally ends his two-hour effort. Though we have only a tiny, matchbox-sized specimen in the bins, the time spent retrieving it is justified by the need for samples from as low a level in the trough as possible. Direct study of the deep seafloor from manned, deep-diving submersibles, such as we are doing now, is opening a new chapter in the exploration of the earth's surface. It is a generally accepted concept that the grinding, twisting, sliding movements of great continental and oceanic slabs or "plates" account for most earthquakes and volcanic eruptions.

In trying to fit together the jigsaw puzzle of past and present plate movements, scientists have found the Caribbean to be a critical area. It appears to have been a "no-man's land" between two embattled continents—North and South America—whose converging and rotation distorted the Caribbean floor. It has

(Please turn to page 148)



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## TWO MILES DOWN

(Continued from page 146)

been suggested, for example, that in the last 15 million years Hispaniola—the island on which Haiti lies—has moved 120 miles eastward relative to its neighbor, Cuba.

In the last 70 million years, according to this analysis, the Caribbean floor has moved some 500 miles east, relative to the Americas. The Cayman Trough forms the northern boundary of this Caribbean Plate, along which most of the theorized

movement has occurred. Learning more about the characteristics of this deep trench—a giant, ever-changing gash in the earth's crust—is what makes our dives in the *Alvin* so important.

### Onward and upward

Again Donnelly attacks a rock formation. So that he can guide the claw from Jelle's port, he detaches the entire arm-and-claw control unit and carries it to that position. Much time is lost as clouds of sediment thrown up by the effort take long to

disperse before Donnelly can see what he is doing.

With more small specimens we continue. Tracks about an inch wide snake across the sediment for a dozen yards or more. At the freshest end of one track is a sticklike object, seemingly encrusted with sediment. There is another track, again with a "stick" at its end, then a third. Clearly, the "stick" is alive. Fish are rare but present—some brightly colored. We wonder how they can see in the total darkness, especially those beautiful colors. What is their purpose so far below the surface of the sea? Intriguing questions, but as yet no definite answers.

The sphere is a medley of sounds: rhythmic clicks, pings from the depth recorder, electronic hums and the strange sound of the STRASA, like a great crowd at a great distance. Flashing lights, glowing dials and status indicator lamps complete the visual picture.

The air is fresh and temperate. The only time I feel slightly claustrophobic is when, with my face pressed close to the port and hands cupped to keep out light from the cabin, I inadvertently cut off my own air. The water outside is close to freezing. The bare metal of the sphere is frigid and wet with condensation, but padded where one is apt to touch it.

Twice a knee hurts from being so long bent and immobile. Though stooped, I can stand and straighten the leg for a few minutes and the pain passes. Knowing we would be submerged a long time, we minimized fluid intake beforehand, but some of us must find comfort in a flask marked "HERE." Later I learn this stands for "Human Effort Range Extender."

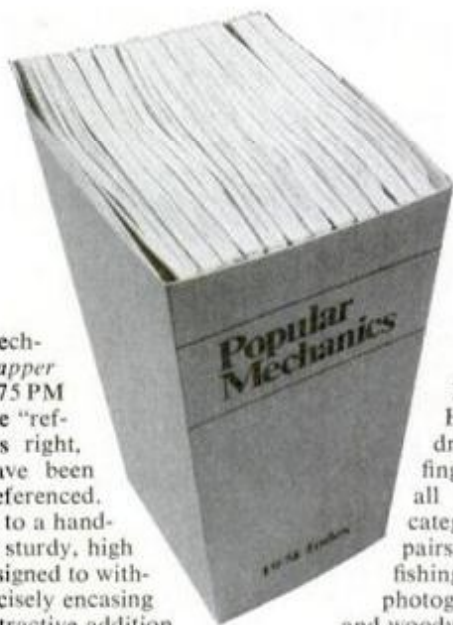
### Happy voyage home

The time is 3:28 p.m. We are resting on a flat stretch eating sandwiches, pears and cookies. At 4:00 we must start up to be on the surface by 5:30. On the way up Jelle removes the cassette with his tape-recorded commentary and produces other cassettes with music. We ride up to a Chopin piano concerto.

"When you see the light coming back," says Jelle, "it is a beautiful moment." Indeed it is. Suddenly the sub, having so long been stable, begins rolling heavily. Looking up from my port, I can see the heaving, scudding surface again.

The flippered leg of a swimmer flashes by. They are attaching the mooring lines. The bottom of a Boston Whaler churns overhead. We know that *Lulu*, having homed on us as we rose, is close by. The dive is over. ★★★

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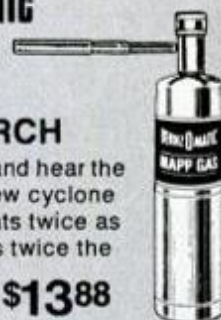
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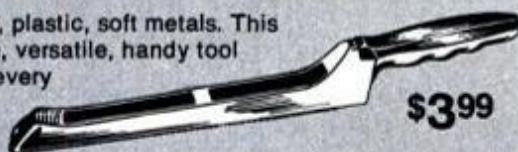
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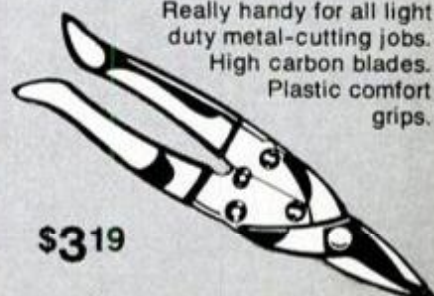
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(Continued from page 81)

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In a body scanner, the patient lies in a "tunnel" at the center of the big machine. The X-ray source and the detectors are mounted on a gantry and rotate around the patient as a single unit. Many X-ray exposures are made as the unit rotates. In a new machine developed by General Electric, the X-ray tube "pulses" 288 times as it makes a complete revolution of the patient's body. This takes but 4.8 seconds. This speed, according to GE engineers, means the X-ray dose required for high-quality pictures is remarkably low. Short scan times also reduce the effects of involuntary patient motion, improving the sharpness of the pictures.

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Though many physicians are highly enthusiastic about the whole-body scanners—and understandably so—there are health-care experts who say more studies are needed to determine their overall effectiveness. These experts also point out that the body scanners are costly. The GE model is priced at \$600,000. ★★★

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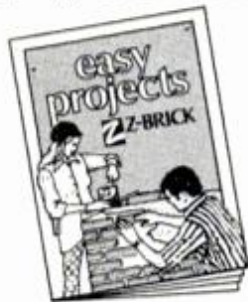
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# Z-BRICK®

## NEW NO-HANDS LANDINGS FOR AIRLINERS (Continued from page 84)

landing by sending out a radio beam that determines the proper descent angle (glide slope) and side-to-side approach direction. Its problem is that its beam width is very narrow, having a spread of only 3° on either side of the runway centerline—like a long, very thin ice cream cone. To follow the beam, aircraft must start from far out and fly straight down this long, narrow "tube" for a distance of at least 5 and often more than 15 miles from the beginning of the approach to touchdown.

Planes waiting their turn to land are often stacked up in holding patterns many miles out from the airport. Aside from causing delays and passenger annoyance, such stackups cost airlines a lot of money—an estimated \$530 million a year in this country alone. Most of this is for wasted fuel consumption as planes circle idly for up to an hour or more unable to land, and the expense is ultimately passed on to the public. By 1985, under the present system, the FAA predicts that delays caused by traffic congestion will be costing air carriers—hence the public—\$1.5 billion a year.

### MLS to the rescue

The new microwave landing system will help to ease congestion by allowing aircraft to sharply curtail their approach distances to runways. The reason is that the MLS beam spreads out 60° to each side of a runway and up to 20° in elevation—like a big, wide-mouthed funnel. This means aircraft will be able to make short final approaches from different directions and at various glide slope angles instead of being limited to long, straight-in approaches at a fixed descent angle.

More planes will be able to get on the ground faster, resulting in fewer delays and less chance of massive stackups that inevitably increase the risk of collision. The possibilities of the system are so remarkable they're hard to believe—but they're for real. Imagine two runways side by side with two huge wide-bodied jumbo jets landing almost wingtip to wingtip, followed by streams of other jets touching down at intervals as short as 40 seconds apart. Within eight minutes, you might have as many as 20 planes on the ground. Such traffic handling has never before been dreamed of.

Parallel runways have not been practical in the past because, under present safety regulations, they must be kept so far apart—a minimum of 5000 feet—that airports would have to be impossibly large to

accommodate them, and many communities are already up in arms over the sprawling size of terminals in their areas. With MLS, the separation can be cut in half—2500 feet between runway centerlines—making parallel landing strips and simultaneous instrument approaches feasible. Future airports can be made smaller, yet will handle more traffic, more efficiently, with greater safety.

Another advantage of MLS will be its beneficial effect on the environment. Because curved approaches can be flown, aircraft can be automatically routed around residential areas in all kinds of weather, not just when skies are clear, leading to a substantial reduction in jet noise.

### Automatic rollout, too

Through a system of radio beams and computerized controls, an aircraft is guided automatically to a landing without assistance from the pilot. The present ILS system also provides automatic guidance, but only to the point of touchdown. Beyond that, the pilot must take over manual control to guide the plane safely down the runway—a difficult or impossible feat in severe weather conditions. This is why, even with ILS, many flights are delayed or diverted to other airports in bad storms or fog.

MLS adds a significant feature—automatic rollout control over the entire length of the runway. All of the functions normally assumed by the pilot after landing—engine reversal, braking, steering, flap and spoiler adjustments—are handled by MLS without the pilot touching anything. In other words, from the time a plane enters the MLS coverage zone—about three miles from touchdown—to the time it heads for the terminal, it is under complete automatic control—in any weather situation including zero-visibility fog, heavy rain or blinding snow. A pilot can, of course, override the system at any point and take over manual control should the need arise. Otherwise, blind landings that a pilot could not handle himself will be possible with MLS.

### An end to interference

Another safety feature of MLS is its immunity to radio interference that can affect present instrument-landing systems. When VHF-UHF signals bounce off nearby hangars, other aircraft or surrounding terrain, they produce secondary reflected signals, a form of electromagnetic interference called "multipath." These false signals can "con-

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fuse" the electronic instructions given to an aircraft and are thought to have been a factor in at least some landing accidents.

With MLS, multipath interference will be eliminated. A function of the equipment called "time gating" will prevent all signals other than the true ones from reaching a plane. Bounce signals that arrive a fraction of a second after the original ones are automatically blocked out by the electronic timing "gate."

MLS also has much greater capacity. It has 200 channels available to it compared to only 40 open to ILS. These 40 channels are rapidly becoming clogged and soon will be unable to handle our increasing air traffic. By contrast, the fivefold greater capacity of MLS will be sufficient to accommodate aviation growth well into the next century.

There are three categories of MLS equipment. Category 3, the most elaborate, is designed for commercial use in handling dense airliner traffic. In addition to all the complex elements needed to bring an aircraft to a safe landing, it also incorporates an emergency backup feature that will provide guidance for a craft that has executed a missed approach procedure.

Category 2 equipment, slightly more simplified, will probably be adopted by the military, including use aboard aircraft carriers where it will prove an invaluable aid to pilots trying to hit a small, pitching flight deck in foul weather and heavy seas. Also being developed is a small transportable MLS unit that can be set up rapidly in the field for helicopters and tactical aircraft.

#### MLS for small airports

Category 1 MLS is the simplest, least expensive form. It lacks some of the features of the other two versions, but will be cheap enough to install at small community airports and aboard private and business aircraft. In foul weather when VFR (visual flight rules) must be suspended, many general aviation airports have to shut down because they are without instrument landing facilities. With MLS—actually less costly than ILS—they will be able to continue operating.

#### Which system?

Still to be decided is the exact electronic means by which MLS will operate. Basically there are two possible approaches. One, backed by the British, uses a Doppler-type system

in which signals of different frequencies are sent out to an approaching aircraft. The plane's position is then calculated and controlled through on-board computer equipment that notes the constantly changing relationship between the differing frequencies as the craft follows the beam down.

The other system, advocated by the U.S., is called TRSB for Time Reference Scanning Beam. In this, signals are also sent out, but calculations are based on time difference measurements rather than on frequency differences. Bendix and Texas Instruments developed the TRSB approach.

Technically, both systems work well, although the FAA contends that TRSB costs less, provides better performance and is less complex, making it easier to install and operate. In the end, the choice will be made by the All-Weather Operations Panel of the International Civil Aviation Organization (ICAO), a group representing 130 nations operating commercial airlines. If the panel makes its decision soon, as is expected, the installation of MLS equipment could begin late next year or early in 1978—happily for all air travelers. ★★



Eagle at 30 ft. Photographed by W. Beecher with the Celestron 1250mm, f/10 Multipurpose Telephoto Lens.

Saturn's Rings. Photographed with Celestron 14 Telescope.



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## NEW HANDLOADS FOR BARGAIN HUNTING (Continued from page 111)

the expander ball on the decapping rod trues up the inside of the neck to the diameter to hold a bullet tightly. Use a small screwdriver or brass scraper to remove hard ash from the primer pocket. Wipe lubricant from the case with a solvent-moistened cloth. Lightly chamfer the mouth of the case with a sharp knife or scraper just enough to remove the sharp burr from the inner edge. This need be done only after the first firing.

### Easy with the primer

A fresh primer is carefully pressed next into the primer pocket in the head of the case. Place a primer, open side up, in the cup of the primer-seating punch of your press. With a case in the shell holder, raise the ram until the priming punch positions the primer beneath the head case and retract the ram just enough to force the case head over the primer. Use slow pressure to "feel" the primer into the pocket without crushing it—slamming the press handle might set off a primer. Be sure the primer does not protrude beyond the case head; it should seat flush with or slightly below the head.

Now for a specific example. If the cases you've sized and primed are .308 cal. Winchester, for instance, and you want to load them for white-tail deer, a 150-grain, .30-cal. (.308 dia.) pointed, soft-point expanding bullet is ideal. This weight and type is listed in the Lyman handbook with several different powder charges. Footnotes indicate that the one load producing top accuracy and approximating the velocity of the standard factory load (with this bullet weight) is 49.0 grains of Ball C2 powder, and that this is a maximum load so the powder charge should be reduced for the sake of safety. We reduce the charge to 47.0 grains, which will still produce velocities close to factory loads.

### Scale the powder

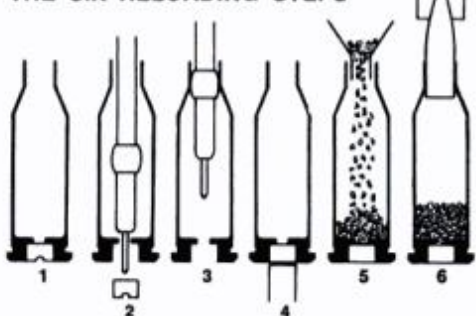
Set the poises (weights) on a powder scale for 47 grains and dribble powder from a spoon into the scale pan until the pointer swings equally above and below zero. Pour the powder charge into a prepared case through a powder funnel or paper cone. Now screw the bullet-seating die into the press, with the ram at the top of its stroke, until it stops against an empty case in the shell holder. Then back it out about 1/8 turn and lock.

Place a powder-charged case in the shell holder and fit a bullet in the case mouth as straight as possible, holding it if necessary to guide it

into the die. Adjust the threaded, bullet-seating stem until the overall length of the loaded cartridge is the same as a 150-grain factory load.

Then lock the seating stem, weigh the powder charge, pour it in each case and seat each bullet until all cases have been loaded. Make absolutely sure to get the correct amount of powder in each case, and that you don't seat a bullet in an empty case. The best way to avoid this is to weigh the powder, pour it in the case,

### THE SIX RELOADING STEPS



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- 2 Decapping.
- 3 Inside neck expanding.
- 4 Priming.
- 5 Charging with powder.
- 6 Bullet seating.

recheck visually and then seat the bullet, completing each case before moving on to the next.

You may prefer to load your .308 for varmints, or possibly elk or moose. For a varmint load, switch to the lighter 110-grain PSP bullet driven about 3200 f.p.s. (feet per second) by 42.0 grains of Hercules Rx7 powder. Really big game indicates a heavier bullet, so use the 200-grain SP, driven about 2500 f.p.s. by 47.0 grains of Hodgdon H380 powder. Tools and operations are the same regardless of load in any one caliber. Only powder and bullet need be changed to load for different purposes.

### Check feed

Always inspect each completed cartridge carefully; then run it through your rifle to be sure it will feed and chamber properly. To insure against accident, remove the firing mechanism first or, if this can't be done, do the checking on a range or other safe area.

Loading procedures are the same for any other center-fire, high-power rifle cartridge. All you need to change over to the .270 Winchester or .30-06, for example, are a new set of dies and the appropriate powder and bullets. Reloading is not only a money saver, but it is fun as well. There is a special satisfaction from shooting ammunition you've made yourself, and you'll probably increase your accuracy as well. ★★

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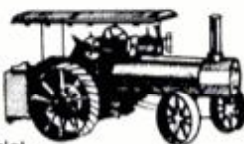
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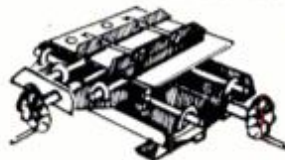
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## MOUNT-ANYPLACE MOBILE CB

(Continued from page 109)

Not that there aren't enough good makes of CBs around. In a car where you use foot controls for throttle and brake, the noise level is low, and you can spare one hand from the steering wheel to hold a microphone, today's mobile models are fine. Afield, a hand-held walkie-talkie is ideal for many sports purposes. But in or on a bouncing four-wheel-drive RV, trailbike, tractor, snowmobile or racing boat, you're likely to be using both hands. When the miles start flashing by, I'll pick the Beltek. While crossing 6000 miles of smooth and bumpy roads and waves, our test model functioned flawlessly.

### A special rig

Essentially, the Enduro 23 is a special shock-mounted, weather-resistant 23-channel CB transceiver. It operates off 12-volt power, puts full legal wattage into the signal, and weighs just over three pounds. Controls include volume, squelch and channel selection, also intercom and public-address switches.

Plug and screw-on attachments underneath offer quick connection



Basic unit has a strap-down bracket, earphone, boom mike, remote button.

of antenna and power leads. A handlebar remote-control transmit button and earphone and boom mike with clamp fasten on your helmet; thus, a driver can monitor a channel or transmit on it without ever touching the set or microphone. I found the small earphone could be worn comfortably under a fishing cap and the boom mike clamped to the cap.

### Ingenious mounting

Mounting the set is equally ingenious. While an optional mounting plate can be screwed to any firm surface, the bracket supplied has four suction-cup feet to further cushion any shock and comes with a strap to fit around a motorbike gas

tank. The same strap, I've found, can secure the bracket to a snowmobile, bicycle, even my leg in a racing powerboat with limited cockpit space. It would work as well, I'm sure, in an airplane.

A sliding lock-arm fastens the Enduro to this bracket once the necessary mike, earphone, power and transmit wires have been plugged in—a chore of about 20 seconds. Removing the set from the bracket and wiring harness is equally quick so that it's little trouble when you park outside a restaurant. Simply unsnap the set and carry it in with you where it will be safe from any passing CB snatcher.

### Little static

Some off-road land and water vehicles aren't initially designed for radio and don't have basic ignition noise suppression. Our tests with the Enduro 23 indicate, however, it can reject a great deal of static. For quick tests of vehicles or boats, we found we could get through all right without modification.

Most people are likely to use this set in only one or two vehicles and can work out installation accordingly. Because we wanted to try a number of applications, we rigged it with a cigaret-lighter plug where dashboard power was available. For bicycle and sailboat use, a little rechargeable motorcycle battery in a small carrying case with shoulder strap served admirably.

### Easy listening

Because only one earphone is used, necessary traffic warning noises like horns and sirens are not shut out. In a noisy vehicle, however, or when wearing a helmet, the earphone proved to make listening a lot easier. With the set switched to intercom, talking to another boat, motorcycle or jeep passenger was found remarkably easier. Other options include a trucker's headset with boom mike, head band and one headphone. The mobile installation package comes with a screw-down mounting bracket, external speaker and hand mike with built-in normal transmit button. For car use, an optional telephone-type handset is also offered, and Beltek has an Enduro 23 antenna with mounting bracket and coax cable as well.

Even without the extras, this unit is versatile. Presumably you could rig it for almost any sport from hang-gliding to skiing—though those we didn't try. A mild spray in a boat didn't seem to phase the unit any more than the considerable shaking it took. The Beltek Enduro seems built to be here to stay. ★★



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### WORLD'S LARGEST TRUCK

(Continued from page 88)



When fully loaded, the Terex hauler can move an incredible 350 tons of material.

momometer stood at 120° F., and there wasn't any shade. I met the Titan's operator, Earl Kem, who invited me to climb the metal ladder to his air-conditioned aerie on the truck's second floor. I sat next to him in the cab and reviewed the array of gauges, warning lights and switches on the Titan's console.

Earl's first task was to teach me how to drive this King Kong. It turned out to be so simple, though, that total classroom time came to something like 10 seconds. There's only one electric master switch, and this has three positions. Move the pointer forward and you're ready to pull ahead. Point it rearward and you're in reverse. Straight up and down means neutral. And the big V16 comes to life on 130 p.s.i. of compressed air.

Driving the Titan feels like jockeying a two-story house while sitting in a little room on the roof. Acceleration is controlled by a conventional "gas" pedal. Push the pedal and the diesel revs up. Cruising means 900 rpm from the two-stroke, turbocharged engine. "Putting the hammer down hard" means a lag in the electric power system. It takes two or three seconds for the "generator" (it's actually an alternator) to shove juice to those four electric traction motors at the wheels.

In a way, acceleration reminded me of very early Buick Dynaflo's. The engine roars, there's a moment's hesitation, and then the electric motors kick in with amazing force, and the great leviathan starts to move forward in a ponderous rush.

The Titan steers with a conventional wheel. It uses power steering of the "full-time" variety. Full-time means you get little road feel or feedback, which is fine, because who wants to fight potholes with those giant 12-foot doughnuts? At very low vehicle speeds, I noticed some shudder through the steering wheel

(Please turn to page 162)

## ALL NEW! ALL GEAR! ALL PURPOSE!

### MAGNATRAC



## The Homeowner's Crawler Tractor

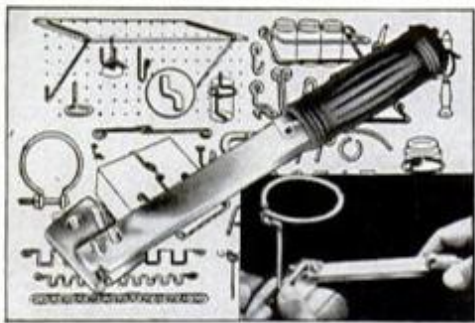
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All-new Magnatrac offers unmatched, full track power for serious gardening, snow removal, landscaping, lawn care. Only 41" wide — goes almost anywhere. Easy to drive all-gear transmission. Saves money — comes factory direct in kit form. Easy to assemble on weekend. Extra heavy duty construction. Use on any terrain or ground conditions with 30 attachments — dozer blade for snow or soil, roto-tiller, plow, front-end loader, rotary mower. Earn extra cash on odd jobs or resell for big profit. Thousands of Struck crawler kits have been sold — you cannot buy more work power per dollar invested! SEND FOR CATALOG showing MAGNATRAC KIT construction and uses — 50¢. Complete PLANS for fabricating Magnatrac from local materials — \$6 (refunded on any purchase).

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**"NRI provides the most up-to-date complete course in Auto Mechanics I've ever seen."**

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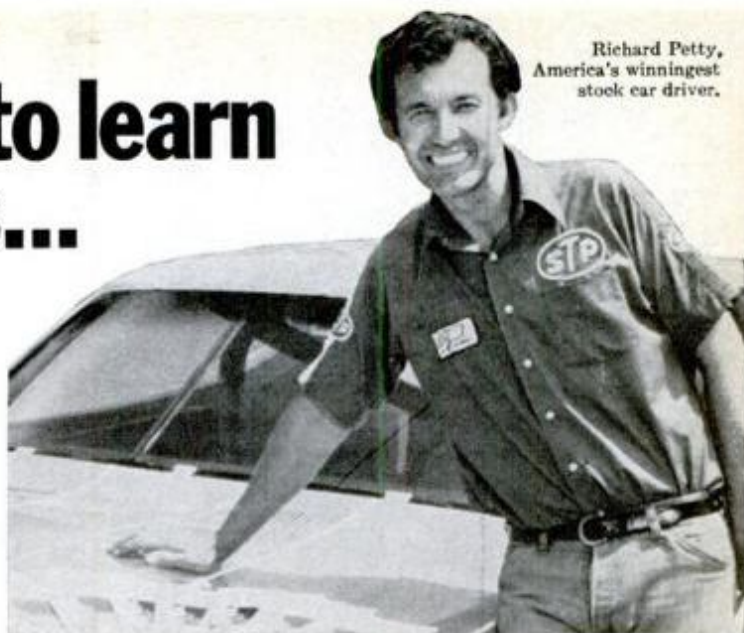
"NRI's complete Master Automotive Technician Course gives you the essential training and diagnostic equipment you need to be a real pro. In addition to NRI's unique personal services and 'bite-size' texts, you get ten pieces of auto service equipment, including a dwell tachometer, AC power timing light, complete set of tools, a volt-amp tester, a solid-state ignition-analyzer scope, and assorted gauges. You pay nothing extra for the professional tools and equipment, and they're yours to keep."

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CERAMIC TILE  
**American Olean**  
A Division of National Gypsum Company

## WORLD'S LARGEST TRUCK

(Continued from page 158)

when I tried to make too quick a turn, but that was my own fault because I didn't use enough throttle.

### All wheels turn

The Titan is amazingly agile despite its size. Its two front wheels turn through a 71° arc. At a preset point in a sharp steering maneuver, the four sets of rear wheels also start to steer, and these have a maximum deflection of 10° total arc. All considered, the Terex Titan can turn with amazing precision and in a surprisingly small circle.

The Titan has three different braking systems. The main system is dynamic braking which utilizes the traction motors as generators. This system is for slowing and sometimes stopping the machine, but mainly for holding a constant speed on a long downhill grade without wearing out brake shoes. The dynamic brakes have been set to kick in at 24 mph, considered a safe maximum speed for the Titan at Eagle Mountain.

The second system, the service brakes, consist of drum-type internal-expanding brakes mechanically actuated by air over oil pressure. These brakes are used for more precise stopping from low speeds than the dynamic brakes. In addition to the service brake pedal, there's a hand stick on the steering column for the operator to "spot" the Titan under the loading shovel.

### The fail-safe system

The third system is the "fail-safe" system, also air over oil, which is automatically applied mechanically to the drive wheels if air pressure drops below 45 p.s.i. It has the capacity to stop the fully loaded vehicle, and the operator can manually set it as a parking brake.

Earl Kem, the operator, told me he earns 16 cents an hour more driving this million-plus-pound Titan than he would driving the next biggest Terex truck, even though the smaller Terex still uses the same diesel/electric drive system. Earl says he prefers the Titan because "... I like all that power, and the ride is smoother."

This experimental Titan is reputed to have cost many millions to design and build. When produced in "volume," the price should come down to just under \$1.5 million a copy. But if you expect to make up your investment in fuel economy, forget it. Kem told me that the Titan averages between 0.20 and 0.17 miles per gallon. ★★★

### GM TEREX TITAN SPECIFICATIONS Model 33-19 350-ton dump truck

#### ENGINE

Type: V16 two-stroke GM Electro-Motive diesel, 45° vee  
Bore and stroke: 9.0625 x 10.000 in.  
Displacement: 10,320 cu. in.  
Maximum bhp @ rpm: 3300 @ 900  
Oil capacity: 333 gal.  
Cooling system: Twin radiators, hydrostatic fans, 258-gal. capacity

#### ELECTRIC DRIVE SYSTEM

Generator: GM Electro-Motive 10-pole alternator coupled directly to engine.  
Traction motors: Four GM series-wound electric motors, pinion and planetary reduction gears for 36:1 final ratio

#### SUSPENSION

Front and rear: Rubber pad springing with sliding struts

#### DIMENSIONS

Wheelbases: 264 and 454 in.  
Overall length: 801.3 in.  
Height, dump lowered: 230.5 in.  
Height, dump raised: 672 in.  
Gross vehicle weight: 1,209,500 lbs.

**TOUGH ENOUGH FOR TAXIS.  
TOUGH ENOUGH FOR YOU.  
THE ORIGINAL TUNE-UP KIT IN A CAN.**

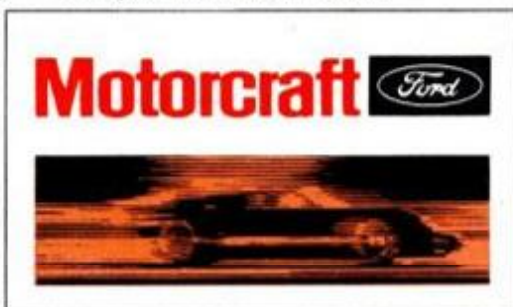


Remember those taxi test commercials on TV? They put Motorcraft Tune-Up Kit Parts in 150 Ford, Chevy and Plymouth taxis in Atlanta and Boston... and ran 'em for 3,000,000 miles to see how tough they were. Changed 'em at regular intervals for taxis, of course. But after 3,000,000 tough taxi miles, less than 1% of the Motorcraft Tune-Up Parts couldn't take the punishment. They're tough. They proved it.

And our kit in the can was first to combine all the parts you need for a tune-up in a single package. You don't need to know parts numbers. Just tell the man the make and year of your car (we cover 80% of all

cars with standard ignition systems.) And you've got *your* kit. The right points, condenser, Autolite spark plugs — plus cam lube, feeler gauge, and complete instructions for the job.

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**ARROW FASTENER COMPANY, INC.**

271 Mayhill Street, Saddle Brook, N. J. 07662

'77 CARS: FORD (Continued from page 93)

**Reed:** With a carburetor calibrated for sea level, as a car moves into high-altitude areas where the air is less dense, the air/fuel mixture becomes richer for the same throttle opening, which can affect exhaust emissions.

**PM: How do you set up the car?**

**Reed:** If a vehicle is going to be sold in any one of 167 counties which are entirely 4000 feet or greater in elevation, it must be certified for Denver altitude, which is 5200 feet. Only cars sold in California high-altitude areas are excluded from the regulation because California has its own set of emission standards.

**PM: A car set up to pass emission standards at high altitude would be running incredibly lean at sea level. Wouldn't it?**

**Reed:** Yes, that's why we have the altitude compensating carburetor, which has an aneroid valve. It senses the lower atmospheric pressure at high altitudes and opens, allowing air to be pulled through a bypass circuit that discharges between the venturi and the throttle plates, leaning out the mixture.

**PM: An altitude compensating carburetor doesn't sound like a 10-cent item.**

**Reed:** That's why we have a manual compensation device for the 2.3-liter four-cylinder, which has a carburetor setup for high altitude. But when you pull a dashboard knob, you open a spring-loaded valve and fuel flows through a calibrated opening into the main well, adjacent to the main metering jet. This provides the mixture enrichment needed for low altitudes.

**PM: What about the guy who vacations or spends a fair amount of time in mountainous areas, but doesn't live in one? Would he gain any benefit from the dashboard device, assuming it comes out with a reasonable pricetag?**

**Reed:** Well, the initial calibration will have been developed for good high-altitude performance, so if drivability at high altitudes is important to him, I'd say yes.

### Combustion chambers

In the good old days of high performance, combustion chamber design was often called 10 percent science and 90 percent witchcraft. We asked Howard Aula of engine engineering if that's still the case:

**Aula:** We think we know a lot more today about combustion chamber design, particularly its effect on emissions, so we hope the science percentage is the bulk of it.

**PM: You've made some significant changes in the combustion chambers on the 351-W and 302 V8s, and Ford is claiming improved mechanical octane tolerance and better fuel economy. Exactly what did you do?**

**Aula:** The big change was in the com-

bustion chamber, to make the fuel burn faster for better torque. The new design shifts the location of the fuel mass so that the sparkplug is now closer to the center of it. We've also redesigned the cooling system passages in the head for better cooling and that lowers the mechanical octane requirement.

**PM: But you didn't actually lower the octane requirements for the engine?**

**Aula:** No, we increased the compression ratios, from 8.1 to 8.3 on the 351-W and 8.0 to 8.4 on the 302 V8, which gives us up to two percent better fuel economy with the same 91 RON gas.

**PM: Is there any change in spark advance?**

**Aula:** No, and we don't need any more. The faster you burn the charge, the less spark advance you require for more output. We have the same amount as last year, but it's now more effective because

## Summing up Ford and Lincoln-Mercury models

**Pinto/Bobcat:** New front-end appearance

**Mustang II:** Refinements

**Capri II:** Refinements

**Maverick/Comet:** Refinements

**Granada/Monarch:** Refinements

**LTD II/Cougar:** New intermediates

**LTD/Marquis:** Refinements

**Thunderbird:** New size

**Lincoln Continental:** Refinements

**Continental Mark V:** Redesigned

you don't have to lead with as much advance.

**PM: How does the new combustion chamber compare with the 1976 version?**

**Aula:** It's much more open, so the flame expands out in all directions better, and it therefore can burn faster.

**PM: Does the modest improvement in performance and economy come at any expense to drivability?**

**Aula:** No. We also reduced the cross-sectional area of the intake manifold which increases the air/fuel mixture velocity and that helps us on drivability.

**PM: Doesn't a smaller manifold mean less performance?**

**Aula:** Yes, it normally means less at the top end, but what we lose with the manifold change we gain back because the area around the intake valve is larger with the new combustion chamber, so the combustion chamber actually is freer-breathing.

**PM: Is there any adverse effect on emissions?**

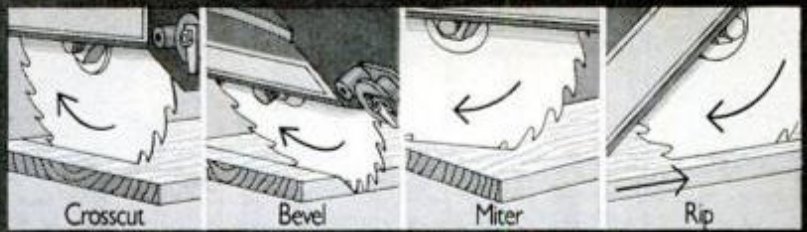
(Please turn to page 166)



AULA



Lincoln Continental Mark V two-door coupe is redesigned and renamed for '77.



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on Sears best  
10-inch radial arm saw.**

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With this Craftsman radial saw and our complete line of accessories, purchased separately, you can make dozens of different cuts from a simple rip to a precision dado. The motor develops a full 2½ HP, the blade tilts, and the arm swings right and left with automatic stops at 45°

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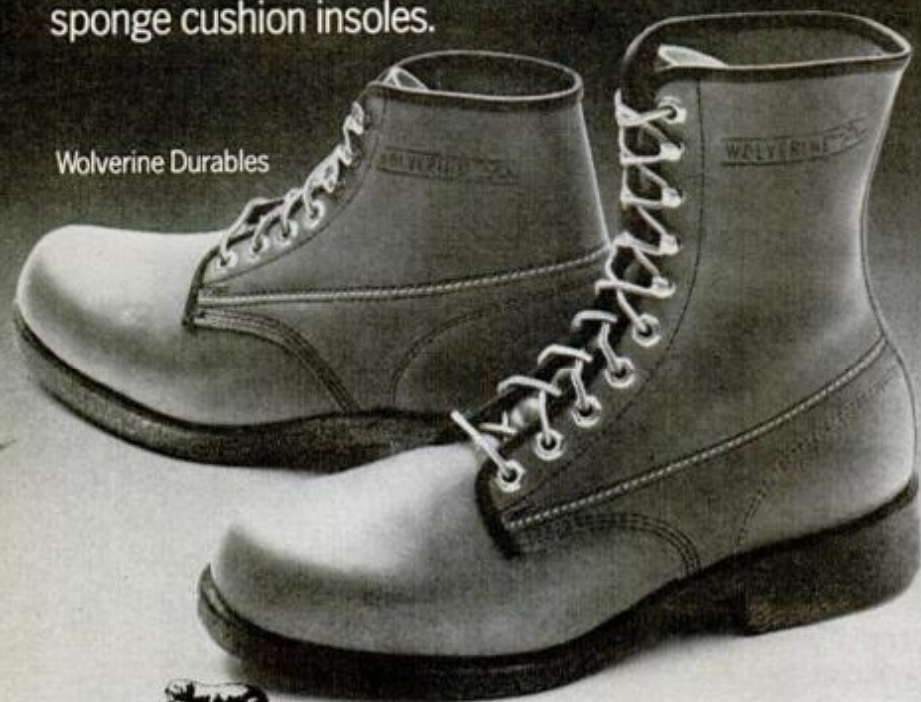
Tools that have earned the right to wear the name.

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## '77 CARS: FORD

(Continued from page 164)

**Aula:** No, because the new combustion chambers have a lower surface-to-volume ratio. Since it's the cool surfaces that produce hydrocarbons, we reduce HC formation by reducing the surface area. The lower ratio is primarily from removing the dish on the 302 piston—it's now a flat top—and slightly reducing the dish on the 351-W. ★★★

## Ford '77 service tips

- Improvements to '77 Fords to make them more theft-resistant include flush-with-door lock knobs on two-door sedans. This makes them impossible to open with wire from outside, so keep spare set of keys handy. Change hasn't been made to four-door sedans, because knobs must be raised to open rear doors, and flush knobs aren't easy to lift from inside car.
- The two air cleaner discs on some Ford V8s should be checked if you encounter cold-driveaway problems. When temperatures are suitably low (40° F. or below), check both by starting engine and flooring gas pedal. If blue disc is good, air cleaner snorkel flap should remain in heat-on position. If "TVS" works, exhaust gas recirculation valve stem should not move.
- Higher-output ignition systems on '77 Fords permit an .050-inch sparkplug gap on all models. Some Ford gaps were as low as .035 inch in 1976.
- Ford '77 higher-performance ignition includes new 8-mm silicone wires, very expensive (\$8 each), so handle plug terminals with care. Right-angle terminals are not repairable, so be careful.

## Fewer oil changes for all makers

The competition on the oil change front has forced the other carmakers to match General Motors' 7500-mile oil, 15,000-mile filter change intervals in 1977.

There have been no dramatic technical improvements involved, just increased use of unleaded gasoline, which reduces oil contamination somewhat.

One top engineer, who admitted he was surprised when GM announced the longer intervals for its '75 model cars, says he's now confident enough to live with the recommendations.

All the carmakers, however, including GM, continue to specify much shorter oil and filter change intervals for so-called "heavy-duty" operation, typically 3000 miles on oil, 6000 miles on the filter. The definition of heavy-duty covers a lot of ground, ranging from the obvious (trailer-pulling) to the not-so-obvious (dusty climate, extensive idling, or short-trip operation below 32° F.).

The oil and filter change recommendations also carry time limits, which effectively reduce the mileage intervals for most drivers. There's a six-month limit on oil, 12 months on filters. In heavy-duty operation it drops to three months for oil, six for the filter.

If you do the typical 10,000 to 12,000 miles per year, your oil change is down to as low as 5000 to 6000 miles. In heavy-duty operation, it is as low as every 2500 miles. ★★★



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Your powerful 2.0 cu. in. engine Mini Mac automatically oils its own bar and chain as you cut, to prolong the life of these parts. There's also manual control for extra squirts of oil during tough cutting jobs.

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## Now-get this fine spray without aerosol propellants.

A fine anti-perspirant spray—get it from Mennen's squeeze bottle, instead. No aerosol propellants—just proven anti-wetness protection in about the most economical form you can buy. And the whole family can use it!

**Mennen Anti-Perspirant Spray lasts 3 times longer than aerosols.**



### 30 NEW ADD-ONS TO CUSTOMIZE YOUR VAN

(Continued from page 87)

curtains and mounting bracket and cover for a spare wheel and tire are among Sears' extras. **10 CCI Pop-Top** is all fiberglass and metal (no canvas), and in the down position adds only inches to a van for easy garaging. Fully extended, however, the unit offers full six-foot, one-inch headroom in a 55x80-inch area. With installation, it is \$895. Camper Conversions also has six interior floor plans, each available for \$1895 installed. **11 BMC Clamp-On Spare Tire Carrier** has fittings that secure to rear door hinges with J-bolts. The \$23.50 bracket can be quickly removed when the spare tire is being carried inside the van. Other Blackstone accessories, in addition to their side-door step, include various van improvements such as a battery pouch for a second auxiliary battery and spare-tire carriers in assorted finishes. **12 ABC Interior**, provided by the Pop-Top Co. division of the ABC Trailer Co., 8903 Mentor Ave., Mentor, Ohio 44060, is shown in a view down through the cut-out top of a van. Dinette/sleeper convertible and sink/stove combination

with cabinet space adjoin a refrigerator, cabinets, enclosed self-contained toilet and furnace. Individual units at various prices can be selected. **13 Overhead Instruments** may be installed in an over-the-windshield console from Flite-Tronics, 2221 Empire Ave., Burbank, Calif. 91504 in a \$55 kit. Mount your own instruments in the high-impact styrene that is covered in simulated walnut. Tape deck and CB plus speakers can also be added. **14 Vantastic Interiors** are produced by Hop-Cap, Inc., 1730 West Bike Street, Bremen, Ind. 46506. Their "Spirit of '76" model includes a red-white-and-blue rear couch that pulls out into a bed, timbered ceiling with recessed lights (a Hop-Cap specialty) in the roof beams, timber-paneled bar and storage cabinets, with shag carpeted blue floor and walls. **15 Chevy Beauville Sport Van** is another model ready and waiting for conversion ideas. Available with a sliding side door and optional panoramic windows from Chevy dealers, it can seat up to 12 and the long wheelbase lends itself to motor home conversion. **16 Assorted cus-**

tomizing from LRP (Leisure & Recreational Products, Sheridan Springs Road, Lake Geneva, Wis. 53147) includes mag wheels, directional aerial, bubble tinted-window ports, chromed roof rack and a Mr. Jaws shark mural painted on the side panels. **17 Woodsman** is another LRP conversion, this one with hand-painted murals flanked with shaped bubble windows. The interior has rustic rough-sawn paneling and fur accents. **18 Pop-Tops** from the Pop-Top Co. subsidiary of ABC Trailers are offered in kits of two sizes for do-it-yourself or dealer installation. Both have cartop vinyl sides and come in sizes of 46x47 inches for \$475 and 46x88 inches at \$525. **19 Executive Suite** is ABC's name for paneled wall office layout with four swivel seats, bar, sink, serving counter and floor sockets for front or rear placement of the table. **20 Tops from CED** (International Campers, Inc., 1010 Sunrise Highway, Amityville, N.Y. 11701) run \$770 to \$865 for fiberglass; pop-tops are \$695; and complete camper conversions (the works) start at about \$1485. **21 CED's Refrigerator/Stovetop Unit** can be ordered with a 2.5-cubic-foot, 12-volt/110-volt electric refrigerator with a secondary battery system for \$395. **22 Rooftop Vents** that crank open, van bubble windows, and an all-weather insulating and installation kit for both are among the many off-road items from the Wholesale Tire Co., 5005 Market St., Youngstown, Ohio 44512. Their catalog is \$2. **23 Sliding Van Door Extender** to clear oversize wheels and tires is one of many van extras in \$1 catalog of Desert Dynamics, 13720 E. Rosecrans Ave., Sante Fe Springs, Calif. 90670. **24 Quilted Headliners**, panels and accessories from \$11.95 to over \$100. **25 Rear Bolt-On Ladder** for \$16.95. **26 Ford/Chevy/Dodge Conversion Plans** book at \$8.99. **27 Fender Flares** and spoiler kits from \$20. **28 Vinyl Murals** that are self-adhesive, \$10 up. **29 Black Light lamps** for van. All these and many more mail-order items are from J.C. Whitney & Co., 1919 Archer Ave., Chicago, Ill. 60680. **30 How To Live in Your Van and Love It** is a new guide and equipment catalog by Howard Pootee, \$8.95 from Trail-R-Club of America, Box 1376, Beverly Hills, Calif. 90213.

But these 30 tips are only the beginning. Your local automotive and camping equipment stores, and PM's advertising pages, show a continuing flow of new van models and the extras that can make your vehicle especially right for you. ★★★



(Continued from page 94)

changes will be received by the government. There's even a regulation on how much noise a car can make. About the only changes the companies can make without worrying whether Washington will approve or disapprove are in the cosmetic category.

Although the companies grumble about the many rules and regulations, rela-



Chrysler's HEINEN with LUND

tions between Detroit and Washington are better than they have been at any time since the government started telling the auto firms how to put the pieces together. Both sides are more willing to listen to the other guy's point of view and there isn't the Us-vs.-Them animosity there used to be.

Detroit still complains against the "regulators." (That's the industry put-down word for the government agencies that write the rules.) But the complaints are not directed so much against the regulations as they are against the failure of the government to spell out procedures for complying with the regulations. Like telling a motorist not to speed and what the penalty will be if he is caught speeding, but without telling him what the speed limit is.

Charles M. Heinen, Chrysler's director of vehicle emissions and fuel economy planning, has been dealing with government agencies as long as any executive in Detroit. He talked with PM about the difficulty of meeting government mandates.

**PM:** Has there been any improvement in relations with Washington?

**Heinen:** Yes and no. Relations with the administrative agencies are better. The agency people are becoming more knowledgeable and sophisticated. They understand what we're talking about. They want to cooperate with us and, in that sense, relations are better.

But the problems have multiplied. The regulations have proliferated so rapidly and one regulation frequently conflicts with another to a point where it's darn near impossible to follow them. Not only for us to follow them, but for EPA (Environmental Protection Agency) and DOT (Depart. of Transportation) to follow them. Hell, their job is almost as difficult as ours.

**PM:** Give me an example of a regulation that's causing you trouble.



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**Heinen:** For 1978 the law says each company's cars must have a fleet average of 18 miles per gallon. That's clear enough. What isn't clear is what the test procedures will be. How many cars do we test? How frequently? How accurate are the testing methods? What's the statistical competence of the test procedures? How long will we have to conduct the tests?

The tools we have for establishing fuel economy on a fleet level are no more sensitive than a sledge hammer and the task the government has defined is that of swatting a fly.

**PM:** Who's to blame for the confusion?

**Heinen:** Congress makes the rules and only Congress can undo the confusion. There's too much red tape.

### Maintenance

Richard E. Goodwillie is assistant chief engineer for emissions and fuel systems engineering and product development.

**PM:** Engines get more sophisticated and complicated every year. What is this doing to the guy who likes to work on his own car, the do-it-yourselfer?

**Goodwillie:** The guy who wants to do it himself can still change plugs, oil, air filter, that sort of thing. There are more lines and hoses than there used to be, but he can work around them or move them out of the way.

I think the more things we put on

the car to reduce emissions, but at a penalty to fuel economy and performance, the more incentive there is for the do-it-yourselfer to modify those things or remove them. Not that we're designing things to make it easy for people to do that. We're trying to



Chrysler's GOODWILLIE with LUND

build everything in the engine that we can to reduce emissions and maintain good fuel economy and performance while we're doing it.

**PM:** How about the future, say two or three years from now? Will there be more jobs the do-it-yourselfer can tackle? Or the opposite—cars becoming so complicated that only a professional mechanic can work on them?

**Goodwillie:** If anything, I think there will be more jobs he can do. But that's difficult to predict because we've got things going in both directions. On

(Please turn to page 170)

# If you see what you want, pipe up.

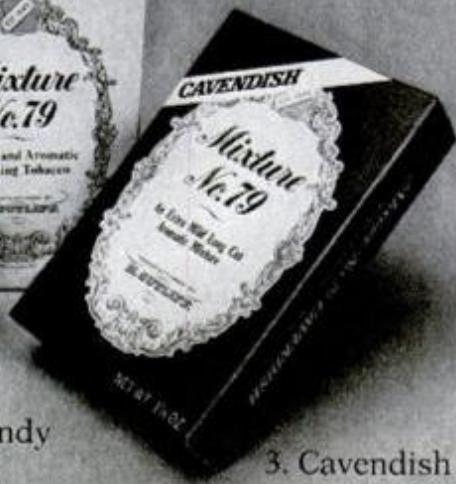
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### '77 CARS: CHRYSLER

(Continued from page 169)

one side, we're trying to make the cars easier to service. There are more hoses, switches, things in the engine compartment the owner can work on, maintain or modify. On the other hand, we've got ignition systems and our electronic lean-burn system that discourage the guy from doing things himself. As we get into more electronics, I think the average do-it-yourselfer will be discouraged from working on his car. He will have to be a pretty good electronic engineer.

### Lean burn

This is the first big year for the lean burn electronic spark advance system. We asked Earl Meyer Jr., assistant chief engineer, engine electrical engineering, what models it will be on.



MEYER

Meyer: We'll have it on all four-barrel V8s at the start of the model year, and add it to the 318 two-barrel later on.

PM: What about the six-cylinder?

Meyer: We'll have it for the Six in 1978.

PM: What sort of reliability have you had with the 100,000-plus 1976 lean burns?

Meyer: So far, the failure rate is less than 0.1 percent.

PM: Are you sticking with exactly the same setup for 1977?

Meyer: No, we're introducing changes with the start of the new model year. The centrifugal advance was a conventional mechanical type in 1976. For 1977 it's handled electronically.

PM: You mean that the centrifugal advance is gone from the distributor body?

Meyer: That's right.

PM: What else is coming?

Meyer: Our two pickup coils—the start and run pickups—will be replaced with one that does both jobs some time in the model year. The computer itself will be changed, as we replace more than half of the 216 parts with three custom integrated circuits. We'll be down to 100 parts, which will cut the cost, improve the manufacturing process and better our position for larger volume.

PM: Aren't you setting up the customer for a pretty big bill if something fails? Right now you're replacing the whole computer, even though the computer has at least three or four parts that could be replaced, namely the vacuum transducer, the electronic ignition control board, the air temperature sensor and the spark advance computer board.

Meyer: Well, it is warranted for five years or 50,000 miles, and we feel that the further we go toward making it a single component, the greater reliability we can build into it. For example, if we made that air temperature sensor replaceable, it would

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have to be a plug-in part, and the connection wouldn't be as good as what we have now.

**PM:** You've managed to eliminate exhaust gas recirculation with lean burn, and there's talk of being able to make the standards without even a catalyst. How about it?

**Meyer:** We believe we can qualify at least one car, probably a 400 V8 four-barrel, without the catalyst, because there are people who have feelings against it, or want to run on leaded gas, which is cheaper, and we may have it by the middle of the model year. We also have some new ideas on recalibrating the spark computers on cars with catalysts for better fuel economy and we'll try to introduce them as running changes in 1977.

**PM:** How can a Saturday mechanic make basic operational checks on his lean burn computer?

**Meyer:** He can start the engine with a timing light connected and watch the marks for 60 to 90 seconds. The computer gives an extra four to five degrees of advance for that period, immediately after starting.

**PM:** How accurate is that test as an overall indicator of computer performance?

**Meyer:** About 70 to 80 percent accurate.

**PM:** Are there some other simple checks that could improve that percentage a bit?

**Meyer:** There's a complete test procedure we've prepared that requires a tachometer, timing light with an advance meter and an ohmmeter. It takes longer than with our special tester, but you can do it.

### Wiring diagrams

No one who's ever tried to read a wiring diagram on a modern car would question the need for a new system of presenting the diagrams. This year Chrysler has it.

What the inspiration was for Chrysler is the question we asked of Frank Gualdoni, product engineer, wiring and circuit systems.

**Gualdoni:** Frankly, the idea was to save money on warranty work. A lot of professional mechanics weren't much better than Saturday mechanics at reading them, and they were just guessing and making parts replacements.

**PM:** Is the new wiring diagram really something a Saturday mechanic can handle without having to be an engineer?

**Gualdoni:** The wiring on the cars is what's complicated and the diagrams only reflect that. We can't completely eliminate the need to turn pages, but now you don't have to turn nearly as many. If a Saturday mechanic understands electrical circuits, he'll certainly find our new diagrams a great deal easier to follow.

**PM:** What is the most significant change?

**Gualdoni:** The new diagrams give you a complete circuit, whether it's starting or charging or the electrically

(Please turn to page 172)



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## '77 CARS: CHRYSLER

(Continued from page 171)

heated backlight. In the old diagrams you had to find components and trace the wiring, which was buried in with wiring from many other circuits. Then you had to look up individual parts in the circuit and look for detail drawings to see how they were wired.

**PM:** How do you handle the points where circuits merge?

**Galdoni:** On the system page itself, we have named references to the start of the whole circuit, not something like 'see zone C-64' so you're forced to start flipping pages to get a junction block.

**PM:** How do you handle the old headache of finding components, where they're grounded, and so on?

**Galdoni:** First, we're trying to use standard terminology, so the guy knows what it is when he sees the name. Where necessary, we call out the grounding points, such as with the electrically heated backlight on compact

### Summing up Chrysler-Plymouth and Dodge models

**Arrow/Colt:** Refinements

**Volare/Aspen:** Refinements

**Fury/Monaco/Charger/Cordoba:** New front and rear styling

**Gran Fury/Royal Monaco:** Refinements

**Newport and New Yorker:** Refinements

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wagons. The diagram plainly says: 'on jack hold-down bracket.' This compares with the previous system, which gave you an arrowhead that referred you to a connector page and the connector page told you where it was grounded. We're also calling out less-than-obvious locations of connectors. With the heated backlight, for example, one connector is labeled as in the lift gate on compact wagons, so you pull the lift-gate cover and there it is.

**PM:** As long as you went to an overhaul, are there any other improvements in the diagrams?

**Galdoni:** Yes, we now have a fuse distribution chart, which covers anything fed through a fuse. This tells which fuse covers what, at a glance, so if something goes wrong on a fused circuit, you can tell if the problem is after the fuse or in the feed to the fuse or perhaps the fuse itself.

**PM:** What's the next step in improving the wiring diagrams?

**Galdoni:** We have a set of drawings that we're working on that show the way all the harnesses run throughout the car and where electrical components are located. The drawings include detailed art on all body parts, so you know what part of the car to actually look at.

### What about aluminum?

Aluminum or steel? That's the big question in planning future cars. Alu-

(Please turn to page 174)



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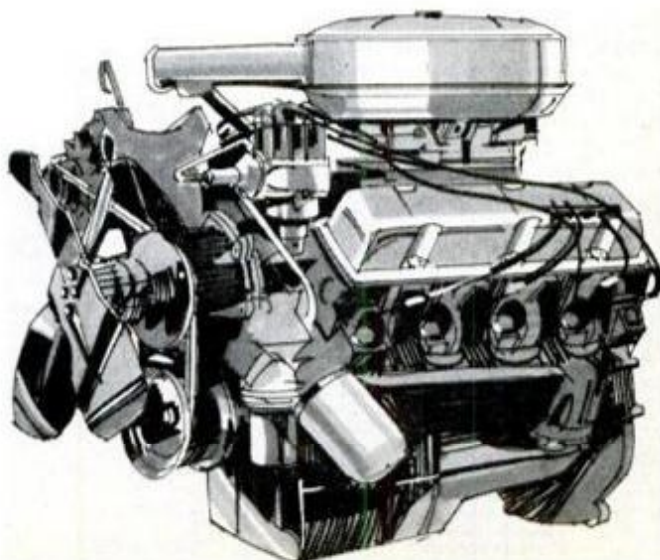
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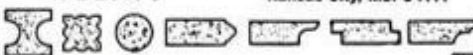
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R. S. Clark - Springfield, Ohio

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W. W. Robinson - Flat Rock, Illinois

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Jay Hedden, Editor  
Workbench Magazine

## '77 CARS: CHRYSLER

(Continued from page 172)

minum reduces weight and the more pounds you sweat out of a car, the more you improve fuel economy. The disadvantage of aluminum is that it costs more than steel. A lot more. Where the car companies pay about 15 cents a pound for steel, aluminum goes for 55 to 60 cents a pound. That's big money when your product weighs anywhere from 2500 to 6500 pounds.

Chrysler has used aluminum for its automatic transmission housings for several years. On the '77s, the company will use the light metal for the housing of its manual four-speed overdrive transmission. Chrysler foresees greater use of aluminum in down-the-road cars, despite the price penalty.

PM discussed the pros and cons of aluminum with Dave Strong, of product planning.

PM: How long before you get into wholesale use of aluminum?

Strong: I don't know about "wholesale" use of aluminum, but as the fuel economy standards come in in '78, use of aluminum will increase substantially. That will continue into the 1980s.

PM: Where will you use it?

Strong: In the hang-on pieces—hoods, deck lids, engine, brackets. We're working very closely with the aluminum suppliers. ★★

## SERVICE TIPS

■ Air aspirator valve, the "poor man's air pump," is widely used on '77 Chrysler products. It's a rubber diaphragm assembly made to suck in sufficient air for the catalytic converter. To quick-check, disconnect hose to air cleaner at cleaner or valve, idle engine and with finger over open end—you should feel a pulsating vacuum.

■ The altitude compensator on '77 Chrysler Corp. 318 V8s is the simplest design: an adjusting screw in the carburetor throat. Turn screw per factory specs to set the carb for high or low altitude. Not as automatic as a built-in barometric bellows adjuster or convenient as a dashboard cable control, but cheaper.

■ Artificial enrichment (additional fuel), a way to set carburetor idle mixture on Ford products since '75s, has caught on at Chrysler for '77. Idea is to add propane (from conventional torch) through the air cleaner to raise engine idle speed. If rise is above specs, mixture is too lean; if less, too rich. Ford adapter adds propane through evaporative emission hose neck; Chrysler expects to add it through air cleaner snorkel.



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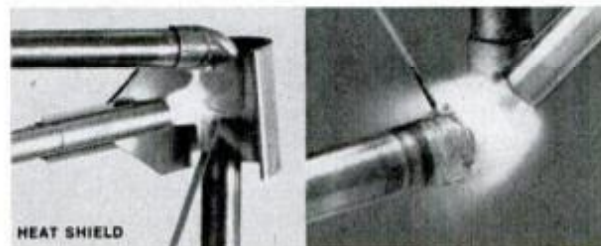
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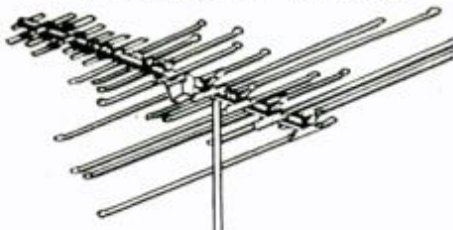
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## '77 CARS: AMERICAN MOTORS

(Continued from page 96)

facturer brings out a new model, you always have the possibility of some substitution. What the Pacer wagon does, though, is give us an added vehicle in a place where there wasn't one before. Therefore we've got the opportunity for overall increase, which is what we're looking for.

**PM:** Tell us something about company thinking regarding the new Hornet AMX model.

**Stuckey:** The AMX springs from the Hornet Hatchback, but adds some sporty youth-oriented features that used to be in what we previously called muscle cars. Today that sort of vehicle has become more personalized transportation.

**PM:** How about new 1977 technical items?

**Stuckey:** Well, we have a new four-speed manual transmission that should provide some very good fuel economy when coupled with our 2.53:1 axle ratio. This is with the six-cylinder engines only so far; the four-speed isn't available yet for V8s.

**PM:** Would you say that this new four-speed replaces last year's electric overdrive option?

**Stuckey:** Yes, we look forward to its doing this. Whether the mileage figures will be exactly identical I don't know yet, but in terms of road performance with 2.53 ratio, it should be a very good, economical performer.

**PM:** Could you comment on the emissions and safety aspects of AMC's 1977 lines?

**Stuckey:** The emission and safety issues both play dominant roles in our 1977 car lines. With the new emissions standards, in certain cases we added catalytic converters. We also included a change in the six-cylinder engines—a quench-head design—and tailored the overall emission package with recalibrations in carburetor and distributor.

Also, the EGR system in all cars was revised, with proportional EGR, which better tailors the exhaust gas flow to meet the needs of the vehicle at various speeds.

On the safety side, the principal standard that came on-stream was the '301—Fuel System Integrity,' which required revisions in the rear of all our cars to give added protection in the fuel-tank area. This was accomplished through a variety of changes relating to the structure in the rear axle, and a general, overall making the rear end more fuel-system protected.

**PM:** With the market seeming to swing back toward bigger cars, are you going to push harder on the Matadors this year than you did in the past year?

**Stuckey:** We will be pushing on the Matador. I wouldn't say we'll be pushing harder. I think we'll be continuing with the promotion of the Matadors as we have in the past. But to say we'll be pushing harder—I don't think so at this point. We hope to sell more, sure.

**PM:** Let's turn to the 1977 Jeep line. **Stuckey:** The significant addition is the four-door Cherokee wagon, which moves in between the two-door Cherokee

and the Wagoneer. We feel that the new four-door Cherokee goes after a market segment we're really not touching today and, of course, no one else is, either.

The Cherokee two-door certainly has met all the expectations we saw for it a couple of years ago. This just seemed to be a natural extension of that, because the profile of Cherokee owners is substantially different from that of the Wagoneer buyer.

Once again, the four-door Cherokee comes into an area which we think will appeal to a younger buyer.

### Quench head

We spoke to Bob Petersen, AMC's director of powerplants and research about the new head on the company's six-cylinder engines.

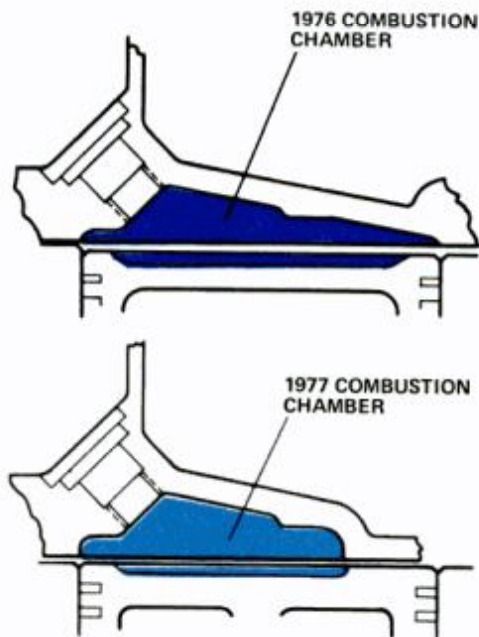
**PM:** Your '77 six-cylinder combustion chamber features what you call a "quench head."

What does it do that your '76 chamber didn't?

**Petersen:** It pushes the mixture closer to the sparkplug, and in so doing, it creates some turbulence for better mixing. The result is that the engine is less octane sensitive and we can get in an additional 3° of spark advance with-



PETERSEN



out knock. This gives us one more mile per gallon on the EPA urban cycle.

**PM:** Wasn't this something you could have done before?

**Petersen:** We originally had a quench head, but we had to open it up more because with leaded fuel we had a cold area where the fuel wouldn't burn.

**PM:** Why was that area, away from the sparkplug, so cold?

**Petersen:** Lead deposits.

**PM:** Don't lead deposits create hot spots, not cold ones.

**Petersen:** Both. The deposits form what we call a sponge layer. The peaks can get hot, but there are valleys in which fuel droplets sit and don't burn, which raises emissions. Now that we have unleaded gas everywhere we can

## Summing up AMC models for '77

**Gremlin:** New sheet metal  
**Pacer:** New station wagon  
**Hornet:** New AMX model  
**Matador:** Refinements  
**Jeeps:** New four-door Cherokee

specify that and not have the deposit problem.

**PM:** Yours is the only company in 1977 with a significant percentage of non-California cars without catalytic converters (40 percent of estimated production). Wouldn't there have been an advantage to keeping the old cylinder head and giving the public the chance to buy a car that ran on leaded gas?

**Petersen:** Yes, we would have liked that, but we certified the noncatalyst engine, our two-barrel Six with automatic, with unleaded gas, and we have to recommend only that fuel.

**PM:** Why did you do that?

**Petersen:** It was the only way we could get the engine through the 50,000-mile certification. We get a higher deterioration factor with leaded gas because of a problem at the valves that we call gassing.

**PM:** Isn't it just the other way around, that the lubricating effect of lead in gas reduces valve deterioration?

**Petersen:** This is something different. It's an effect that you don't notice in the form of compression losses, but a form of leakage that shows up as higher emissions on the instruments.

**PM:** Therefore, there is really no reason one of your Sixes couldn't be operated on a fair amount of unleaded gas.

**Petersen:** From an engineering viewpoint, no. But because we certified the car with unleaded gas, it would be illegal for any station to fill the car with leaded.

**PM:** Then why don't you just put on a converter and really tune the engine for the best performance.

**Petersen:** We get no better fuel economy with the converter.

**PM:** What makes your engines so peculiar, particularly in their ability to meet the emission numbers without the converter?

**Petersen:** There's no magic. We have a six-cylinder in a light car, which gives us a good power-to-weight ratio. This means we don't go as deep into the throttle and pick up the power enrichment section of the carburetor, where the carbon monoxide and hydrocarbons really go up. In fact, we may have the converter off the one-barrel automatic by November.

**PM:** The Six in a light car does cost you fuel economy on the EPA cycle, however?

**Petersen:** True, but we'll have the four-cylinder ready soon.

### Update: four-cylinder Gremlin

AMC's long-expected Gremlin Four is about ready. The engine, Audi mill now used in the Porsche 924, will have a

*(Please turn to page 178)*

## HENRY MORGAN SAYS:

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## '77 CARS: AMERICAN MOTORS

(Continued from page 177)

two-barrel Holley carburetor, not the Audi's Bosch continuous fuel-injection system.

Reasons for the carb: It's cheaper and AMC doesn't have the technical resources to take on fuel injection now. The Holley was picked because it was the only production domestic carb that matched the engine and could stand the higher vibration of a four-banger for the 50,000-mile emission certification tests. A cold-air duct from the right side of the engine compartment is used.

The engine develops 95 horses with fuel injection; with the two-barrel carb it will put out 87 to 88. The engine compartment looks like a weekend mechanic's dream; the four-banger takes up even less room than the Six.

### AMC technical shorts

Overdrive, that option that contributed mightily to AMC's economy run victories of years ago, has been dropped in 1977. At about \$150, it was apparently too big a bite and didn't sell.

A four-speed transmission, available as a '76 1/2 on Pacer, will be offered on all '77 Hornet and Gremlin Sixes. The Borg-Warner box, which has an integral shifter (no external adjustments), will come with a diaphragm clutch.

The three-speed manual also gets a diaphragm clutch for '77, but none of the parts will be interchangeable with the clutch on the four-speed. ★★★

### SERVICE TIPS

■ AMC has a self-adjusting heater temperature cable in '77, eliminating a need to reach into tight quarters. There's a friction fit clip on the heater door link for the cable. No matter which way the cable is moved, it always readjusts to the correct position when you move the dashboard control to "warm."

■ Single-barrel AMC carburetors have a manual adjuster on cars sold in federally designated high-altitude areas. A coin is used to turn the adjusting screw counterclockwise for altitude, clockwise for sea-level.

■ AMC finally adds a dryer to the receiver in its '77 airconditioning system. This means that if you're a bit low on refrigerant and have no significant leak, you may be able to just add a can of refrigerant yourself with a kit available in auto accessory stores. Lack of dryer on previous models meant a refrigerant likely was accompanied by intrusion of excessive moisture, so that complete evacuation vacuum pumping to remove moisture and recharge was mandatory.

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## '77 CARS: GENERAL MOTORS

(Continued from page 101)

with the Highway Economy model the slower one. However, there's one more part of the package that doesn't add economy but makes the car more tolerable. With airconditioning, there's a switch at the gas pedal that shuts off the compressor at or near wide-open throttle.

**PM:** With such a small difference without AC, wouldn't the compressor cutout make the economy model actually faster on acceleration than the standard model, if both have the AC turned on?

**Miner:** Yes.

**PM:** What price range will the Highway Economy Package fall into?

**Miner:** Somewhere less than \$50 over the base LeSabre, perhaps as little as \$25.

**PM:** That's practically nothing. Why wouldn't anyone buy it, unless of course there's an urban fuel economy penalty?

**Miner:** No, it should do a mile per gallon better in urban driving. The problem is that some of the components are not available in high volume, so we just can't supply more than 10 percent of V6 LeSabres. The big imponderable, of course, is the degree to which the dealers will push the package, and that we just don't know. If it really catches

on we might try to tool up for greater capacity.

**PM:** This car apparently represents about as far as you can go with recalibration, axle ratios, shift points . . .

**Miner:** You mean all the normal tricks.

**PM:** Yes. If you were looking for further gains, other than what you get from down-sizing, which offer the best potential?

**Miner:** Engine friction is one area where there is potential for reduction, in the ring, piston and cylinder area. We can change piston-to-bore clearances, spring-loading of rings, cylinder bore micro-finishes.

**PM:** Don't some of these potentially increase oil consumption?

**Miner:** Yes, there is a tradeoff.

**PM:** You haven't mentioned electronic spark control or fuel injection?

**Miner:** Fuel injection and a well-designed carburetor do equally well on economy, and the fuel injection isn't cost-effective. We've run comparison tests with virtually no advantage on economy for fuel injection.

The electronic spark control does increase fuel economy, but on our engines anyway, the fuel economy gains over a well-designed conventional system aren't that great. We can do just about as well with conventional mechanical hardware.

On the economy model, for example, we've squeezed the spark advance and we have made gains. Of course we're still working with electronics and when the numbers make sense, what I'm saying will be subject to change.



FISCHER

### EST

Better fuel economy is one advantage of GM's new Electronic Spark Timing (EST) system that will be used on Olds Toronado this year. We asked Bob Fischer, Project Engineer, Powertrain at Oldsmobile about the system.

**PM:** What's the basic difference between your setup and Chrysler's Lean Burn?

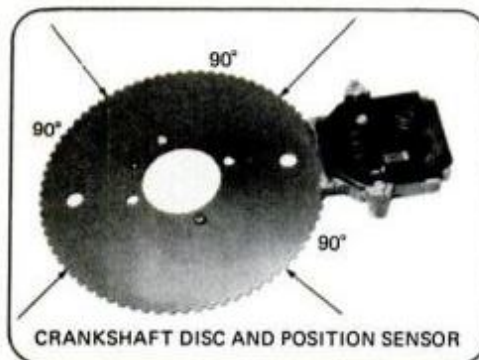
**Fischer:** We have a digital computer; Chrysler has an analog. The digital can match engine requirements faster than an analog. It's inherent in the design. I can change timing from zero to 65 degrees BTDC in an instant with the digital computer.

**PM:** Is there ever a practical need for a greater rate of change than possible with the analog?

**Fischer:** On our engines, yes. There are times that for a few inches of

(Please turn to page 182)

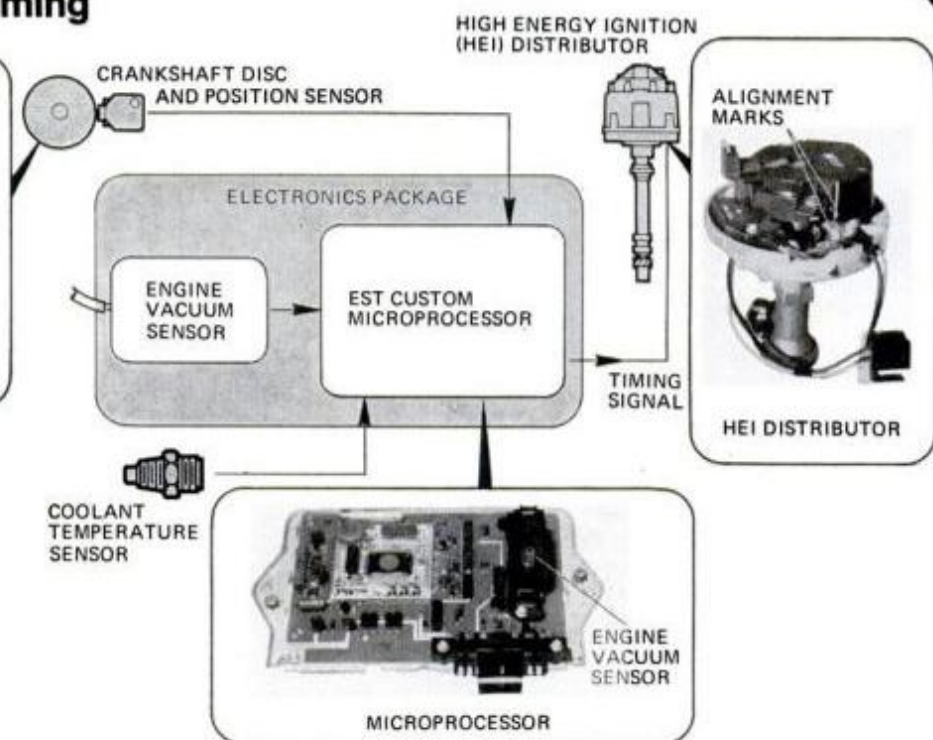
## Electronic Spark Timing



Electronic spark advance control, introduced in the middle of the '76 model year by Chrysler under the "Lean Burn" banner, makes a limited debut at General Motors on the '77 Olds Toronado. An engine's best ignition timing for fuel economy and performance may change enormously from one sparkplug firing to the next, particularly if the engine is running on a very lean mixture.

The hardware for the Olds system differs substantially from that used by Chrysler. The computer is a digital, compared with Chrysler's analog. The distributor is just that, the part that distributes spark to each plug wire. It also houses the tiny electronic module that, upon a signal from a computer-controlled sensor, triggers the ignition coil.

However, it does not contain the sensor, which replaced ignition points and condenser when the industry switched to electronic ignition. Because vacuum and centrifugal advance are



controlled by computer, the distributor doesn't contain these components.

The sensor is positioned on a stationary bracket next to the crankshaft pulley in front, and it is fed current from the computer to generate a magnetic field. The crankshaft has a toothed trigger wheel, called a "pulse disc," alongside the pulley, and its teeth cut into the magnetic field to generate impulses in the sensor.

The impulses are transmitted back to the computer, which also receives temperature signals from the coolant temperature sensor and manifold vacuum from a built-in vacuum sensor connected by a hose to the intake manifold.

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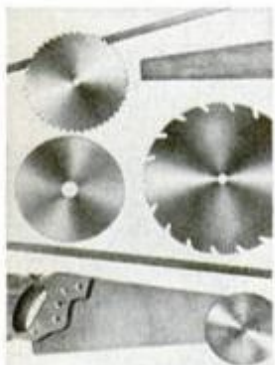
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## '77 CARS: GENERAL MOTORS

(Continued from page 180)

change in vacuum I may want to change timing 30 or 40 degrees.

PM: What sort of fuel economy improvement does this give you?

Fischer: On the California Toronado, EPA highway mileage is almost the same as on the 49-states Toronado. With other models it is an average of two mpg less.

PM: How does your sensor operate in conjunction with the crankshaft pulse disc? It doesn't look as if it has any way of determining when No. 1 piston is at top dead center, compression, for a reference point.

Fischer: The sensor doesn't care about No. 1. There are 72 teeth on the pulse disc and four of them, 90 degrees apart, are smaller than the others. The sensor gets the different pulses and the computer can count at the leading and trailing edge of each tooth. There are four pulse points along the sensor, so I can tell exactly where the crank is to within about 0.6 degree.

PM: What information does the computer get for the decision-making process?

Fischer: It measures manifold vacuum, coolant temperature and engine speed. In a next generation model I would also want to measure humidity, because that can be a significant factor.

PM: What range does the computer operate within?

Fischer: It can give us a maximum spark advance of 65 degrees.

PM: If this distributor just distributes the spark, how do you set ignition timing?

Fischer: The position of the crank sensor determines timing, and although it's adjustable, the adjustment should only be necessary for the initial setting, and if the sensor has to come off for replacement or major engine service. The distributor body has the usual clamp that can be loosened, but if I could have made the change I would have it bolted down because it has nothing to do with timing.

PM: But it does have to deliver the spark to the right cylinder. So if it's got to be removed for some reason and re-installed, what's the procedure?

Fischer: There's a white line on the rotor and an aligning tab on the distributor body. When they're lined up, the rotor will be pointing over the shoulder of the center seat passenger and the distributor body will be in the right position so that wires don't get twisted. The distributor can now be removed and installed.

PM: How can you tell if the control is functioning?

Fischer: One quick check you can make is with the engine warmed up and idling. Pull the vacuum hose from the computer at the carburetor base, and timing should drop from 29 advance to 15 degrees if the vacuum sensor and the microprocessor computer are working. Also, there's a dashboard light that is on during starting. If it doesn't go off after the engine has started, part of the computer circuitry, the run cir-

(Please turn to page 184)



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That innocent-looking water heater may be the biggest waster of energy in your home. Good reason to install a Water Heater Insulation Kit. The vinyl-faced fiber glass insulation in this kit is designed for easy, do-it-yourself installation. Ask your insulation dealer for a Water Heater Insulation Kit. It's new from Johns-Manville.

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## '77 CARS: GENERAL MOTORS

(Continued from page 180)

cuit, isn't working, and the engine is running on what we call the reference circuit. The crank sensor can be checked with an ohmmeter at the connector and we will publish the specifications.

**PM: Why do you have to separate circuits in the computer?**

**Fischer:** It takes a lot of electrical energy to start a car and in cold weather there may not be enough in the battery to both start the car and run the full circuitry of the microprocessor.

**PM: How significant is the coolant temperature sensor in the operation of the system and how would you check it?**

**Fischer:** Well, a coolant sensor failure won't prevent starting, but it does cover a 20-degree range, from an additional 15 degrees advance at zero degrees to five degrees retard at 260 degrees to prevent overheating. This can have a great effect on performance.

The sensor is closed at high temperature, open at low temperature, so you

## Summing up GM models for '77 Chevrolet, Pontiac, Buick, Oldsmobile and Cadillac

**Minicars:** Chevette refined

**Subcompacts:** Vega, Monza, Astre, Sunbird, Skyhawk and Starfire are refined

**Compacts:** Nova, Ventura, Skylark and Omega are refined

**Intermediates:** Chevelle, Le Mans, Century and Cutlass are refined

**Full-size:** Impala, Caprice, Catalina, Bonneville, Le Sabre, Electra, Delta 88 and Ninety-Eight are all-new for '77

**Specialty cars:** Corvette, Camaro and Firebird, Monte Carlo, Grand Prix refined; Riviera all new and Toronado refined

**Cadillac models:** Seville, Eldorado, and limousine refined; Coup DeVille, Sedan DeVille and Fleetwood Brougham are on shorter wheelbase

can test it with a jumper wire and a timing light. If the engine is warm and the coolant sensor connector is removed, the signal to the computer is zero degrees and the timing should advance 15 degrees.

**PM: When did you first discover that engines have such precise and varying ignition timing requirements?**

**Fischer:** We've always known what the engine wants, but the hardware available that was both reliable and at reasonable cost forced us to compromise. Now we can give the engine the exact amount exactly when it wants it.

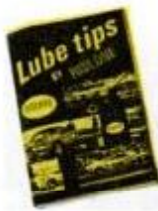
★★★



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Just wait until you hold this beauty in your hands. Notice its heft—a rugged 5 oz. of precision-balanced craftsmanship. Notice the handle. It's solid brass all the way through, heavily inlaid with thick slabs of exotic Pacca wood—the miracle wood that resists moisture, heat, grease and food acids. See the gleaming blade, honed to such razor sharpness that you can almost hear the hiss as it zips through meat, bones fish, dresses game, even cuts kindling and tent stakes. Forged of high-carbon molybdenum steel, the G-96 Titan blade has been specially processed metallurgically to hold a keen edge even after many years of hardest use.

A joy to carry, the G-96 Titan is only 4½" long when folded. Yet open it up and you've got an 8¾"-long wonder that beats the best belt sheath hunting knife you could ever hope to own. (The opening mechanism is as smooth as silk and holds the long blade locked firmly into place until you press the safety release in the handle for closing.)

A triumph of the knifemaker's art, the G-96 Titan is rugged and reliable, a lifetime investment for every outdoor sportsman and genuine collector's item. You'd expect to pay \$19.95 and even more for a knife of such uncompromising quality. Yet thanks to a very special purchase we can offer it now for the amazingly low price of \$14.95. (You'll never need to buy another.)

But remember, not every outdoorsman can own the G-96 Titan. Each one is individually hand-crafted and can never be in unlimited supply at this special low price. Avoid disappointment. Mail the coupon today. Satisfaction guaranteed or your money back.



### LIFETIME GUARANTEE

The G-96 Titan is a hand-crafted precision instrument made of the finest materials available. It is unconditionally guaranteed in normal use against all manufacturing defects for the life of the purchaser, or simply return it to the manufacturer, postpaid, for repair or replacement free. What other knife dares to make such an ironclad guarantee!

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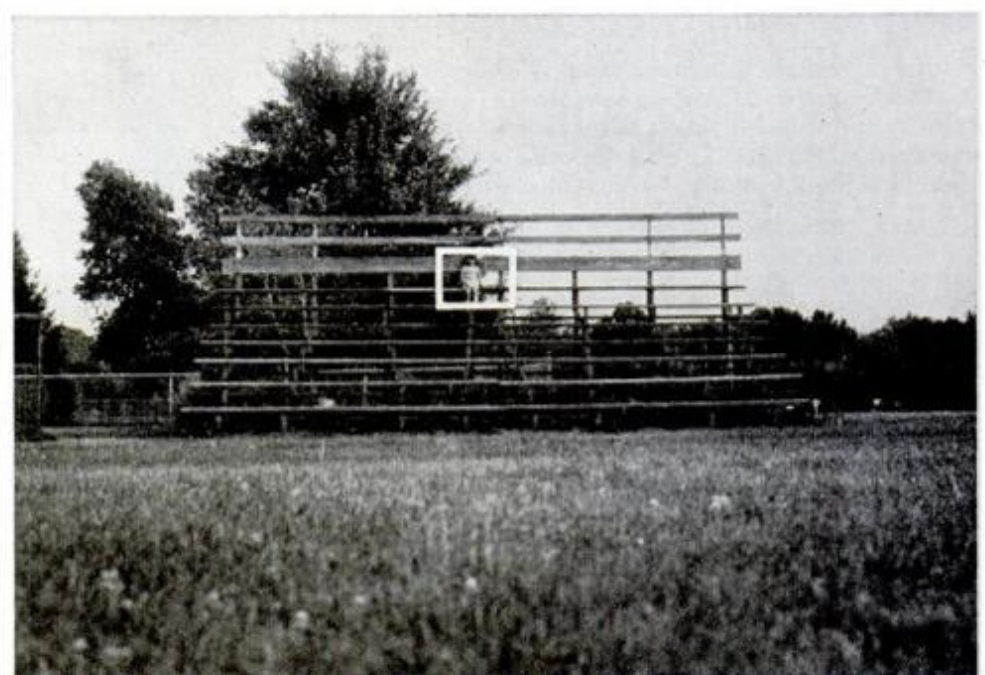
## SMALL OPTICS (Continued from page 71)

telephoto focal lengths and help offset the disadvantages.

Binoculars also use light-folding techniques—the bulge in their shape and the offset that puts the objective lenses farther apart than the eyepieces are both due to the use of prism systems. What's new here is the extensive trend to "roof prism" designs that turn the light path around enough extra corners to equal the path length of a standard binocular while keeping the tube straight and free of offsets and bulges. Roof prisms have been around a while, too, but in recent years binocular makers such as Konica, Redfield and Asanuma have

taken advantage of this design's compact, tubular shape to make folding models. Minolta has now taken this a step farther, with binoculars that fold but still have the convenience of center-wheel focusing. Still another approach to compact designs is taken by Minolta, Bushnell and others who reverse the binocular offset, so that the objectives are closer together than the eyepieces.

And for the ultimate in compactness, try a monocular. Again, they're not new, but the latest wrinkle in them is the use of close-up attachments, such as the one that makes the Pentax monocular a 22X microscope with stand. ★★★



**Magnification of 600-mm telephoto lens is 12 times that of normal 50-mm lens. Compare lower shot taken with 600-mm "solid cat" to upper shot taken with normal lens. Note how bright spots in the out-of-focus foliage behind the child in the 600-mm shot register as circles—that's a hallmark of all catadioptric mirror lenses.**

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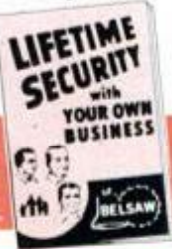
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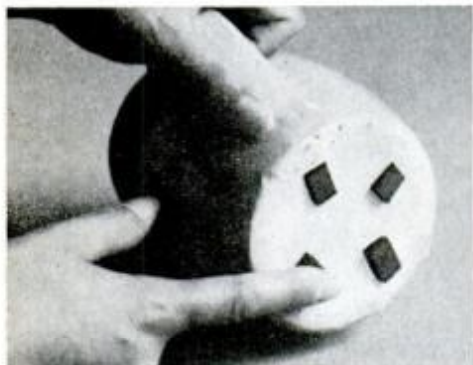
## STICKEST REPAIR PROBLEMS

(Continued from page 103)

sight when assembling kits and complex units. Placed sticky side up on your worktable, the tape keeps easy-to-lose items from straying. Masking tape also helps to keep glued parts together until the glue has had a chance to set.

### Protective sponge tape

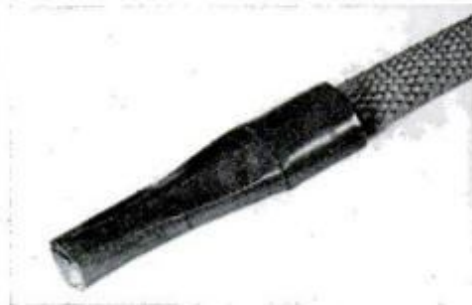
With Mystik Sponge Tape you can protect fine wood and other delicate surfaces in your home from heavy or rough objects. Just cushion the bottom of such objects with strips of the tape. This tape can also be used as an insulator around windows and doors.



This pottery can now be safely placed on tables with no fear of damage.

### Try a tape combination

Cushion tool handles with tape. Files and rasps are more comfortable to use with a handle made of Sponge Tape covered with Cloth Tape, both from Mystik. Bailey III Cushion Grip Tape is made to wrap handles. It absorbs shock and hand perspiration.



Sponge Tape covered with Cloth Tape makes a comfortable rasp handle.

### Tapes for special needs

Mystik Hose Tape makes a permanent, watertight seal over leaking cracks in plastic and rubber hoses.

Other specialty tapes include carpet tape, duct tape, freezer tape and book tape. Although each was made to perform a specific task, even these tapes can help out in other situations. For example, carpet tape can also be used to apply wall tiles.



This water-resistant hose tape holds fast and stretches tight to stop leaks.

### What's to come

Tapes for medical purposes, food processing and rocket and missile maintenance are now available but have not yet reached home users because of high cost, manufacturing and distribution limitations or lack of immediate application. For example, "Bytac" made by Chemplast is a tape with an FEP Teflon topping. It is applied to paint booths and areas where chemicals are used, because paint can easily be cleaned and chemicals won't corrode it. It's \$60 a 5-yd. roll. ★★ ★

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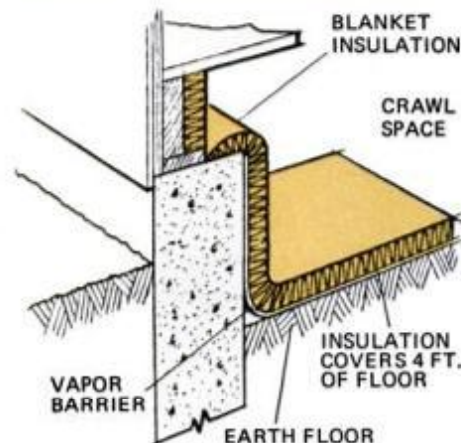
## 10 WORST HEAT THIEVES

(Continued from page 115)

your thermostat. Small amounts of electricity cause heat to flow from the resistor at the top of the unit to the temperature sensing controls of the thermostat. The built-in 24-hour timer lets you set the off-on cycle to your convenience.

## 10 Basement insulation Saving per yr., \$20-\$45

If you've insulated heating ducts or heat-system pipes in your basement or crawl space, it is almost essential to insulate the house foundation walls to protect water pipes and to make the basement livable. In accessible crawl spaces, batts are run between each floor joist (see sketch at right), over the sill, down the wall and across three or four feet of the earth floor inside the space. In full basements, 2 x 3 framing (with sill and plate) is built on two-foot centers, against the foundation with insulation batts run between. The batts need only extend down the wall as far as frost line for your location. This structure then can be covered with dry-wall panels to accommodate the use to which the space will be put. In both foundation types, a vapor-barrier sheet should be laid against the concrete surface just beneath the insulation.



proofing buildings would be available to low-income families. Retrofitting existing structures in such ways—along with the proposed energy-efficient standards for new construction—would save the country at least 12 million barrels of oil a day by 1990, according to a study made by the American Institute of Architects. But that's not all the help that's in the wind. Industry itself is getting into the act.

■ A Minnesota utility company has offered to finance, at remarkably low cost, any insulation job by any of their customers that's designed to bring the dwelling up to maximum protection. The stipulation is that their own suppliers and contractors must do the work, since they've made arrangements for volume discounts far in excess of what individual homeowners could do for themselves.

■ A major Seattle bank recently established special rates—a full percentage point below market—on mortgages for energy-efficient homes, boats and automobiles.

In cities all across the country, dozens of similar programs are afoot. So check your town. The bank should know what's cooking in energy-saving, home-improvement money. If you plan an insulating job to save money, now's the time. ★★★

## Money incentives on the way

As pressure on the world supply of fossil fuels increases, the federal government as well as private businesses are moving in with financial help programs for any homeowner looking for assistance in valid energy-saving, home-improvement projects.

■ The Senate has under consideration a House-approved bill that would provide a tax credit on energy-conserving home improvements. Combined with additions by the Senate, in a version of its own, the bill also would set up a system of rebates to homeowners and small businesses for insulating, installing heat pumps and providing other energy-saving systems or devices. Solar-energy water heating, space heating and other energy-efficient retrofitting would, if approved, receive a 25-percent subsidy, up to \$2000. Outright grants for weather-



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Small engine professionals charge \$12-25 per hour for service labor. And even at those prices they simply can't keep up with the demand. With over 50 million small engines in service in the U.S., owners need qualified servicemen to keep their equipment going. Everything from power lawnmowers to hedge trimmers to chainsaws, tillers to edgers to snowmobiles, power rakes, garden tractors, minibikes, outboard motors—owners of these units need expert help. They want factory-authorized service centers to work on their engines. That's what you'll be after Advanced Engine Products Field Service Division Training.

## Fill the gap—and fill your pockets!

Over a million small engine-powered devices are being sold every month. Homeowners and others are frustrated—they want factory authorized servicemen to work on their engines, and they want the service fast. Many owners try to do it themselves simply because of the backlog of servicemen. But they can't do the jobs right, and they can't diagnose the cause of the trouble or get the parts they need. That's why they'll welcome you!

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Advanced Engine Products is expanding its Factory Authorized Service Dealer network. We are seeking only the best. Motivated self starters willing to devote the effort required to start their own business. We're leaving no stone unturned. Our people and their training, and support must be the best. And once you've completed it, you'll be a true professional. You can train at your own pace—nights or weekends, part time or full time right at home.

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spare parts catalogs—and special tools, plus two engines you'll assemble (a 2-cycle and a 4-cycle engine)! They are yours to keep as you gain vital hands-on experience right from your very first assembly module.

## There's more to our program than just mechanics!

An important part of the AEP Small Engine Repair Field Service Training Program are the secrets of successful business operations. We'll show you everything you need to know to open up a prospering business of your own. How to buy parts and equipment wholesale, how to get started on a shoestring...all you need to make your small engine repair service successful and highly profitable!

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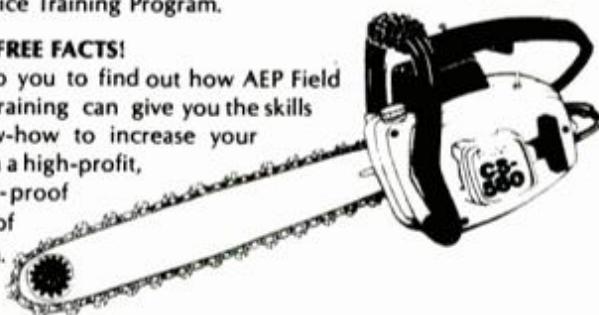
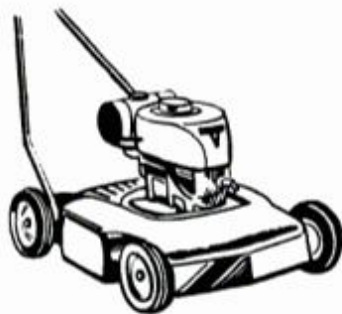
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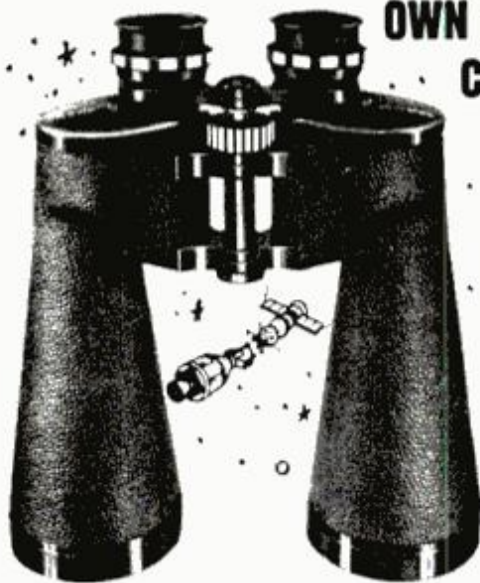
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## INSTANT-PICTURE CAMERAS

(Continued from page 105)

a zooming circle that gets bigger as you focus closer, to match the size of a normal adult head. It works—but only for pictures with normal adult heads in them, and only between four and 25 feet. For other subjects or distances, you have to guess the distance and set the focusing scale—and that job's easier on the Pronto! and Wizard. By the time you read this, though, you'll have the option of buying a Pronto! with rangefinder focusing, for under \$80; that should be the easiest of the lot.

Focusing counts for more than sharpness: It also affects exposure accuracy when you're using flash. All three cameras set flash exposure according to the distance you've dialed in. (The electric eye on Pronto! also works during flash exposures, to keep exposure accurate if you've focused a bit wrong, and also to allow flash fill-in of shaded subjects in daylight.)

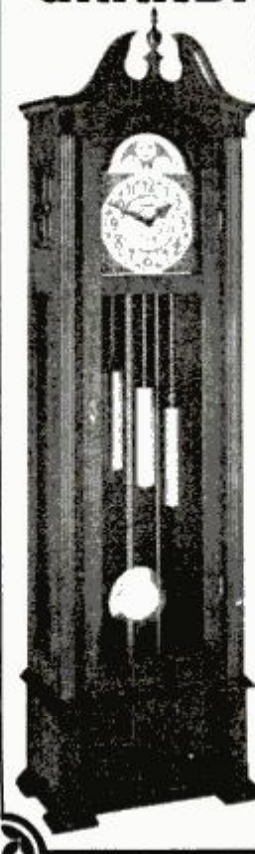
## Two useful circuits

Pronto! has two other useful flash circuits: One keeps the flash from firing if you've run out of film, while the other keeps the camera from firing off a shot if you've used up all 5 flashes on the side of the Flashbar facing your subject; shooting will resume as soon as you turn the Flashbar around to its unused side. Wizard uses the same Flashbar, whose 10 shots match the 10 shots of the SX-70 film pack, but without the automatic safeguards. Kodak's Flip-Flash sits on end to raise its light a bit above the camera to minimize "red-eye" reflections, and has little green spots that show how many flashes have been fired; but there are only 8 shots per Flip-Flash versus 10 per pack of film.

The Kodak and Keystone cameras have tripod sockets built-in, but there's no provision for a cable release. The tripod socket on Pronto! is an accessory.

My choice would be the Pronto! (even more the new rangefinder model): It's the lightest (about two-thirds the others' weight), the most compact (about two-thirds the Kodak's size, three-quarters of the Wizard's), feels coziest in my hand, and its smarter circuitry saves film, saves flash, and allows flash-fill shots in daylight. Its film is less expensive than Kodak's (about 70 cents a shot to Kodak's 75) and that price includes the batteries built into every film pack. (Dead batteries were a problem with early SX-70 packs; lately, they don't seem to be.) ★★★

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I'm getting old, and I don't have much longer to live. Unless I do this now, when I go the secret goes with me.

What I am about to give you is KNOWLEDGE — the knowledge that men have been searching for since time began.

I used to be an ordinary man. I spent the early part of my life stumbling in the dark, trying to find a way to make all the dreams I had as a young man come true. I wanted, like most people, to be healthy, admired, respected. I wanted love and happiness. I also had many questions about life and wanted some answers. Yet, no matter how hard I tried, everything always seemed to be kept from me. As though it was all hidden in the very next room, a room whose door was impenetrable without the right key.

After years of being kept from those things that I wanted most in the world my spirit could have easily broken if I allowed myself to become consumed with failure and rejection. Little could I know then how lucky I was for this to have happened to me. For something grew inside me that would not let me rest until I found the answers that would bring me all the things I so desperately wanted.

This was the beginning of a search that would become an obsession. To find the knowledge that I so desperately longed for and knew must exist somewhere. The inspiration of the great men of the past took much of the torment away. The multimillionaires and reclusive billionaires that seemed to have the world at their beck and call. The men that were able to control the very destinies of nations. How they held respect and admiration, how they were rich and powerful but not me, never me. What did all these great men have that I didn't? I knew there must be an answer and I dedicated my life to finding it; because I knew there could be no true life for me until I did.

I started to read, to do research into the past. I spoke with and studied of the richest, the most powerful, as well as the wisest men of my time. I read every possible piece of literature that I thought would hold a clue. I delved into the oldest recorded writings of the ancient civilizations. I studied and I learned. Trying almost insanely to put all the pieces of this great puzzle together. I kept asking, myself, what did these men have? What did they have that I didn't and how could I get it?

I involved myself in all sorts of situations trying to put into practice what I had learned. I traveled

with the hope that the answers might somehow lie beyond the horizon and though I didn't find them there, I now know that the proverb, "Seek and ye shall find," couldn't be more true. For when the answers were finally revealed to me they came in a way that I could not directly attribute to any place I had been or any individual effort I had made to find them. It was as though my mind had crossed into a new frontier, a frontier that I was certain relatively few men had ever gone into before. Suddenly I saw the whole world differently, what seemed confusing before I could easily understand. What was unobtainable before suddenly became easy to get. The things that people saw one way I saw differently as though I could detect more aspects of the same thing and thereby see it more clearly or as it truly was. I had an undefined power that gave me an advantage over everything I did. After a while I realized that I was very different from before. I was at last the way I wanted to be. I had learned what I wanted to learn and was at long last able to live the way I had dreamed and knew it was possible for a man to live.

It is written, "Once in a thousand years, a man lives a dream." For the last 1/3 of my life that is exactly what I have done. I have lived with more wealth and power than any man could ever want. I have done almost everything that I ever set out to do. I doubt if there has been a man who has lived a more fulfilled life than I. But now I have only memories. This, in my opinion, next to life itself, was the greatest gift that a man could be given. But now I have come to realize that if I don't share this knowledge now I may never get another chance to do so. I now know that I am obligated to share it and in the end this was the way the fates had destined it to be.

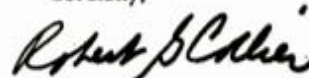
I know that most people who read this letter will think I'm a crackpot, a fraud, a liar. They won't believe that I have this knowledge or at least that it could be put into a book and taught to them. For them I am truly sorry, for they unfortunately, still have the same tendencies, even in this technological age, as did the early cave men, who never wandered far from the security of their caves, who unwittingly traded the wonders and secrets of the outside world for it. Those few who ventured outside have always and will always be the few who reap the rewards. The few that are remembered when everyone else finally sees that it's safe to follow. The few who will always be a step ahead of and have the advantage over everyone else. Life holds next to nothing for those who cannot see beyond the present time, who believe that their own little world of intellect is the final answer.

This letter then is intended for the few who have not yet submitted to the world and become total slaves to society. The few with the spirit and guts to want more from life than they have been told all their lives by those with nothing that they could get. The few who believe there is more to life than most people think is possible and want it as I did when I was young.

I cannot know if you are one of these unique people. I will only know that when I receive your name on the order form below. If you want a copy of this book and want to learn this knowledge and want the rewards knowing it will bring you; send me the enclosed order form with ten dollars for payment in full. I urge you to send for it NOW... it will be the smartest thing you've ever done.

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Cordially,



P.S. I hope you don't think that I'm only interested in your ten dollars. I would like to give this book to everyone free, but I have found that people appreciate as well as apply themselves wholeheartedly when they have to pay for it. Besides with the costs of labor, mailing, this ad, and printing I hope at best to just get my costs back to inform as many deserving people as I can before the end. I think it only fair to warn you though, that this book contains only 344 pages yet, people that have read it through have experienced a drastic change in their attitude and outlook of life. Once you read this book you can expect a very drastic change in your life as well. The knowledge within it will give you a distinct advantage over everything you do, an advantage you never had before. Although this may seem like a good thing to you, there are many people who are very happy to be failures and actually enjoy having to feel sorry for themselves and once they read this book through they can never expect to do that again.

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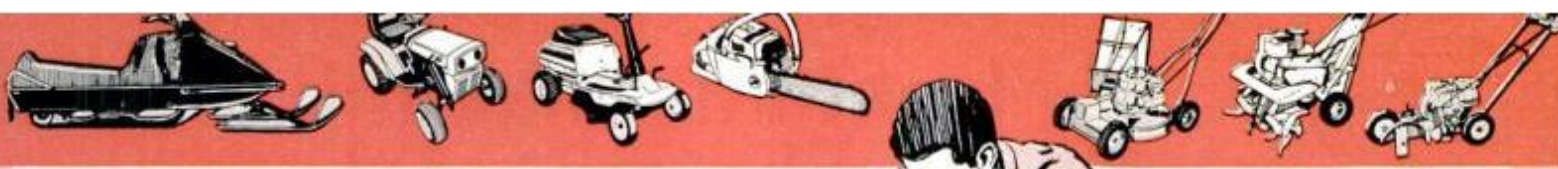


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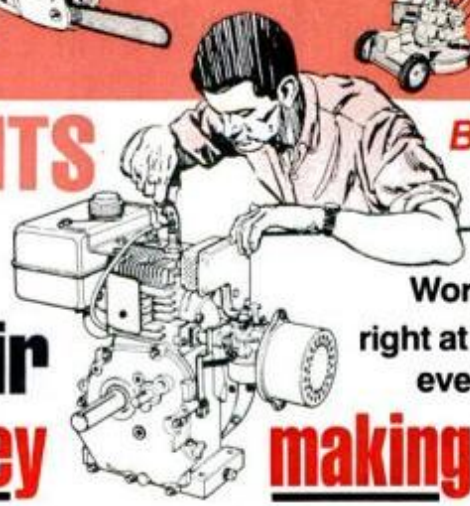
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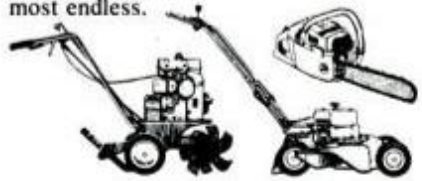
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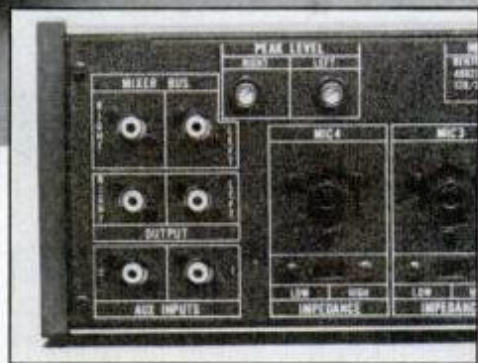
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# Heathkit mike mixer has professional pizzazz

by Lancelot Braithwaite



Shaped like a miniature recording console, Heath TM-1626 has such professional features as sliding controls and a pan-pot (see text). Unusual extras on the rear panel include microphone impedance selectors, adjustments for the front-panel peak-level indicator lights, and mixer bus outputs.



Mixers let you add professional effects to your recordings. But the good ones usually bear professional prices, too. At \$130, Heathkit's TM-1626 stereo microphone mixer fits neatly between the limited but inexpensive and the flexible, high-priced models.

Its most unique, and most professional feature is a "pan-pot" that lets you make one microphone appear to come after either the left or right or from any position between. The sliding pot feeds the microphone's signal into both channels, in varying proportions that control its position.

The other three microphone inputs and both high-level "Aux" inputs can be switched into either the right or the left channel. And all six inputs can be switched off individually, another professional feature that makes it easy to check the level and clarity of each signal.

VU meters keep track of the average signal level while you record,

and LEDs flash to indicate high peak levels. Both have adjustable sensitivity, with the VU meters controlled by a front-panel switch, and the LEDs by screwdriver adjustments in the back.

The four microphone jacks can be adjusted for high or low impedance, and Heath tells you how to replace their phone jacks with professional Cannon types. Additional, "mixer bus" jacks let you link two or more of these mixers together.

Construction took 12 hours, with only two places where the instructions needed clarifying.

The Heathkit's performance is surpassed only by professional equipment. In a test with all gain controls set at maximum (more of a test than any real life situation), hum and noise were more than 50 db below the "0 VU" level, and harmonic distortion was only 0.34 percent. The mixer can handle signals up to 18 db above reference level without clipping.



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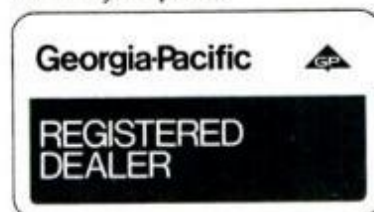
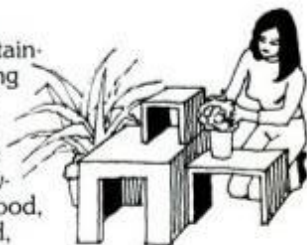
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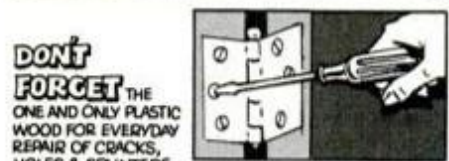


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# This calculator tells how you'll feel next Thursday

**C**asio's new Biolator calculator can figure more than just the usual addition, subtraction, multiplication and division. It can also tell you what day of the week any 20th-century date falls on, how many days apart two dates are—and, according to proponents of the "biorhythm" theory, predict your state of health, happiness, and intelligence for any day of your life.

To check your biorhythms for next Thursday, for example, you first enter the year, month and day of your birth, then subtract the same figures for Thursday and push the "BIO" key. You'll get a readout something like: 12.10.26.

The first number tells you that Thursday is the 12th day of your 24-day physical cycle. On the graph above the display, you see that on day 12 the physical (P) curve crosses the center line, making Thursday a "critical day" on which accidents or poor health are more likely. So Thursday might be a good day to take the bus to work instead of driving.

The second number places Thursday as the 10th day of your 28-day emotional sensitivity (S) cycle. The graph shows that to be about the peak of your emotional well-being—a good day for tests, public performances, courting, or a job requiring teamwork.

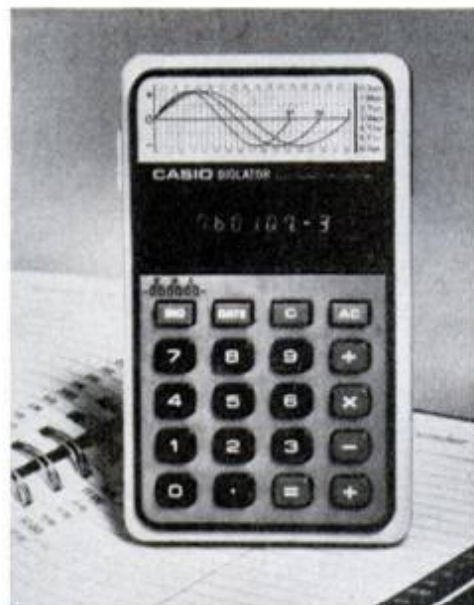
But intellectually, according to the "I" curve, you'll be about as far below par as you normally get, on day 26 of 33 days. Not a good day for making decisions or starting new projects—but not bad for simple jobs.

But do these rhythms work? The evidence is sketchy.

A Japanese bus company cut accidents 50 percent the first year it monitored drivers' biorhythms and issued safety warnings on critical days. And accidents have continued falling.

To prove that warnings alone don't do the job, a New Jersey company with a fast-rising accident rate stopped the rise among workers given biorhythm-based warnings, but only slowed it slightly among those warned on a random basis.

But though safety warnings linked



January 7, 1976 was a Wednesday, says the display of this \$30 Casio calculator, which also checks your biorhythms and tells how far apart two dates are.

to biorhythms seem to help prevent accidents, other studies show no correlation between biorhythms and the accidents that actually occur. (Could it be that critical days don't make it more likely to have accidents—just more likely to heed safety warnings?)

Heeding biorhythm's warnings is a subtle process in any case. Many other factors also affect your life—your heredity, upbringing, diet, the weather, other people in your life, to name a few. And you can rarely put off stressful situations till your rhythms are right for them.

But what you can do is compensate for problems that biorhythm predicts. If you have a gruelling physical task to do on a physically critical day, you could get more rest beforehand, rather than overtiring yourself with extra training. If you have a report due Friday, do it now, not Thursday night when your intellectual level is predicted to be low.

Watch out for combinations, too: next Thursday's emotional high and intellectual low could lead you to euphoria—and dumb decisions.

But even if you're unconvinced, the Biolator is a fine, compact, easy-to-read calculator with unique entertainment value.—Ivan Berger



## THE WAY TO GROW

(Continued from page 134)

strips. After the glue dries, you plane the strips flush on both sides with a sharp block plane, being careful not to cut into the veneer. A brad or two can keep the strips from shifting, and masking tape will hold them in the absence of enough clamps.

Before assembly, cover the 6-in. fascia board at the top (both boards if the unit is to be a room divider) and the double-thick counter with plastic laminate such as Formica. Do the edges first, then surfaces. If you haven't applied plastic laminate before, see *How to Apply Plastic Laminate*, page 110, Feb. '75.

Make a  $\frac{5}{8}$ -in.-square rabbet along the rear edge of the counter and rear edges of the sides at a point from the counter down to hold a  $\frac{1}{2}$ -in.-plywood back panel. Guide a straight-shank bit in your router with a straightedge clamped to the work.

To assemble, nail the top member first to the two 6-in. fascia boards and the bottom board to the  $2\frac{3}{4}$ -in. kickboard. Paint the inside of the top matte white. Next, start two nails through one side member at each of the four cross-member locations. Apply glue, drive home the nails within  $\frac{1}{16}$  in. of the surface, set the heads and fill. Now, with help, turn the assembly over onto protective wood strips on the floor and nail and glue the other side member the same way.

Check for squareness, then hold the assembly square with a diagonal brace across the back. Install the back panel, then cut, fit and hinge the doors with  $1\frac{1}{2}$ -in. butts.

For a rubbed-effect finish, brush on a wash coat of sanding sealer diluted 50 percent with lacquer thinner. Sand lightly when dry and follow with a coat of Beverlee's natural-teak satin stain. Even out the coat and lighten by wiping with a soft cloth. Work fairly fast, one section at a time. For a darker accent on front edges, brush on stain and omit the wiping. Then add two coats of Fabulon's polyurethane satin-luster finish.

If you can't find a side-mounted fluorescent fixture, there's space for a conventional 36-in. two-lamp channel-type fixture with a T8 ballast. Fit it with two GE 30-w. Gro & Sho fluorescent F30T8/PL lamps. Run the lamp cord through a hole in the cabinet top, knot the cord, insert a grommet in the fixture and connect wires. The plastic "egg-crate" diffuser is available at lighting and building-supply centers. ★ ★ ★



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# HINTS

FROM READERS

## Perfect tool holders



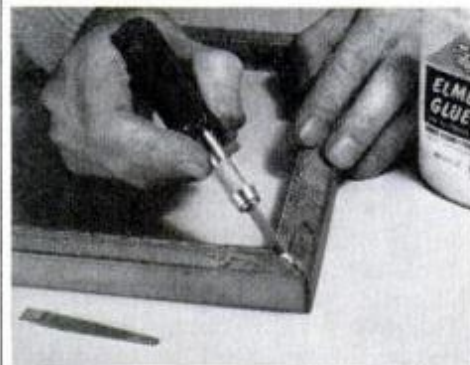
Such throwaways as toothbrush cases and metal cigar tubes make perfect containers for keeping track of tiny twist drills and small files in your toolbox.—*M. E. May*

## Sorter and funnel



When you dump the contents of a small-parts drawer in a cake pan which has a 1-in. hole in the corner, you can easily get the bolt or screw you want, then pour the contents back into the drawer through the corner hole.—*Erik Miller*

## Glue applicator



To work glue deep into an open joint, cut a narrow blade from thin tin-can metal, fold the upper end double for 1/2 in. and insert in a craft-knife handle.—*Rick O'Shea*

# Introducing the battery that thinks it's a camel. It never needs water.

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## **Sealed batteries can't be saved.**

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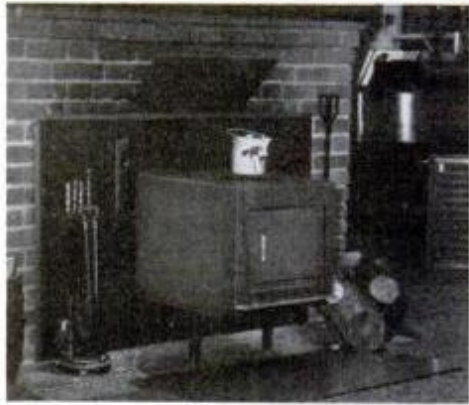
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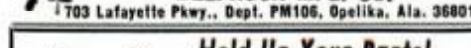
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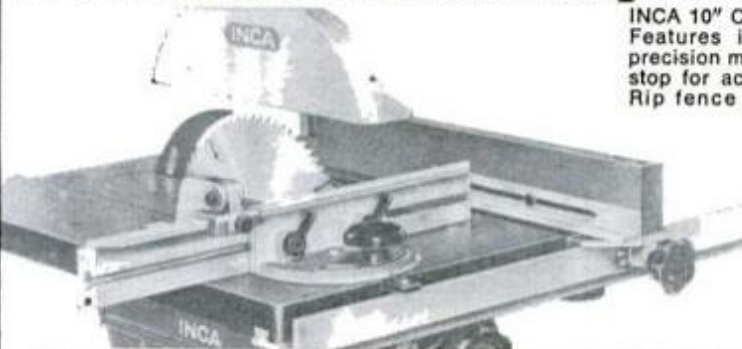
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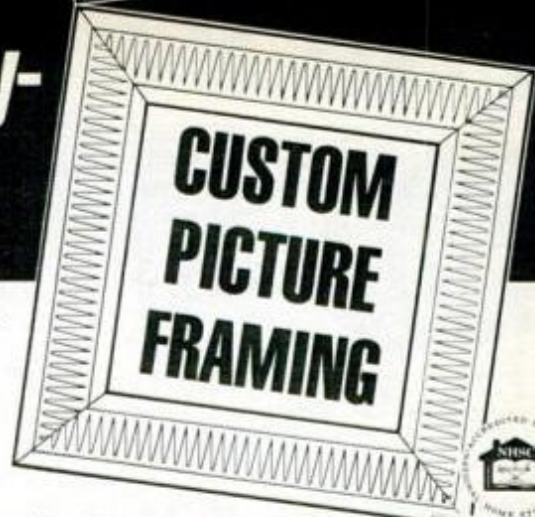
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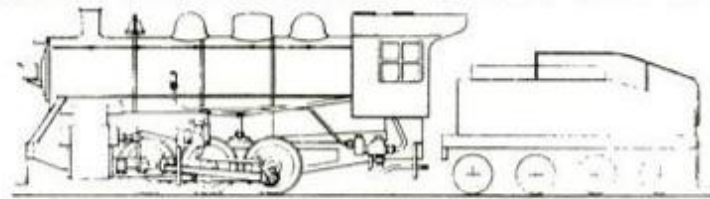
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# Silvo (BRAND NAME) Tool Catalog Specials



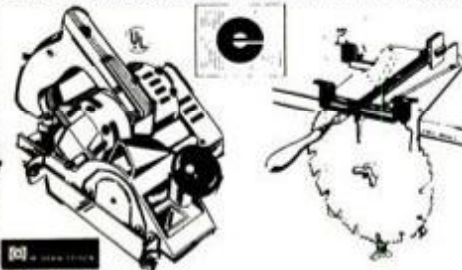
**No. 59 Stanley Doweling Jig** — Make boring dowel holes in edge, end or surface of boards easy — complete with 6 guides  $\frac{3}{8}$ " to  $\frac{1}{2}$ " — with depth gauge — add .75 for shipping — Reg. \$21.70  
**59-S19 Doweling Jig** ..... \$14.25

**Stanley Web Clamp** — Heavy duty — Tough 12 ft. long nylon webbing — 600 lb. test, holds all sizes and irregular shapes under positive, even pressure. Clamp tightens easily with wrench or screwdriver. Ratchet action keeps webbing tight. Add .50 — Reg. \$5.60  
**41159-S19 Web Clamp** ..... \$3.98



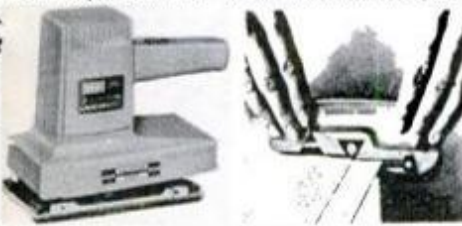
**McGraw-Edison 5" Bench Grinder** — 3.2 Amp., 3500 RPM motor, 1 fine grit and 1 coarse grit wheel. Light illuminates work area. Features eye shield, end bells, adjustable tool rest, water trough, rubber shock mounts and screw mounting holes. Add \$2.50 for shipping. Reg. \$39.95  
**2601-S9 5" Bench Grinder** ..... \$24.98

**Eclipse Honing guide** — holds securely wood chisels and plane irons at correct angle to the oil-stone and insures a true square edge. Hold from  $\frac{1}{4}$ " to  $2\frac{1}{4}$ ". Reg. \$6.95 Add .50  
**34-E5 Honing guide** ..... \$4.98



**McGraw-Edison Electric Planer** — Powerful motor smooths and shapes wood with ease — Timing gear belt drive — Burnout protected motor — Precision ball bearings — Adjustable/removable angle guide fence included — 3 amp motor — 14,000 RPM — Adjustable planing depth — Net weight 5 $\frac{1}{2}$  lbs. — 2 removable steel cutting blades — add \$2.00 for shipping. Reg. \$56.95  
**2800-S9 Electric Planer** ..... \$31.49

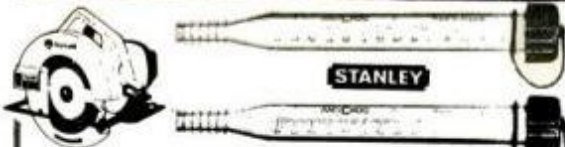
**No. 11 Super Saw Filer** — Joins and sharpens circular saws 6" to 10" with all teeth the correct height and bevel. . . . Easy to use . . . when file hits hardened steel roller, teeth are finished. Saw runs true and smooth with no side pull. Ideal for skilsaw blades. Complete with special 8" file. Add \$1.00 for shipping.  
**11-M1 Super Saw Filer** ..... \$8.75



**McGraw-Edison Dual Motion Sander** — For rough or finish sanding, or bevel or straight line. Sands flush to both sides and front. Sands or polishes wood, metal and plastics. Uses  $\frac{1}{2}$  standard abrasive sheet. Double insulated, burnout protected motor. 2.5 Amps — Lifetime lube bearings. Reg. 39.95. Add \$1.00 for shipping.  
**2503-S9 Dual Motion Sander** ..... \$21.98

**Eclipse Laminate Trimmer** — Scribes and trims plastic laminates to size when fitted to worktops with both straight and contoured profiles, as well as producing parallel strips used for edging. The use of this tool eliminates the risk of costly cutting errors. Add .50 for shipping.  
**2005-E5 Laminate Trimmer** ..... \$4.29

**Eclipse Automatic Center Punch** —  $4\frac{1}{4}$ " long, just press down and make your punch. No hammering is required. Depth of punch is variable by turning knurled head. Reg. \$7.50  
**E171-E5 Auto. Center Punch** ..... \$5.75



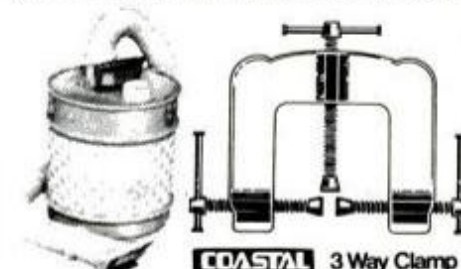
**Rockwell 7 $\frac{1}{4}$ " Circular Saw** — Ball Bearing. Powerful 9 amp motor, cuts 2 $\frac{3}{8}$ " at 90°, cuts 1 $\frac{1}{2}$ " at 45°. Double insulated to protect the user against electrical shock. Telescoping blade guard. Large base. Accurate depth and angle adjustment controls. Reg. \$34.99. Add \$1.50 for shipping.  
**4511-R7 Rockwell 7 $\frac{1}{4}$ " Circular Saw** ..... \$23.99

**Water Level** — with 50 ft. of Rubber H.D. tubing — To take a level over a long distance. Used wherever extreme accuracy is required. Work around corners. Perfect for batter boards, footings, foundation forms, sills, ceilings and lintels. Stanley Mabo Large Plastic Vials, virtually indestructible put in use by turning the stopper  $\frac{1}{4}$  of a turn. Add \$1.00 for shipping.  
**56-398-524 Water Level w/50' hose** ..... \$14.98



**Universal Router/Shaper Table** — Ideal for shaping and jointing small materials that are normally difficult to handle. Build picture frames, plaques, or easily add a decorative touch to moldings. Features miter gauge for safe cutting at any angle. Accepts most routers. Skil, Sears, B & D, Stanley, Rockwell and others. Add \$2.50 for shipping. Reg. \$16.95.  
**71025-S37 Router-Shaper Table** ..... \$10.98

**Electronic Speed Control** — Varies motor speed, maintains full torque, for AC-DC Motors — 10 Amp rating — makes portable power tools (or other equipment driven by AC/DC brush-type motor) do more jobs with less work by reducing motor speed, not torque. Speed settings from 0 to full RPM of tool. On-off switch, female receptacle, 6 ft. 3-cond. AC cord. Clips to belt or mounts on wall. Add \$1.00 for shipping. Reg. \$28.00  
**4X701-G10 10 Amp Speed Control** ..... \$19.60



**Shop-Vac Refurbished Dry Vacs** — A powerhouse for all rugged chores. Perfect for removing bulky debris in workshop, attic, garage, fireplace, etc. Put hose on blower side of vac and blow dirt out of hard-to-reach areas. Includes: Steel tank vac with carrying handle, 2 $\frac{1}{2}$ " x 6 ft. hose, 2 $\frac{1}{2}$ " x 1 $\frac{1}{4}$ " adapter for use with other Vac Attachments. 2 $\frac{1}{2}$ " square nozzle and filter bag. 5 gal. Vac Reg. \$45.95 add \$3.50 for shipping. 10 gal. Vac Reg. \$52.95 add \$4.00 for shipping.  
**222-S12 5 gal. Ref. Dry Vac** ..... \$19.98  
**777-S12 10 gal. Ref. Dry Vac** ..... \$22.98

**Coastal 3 Way Clamp** — Useful for clamping edges of formica and similar materials for gluing and cutting. Durably made of pressed steel. Large swivel tips and sliding tee handles. 2 $\frac{1}{2}$ " opening. Can be used as a Cee clamp. Reg. \$2.40 each. Add \$1.00 for shipping 4 clamps.  
**60207-C5 3 Way Clamps** ..... each — \$1.59  
 Special — 4 for — \$4.98



**Unimat-5-in-1 Metal Machine Shop** — World famous Unimat — the precision lathe that converts to vertical mill, drill press, surface grinder and polisher — over 100,000 in use by R & D labs, inventors, hobbyists and precision machinists — Reg. \$229.95 — Complete machine shop in miniature — Please refer to our Silvo catalog for price that is hard to beat.



**Arco "Quik Sand" Belt Sander** — Handiest tool you have in your shop. It sands, grinds, polishes and sharpens. Use with any  $\frac{1}{4}$  or  $\frac{1}{2}$  h.p. 1725 RPM motor. Suction cup feet hold sander firmly to work surface. Uses 1" x 42" sanding belts. Add \$2.50 for shipping. Motor not included.  
**165-A13 "Quik Sand" Sander** ..... \$25.98

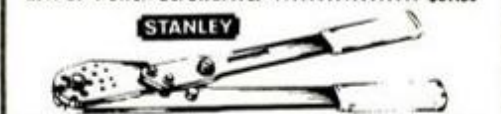
**Rockwell Speed — Bloc Sander** — Palm grip design for one hand use. Thumb control switch, offset pad for 4 way flush sanding, 12,000 OPM. 100% Ball Bearing, 5/64" Orbit, 2 Amps, Direct motor to pad design. Pad size 4 $\frac{1}{2}$  x 4 $\frac{1}{2}$  add \$2.00 for shipping. Reg. \$59.99  
**4480-R7 Speed-Bloc Sander** ..... \$44.50

**Complete Metal Work Shop** — Punches, shears, forms, rivets. A most versatile tool for all industrial plants, experimental labs, repair shops. Spec. punches clean, burr-free holes in metal up to 16 ga. to 1" from edge of stock; Shears metals up to 1" width 16 ga. thickness; Bending & forming dies at back of tool make bends up to 90° in either rod or bar stock. 16 ga.; rivets stock up to 1" from edge and up to combined stock thickness of  $\frac{3}{8}$ ".  
**4-1-T9 Metal Work shop** ..... \$13.98



**Record Woodworkers' Vises** — The finest vise made. "Toe-in" Jaws give even gripping power. **Dual Action Screw**, Quick action special buttress threads increase grip with tension. Built-in adj. "Dog" on front jaw. **52D-7" Jaw**, opens 8", Wt. 22 lbs. **52 $\frac{1}{2}$ D-9" Jaw**, opens 13", Wt. 40 lbs. Add shipping cost to price of vise. (Ask your Post office.)  
**52D-R10 7" Vise 22 lbs.** ..... \$29.98  
**52 $\frac{1}{2}$ D-R10 9" Vise 40 lbs.** ..... \$39.98

**McGraw-Edison Power Screwdriver** — UL approved — 100 to 1 gear reduction — Easily drives and removes screws, nuts, and bolts — Accepts all  $\frac{1}{4}$ " hex shank bits and accessories — For industrial and mechanic use — 3 amp, 220 R.P.M. motor — Reversing Switch — Positive clutch prevents overload — High torque Burnout protected motor — Net wt. 3 lbs. — Capacity: up to #12 wood screws and  $\frac{1}{4}$ " Bolts — Includes 2 Phillips bits, 1 reg. bit and center punch — Add \$1.25 for shipping — Reg. \$56.95  
**2810-S9 Power Screwdriver** ..... \$31.50

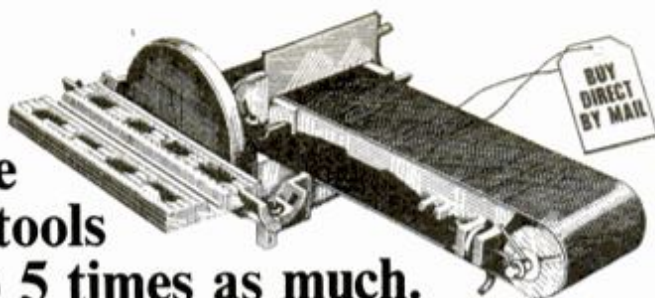


**Stanley Bolt Cutter** 16 $\frac{3}{8}$ " long — New design with unique shearing action. Cuts chain, rod, threaded bolts clean. Will also bend stock up to  $\frac{1}{4}$  inch. Nose cutting action lets you cut chain, fencing and long wire. Shearing action cuts clean, leaves perfect threads. Plus it bends stock up to  $\frac{1}{4}$ " — Add \$1.00 for shipping.  
**84205-S19 Bolt Cutter** ..... \$14.39

**SILVO (BRAND NAME) TOOL CATALOG**  
 THOUSANDS OF EXCITING TOOL VALUES: Stanley, Wen, Speedy-Sprayers, Milwaukee, Rockwell, Dremel, Skil, Nicholson, Disston, Millers Falls, Helios, Wellsaw, Plumb, Kennedy, Huot, Ridgid, Crescent, Vise-Grip, Audel Books, Unimat, Wiss, Channel-lock, General, Pony Clamps and many Nationally Advertised brands of tools and supplies. We ship Coast to Coast at prices hard to beat. Send \$1.00 for our big SILVO TOOL CATALOG today.

Minimum order is \$10.00. Please add minimum shipping charge of \$1.25 to all orders. We will refund over-payment or charge for under-payment of all your estimated shipping charges. **NOTE:** Reg — Regular Mfr's suggested list price.  
 Special Extra discounts of 5% to 20% on order of \$150.00 or more on all items listed in this Ad and all items in our Silvo Catalog.

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We skipped the chrome to save you money... but we did not skip anything on performance. Actually, we skipped more than just chrome, we cut out every costly frill that wasn't absolutely needed.

Our tools are not exactly flashy. But in articles covering test results on AMT tools, written by leading publications such as Popular Science, our tools have been praised over and over again. In spite of their low prices, our tools are full scale and offer full performance and precision.



**HERE'S HOW WE DO IT...** First, we don't claim our tools should sell for five times the price! Just that our tools do the same job... with the same accuracy, ease and speed... and will last at least as long. AMT tools cost less to make and are sold direct. They are bona fide quality power tools used by serious amateurs and professionals alike and if sold in retail stores would be much higher in price. We use no magic, let's be specific:

**SIMPLICITY...** AMT tools are soundly engineered to eliminate every frill and gimmick—to minimize material and production costs. Machined parts are used only where they're needed. Unadorned cast iron and aluminum save you a fortune.

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**STANDARD PARTS...** Our designs use standard hardware items wherever possible. By avoiding custom-made parts we pass on tremendous savings to you.

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*Bill Monte*

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\$4380

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4th & Spring St., Royersford, Pa. 19468

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- G.E. Motor  \$29.90 (with other item)  \$34.85 (purchased separately)
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- Deluxe Ball Bearing 4' Lathe at \$54.10
- Face Plate \$2.50 ) any Lathe
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**Brand new electric motor** developing full 1 h.p. 17 lbs. (Purchased separately, \$34.85). With any AMT machine here. **\$2990**

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\$3470

**FREE OFFER,** cabinet base plans... with one piece of 3/4" plywood, convert your \$34.70 saw into a floor model with a huge 27" x 24" top. Takes cabinet rip fence, \$6.50 add'l.

**BELT SANDER** A precision unit. It changes from horizontal to vertical in seconds. Heavy, sander includes 4" x 36" sanding belt. Uses 1/2 h.p. or larger motor. V-pulley drive and multi-purpose drive spindle. Disc sander accessory, \$12.50 add'l. Mitre gauge, \$2.95 add'l. 18 lbs., f.o.b. factory. **\$3300**

**3' WOOD LATHE** ... 6" swing. Same precision and speed as \$40 units. Sturdy cast iron with tubular steel bed. Lever action tail stock, two-speed pulley, fits any motor. Set of 3 high speed turning chisels, \$6.95 add'l. 4" face plate, \$2.50 add'l. 15 lbs., f.o.b. factory **\$1980**

**4' WOOD LATHE** ... 12" swing. Industrial size, does same job as \$75 units. Tubular steel bed rails, screw action tail stock, 3-speed pulley. Use any motor. 3 high speed turning chisels, \$6.95 add'l. 4" face plate, \$2.50 add'l. 30 lbs. f.o.b. factory. **\$4410**

**DELUXE BALL BEARING 4' WOOD LATHE...** 12" swing, similar to 4' model with heavy duty, double shielded, lubricated-for-life ball bearings. 3 high speed turning chisels, \$6.95 add'l. 4" face plate, \$2.50 add'l. 30 lbs., f.o.b. factory. **\$5410**

**WOOD SHAPER KIT** Makes beads, coves, moldings, tongue-and-groove joints, etc. Accurate cuts at high speeds. Sealed greased-for-life ball bearings. Less wood. Takes 1/4 h.p. motor or larger, standard cutters. Optional hold down assembly, \$3.95 add'l. 9 lbs., f.o.b. factory **\$2595**



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CLEAN: Engines, Air Filters, Lawn mowers. 3 year guarantee on fire box, coils. Uses liquid soap, propane fired. Weight 120 lbs. Auxiliary pump required on low water pressure.  
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I've done it and I've enjoyed new cars, luxurious homes, fat bank accounts, the best foods, wine, women, and best of all, lots and lots of money! I will now sell you my secrets!

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Please give me Ten Minutes right now!

My name is Sid Rosen. I've been a wheeler-dealer all my life and I've been involved in hundreds of successful businesses. Let me tell you what I can do for you.

I will make you appear to be a millionaire . . . in just four weeks! I will teach you how to GET SMART AND LIVE GREAT! I will teach you how to capitalize on human nature, human emotions and human greed. I will teach you to open previously locked doors, create unlimited opportunities and place yourself upon the glittering path to financial prosperity and success. I will help you to acquire and enjoy all the marvelous things in life you've always dreamed of having but felt you would never get—like a luxury cruise around the world, a color TV in every room, expensive cars, luxurious homes, beautiful clothes, gourmet foods, cameras, gadgets, you name it. I will show you how to get it!

I have learned (the hard way) that it is possible to create the "illusion" of great personal wealth quite easily in today's credit oriented economy. Notice now, that I have used the term "illusion" . . . for that is exactly what our entire capitalistic society is based upon.

People, including you and I, believe what they see! We presume a person to be wealthy when seeing his expensive home, high priced cars, well tailored clothes and luxurious lifestyle.

You've probably heard the saying, "It takes money to make money" and you probably have also heard the saying, "You can only borrow money when you have money." The truth that I will teach you is that in today's economy it only takes "THE ILLUSION OF HAVING MONEY" . . . to make money and it only takes "THE ILLUSION OF HAVING MONEY" . . . to borrow money. Remember this, in today's financial marketplace, most money transactions are merely bookkeeping entries and nothing usually changes hands but scraps of paper. This is one of the secrets I will reveal to you in great detail!

Are you having trouble borrowing money? Getting mortgages? Leases? Credit cards? Charge accounts? I will change all that! I will start you on the road to building an AAA+ credit rating that will enable you to get cash, mortgages, houses, property, credit cards, furs, jewelry, airline tickets, just about anything . . . in hours on just your signature or even on the telephone!

I will teach you to wear the hat of a millionaire no matter what your present situation, occupation or past history. My "Smart Money Plans" will enable you to drive a luxury car for which you paid nothing; move into a luxurious home with no money down; walk into a bank and get a \$10,000.00 signature loan and mingle in the top financial and social circles of your community. S.M.P. will even cover your tracks if necessary; misdirect credit investigations. It will even show you how to disappear and become another person to start all over again if necessary free from past obligations.

I'll tell you this . . . I call many of my plans "secrets" because I don't think that more than one person in a thousand knows any two of them and perhaps only one person in fifty thousand knows all of them. And believe me, most of my secrets are astonishingly simple, just requiring the right knowledge and a little brains, guts, gumption, time and effort!

My exclusive S.M.P. manual will explain my many techniques in detail with step-by-step instructions on how to make them work. With this information in your possession, you will have the knowledge to get everything you desire in a matter of weeks, not years. There has never been a revealing insider manual published like this before. Everything . . . and I mean EVERYTHING you need to know is in my manual, which will be sent to you in a plain envelope.

The price of my manual is \$10.00 plus your signed pledge that you will not duplicate or otherwise reproduce or resell my secrets.

Now, I know that most of the people who read this letter will not act upon it. They will be suspicious, timid and unmoved by what I have revealed here. They will reject it quickly as some kind of con game or a lot of bull. This is good and this is as things should be, because if there were too many people with enough faith in themselves to act on my "Smart Money Plans" it could be made useless to the rest of us.

So to you who will not act, please accept my thanks. Your indecision and inaction will help make the rest of us rich! I will leave you with this closing statement. Every word in my manual is true! Every technique workable exactly as stated and can be put into immediate operation. I offer my manual to you only once! I have no future discount deals or the like. My offer is \$10.00 for the complete manual and you gamble that \$10.00 on yourself. There are no refunds and I guarantee you no extra charges or come-ons for additional money. I have absolutely nothing else to sell and, of course, I will keep your name completely confidential.

P.S. I've added a fantastic entire section that will teach you how to extract gold from your credit cards. I will teach you to raise your credit card ceiling from \$200.00 to \$10,000.00 or more in minutes . . . How to raise \$5,000.00 in cash in one hour on your credit cards even when you can't get a loan anyplace . . . How to go into debt with your credit cards and end up making seven times your investment . . . Yes, I'll teach you all this and nine more ideas. You've got gold in your pockets and you may not even know it . . . BUT YOU WILL LEARN SOON!

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*Sid Rosen*

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(Continued on next page)

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(Continued from preceding page)

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(Continued on next page)

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(Continued from preceding page)

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(Continued from preceding page)

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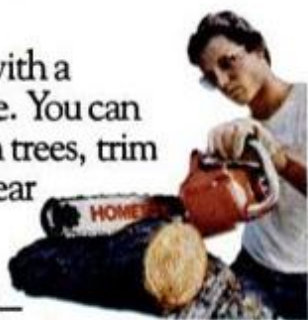
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