

Popular Mechanics

Moscow's
microwaves:
How Reds
spy on us

Make
CB RADIO
pay off
this vacation

BRAND-NEW
MINI VANS
EXCLUSIVE
FIRST LOOK

AMERICAN
ORIGINALS:
Shaker
classics
from kits

Update
your car
with 4 electronic
kit additions

NEW ELECTRONIC
CAMERAS - Just
aim and shoot

OWNERS
REPORTS:
Bobcat and
Olds 98

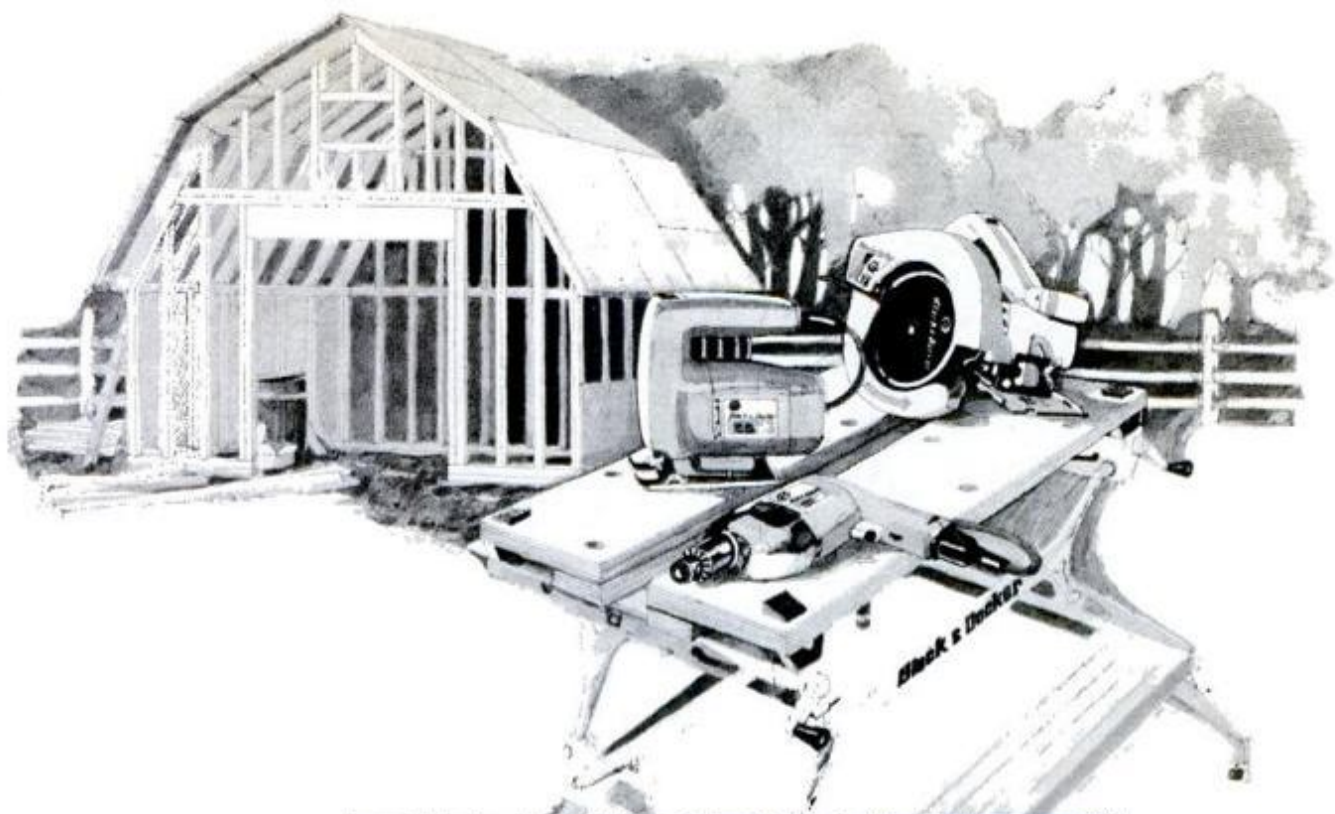
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using its variable-speed feature to slow down nicely around corners and curves.

The Black & Decker WORKMATE, circular saw, variable-speed reversing drill and variable-speed jig saw.

Just about anything you can dream up, they can build.



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The Black and Decker Manufacturing Company for its all-purpose work center and vise.

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ON THE COVER

The illustration by Van Kaufman portrays three mini-vans—the Elite (top), scheduled for production, and the Fiat and Honda concepts.

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INTERNATIONAL EDITIONS: Australia, Caribbean, Mexico, Southern Hemisphere

SPECIAL FEATURES:

How they're watching us is a special article revealing the use of very sophisticated gear in the space-age spying game. Page 47.

What Detroit has learned from recalls tells what's been gained as auto-makers end their first 10 years under the recall program. Page 56.

Shaker furniture is available to you in kit form—as it has been for about 150 years. Page 98.

Your best bets in bargain boats gives you a rundown on what's available this year in low-cost small craft. Page 74.

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Call them mini-vans is an advance view of the scaled-down vans and station wagons that are on the way to the production lines. Page 50.

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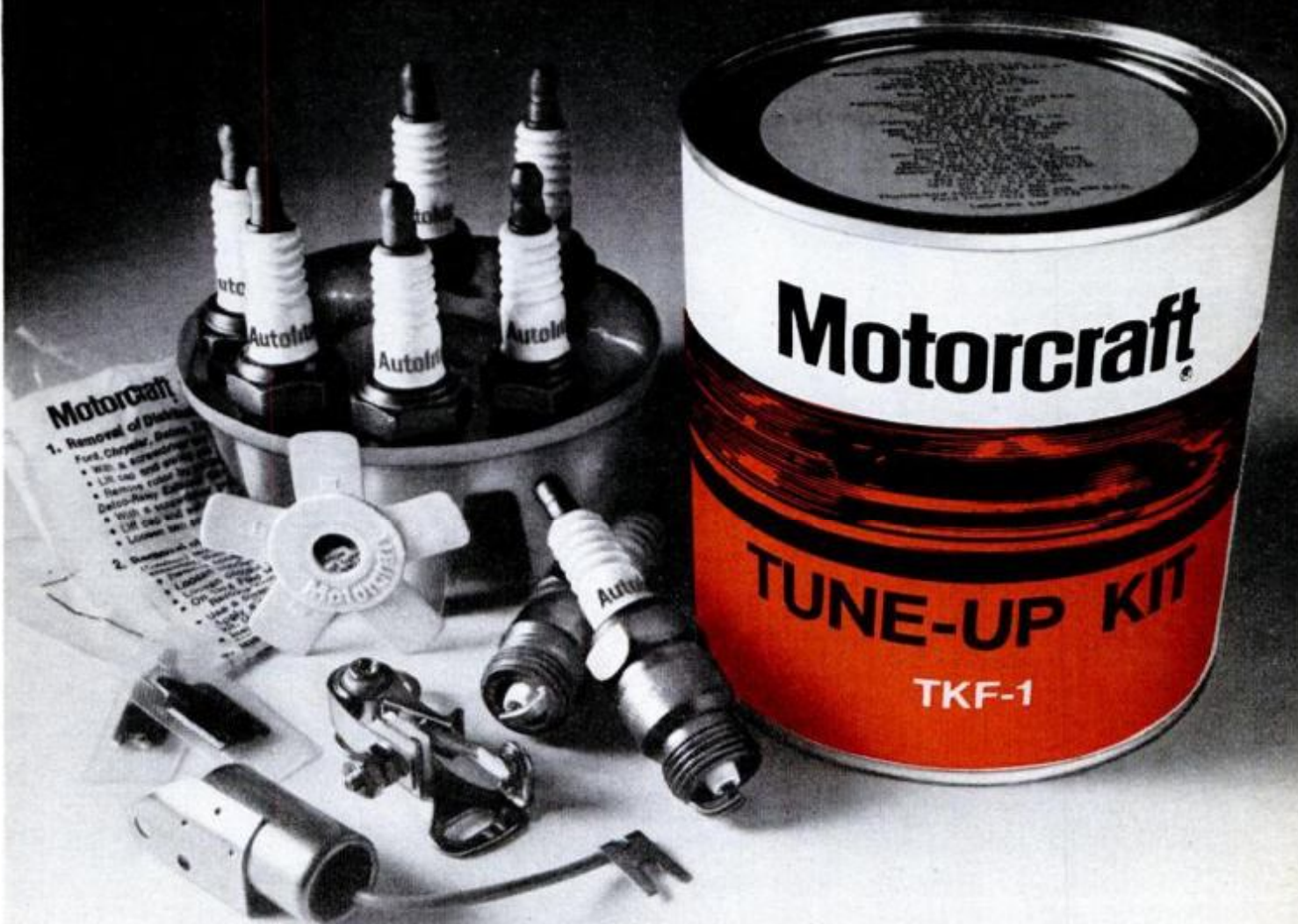
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**TOUGH ENOUGH FOR TAXIS.
TOUGH ENOUGH FOR YOU.
THE ORIGINAL TUNE-UP KIT IN A CAN.**

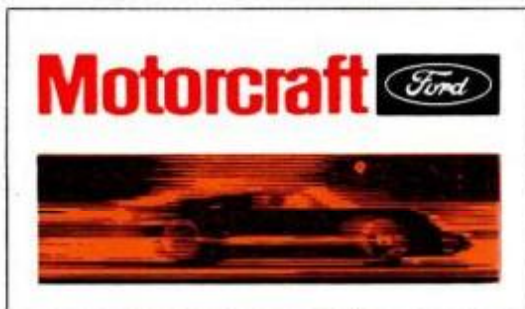


Remember those taxi test commercials on TV? They put Motorcraft Tune-Up Kit Parts in 150 Ford, Chevy and Plymouth taxis in Atlanta and Boston... and ran 'em for 3,000,000 miles to see how tough they were. Changed 'em at regular intervals for taxis, of course. But after 3,000,000 tough taxi miles, less 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.

Motorcraft can help get your mileage and performance back where it should be. So ask for a Motorcraft Tune-Up Kit. And Motorcraft batteries, shocks, filters, and Autolite spark plugs. Tough enough for taxis. Tough enough for you.



TESTED TOUGH

HENRY MORGAN SAYS: "Even if you don't know which end of a screwdriver you hold, you can learn to make money fixing appliances."

If you've seen this well-aged comic on television, you know I'm not in the business of fixing appliances. So what am I doing in an ad for an appliance repair course? It's simple: I got tired of laying out a sockfull of money every time something went wrong around the house. Then I came across an NRI ad and I thought, "Why not? I've spent a fortune on repairs... if I'm too stupid to fix a toaster, this is the way to find out."

So I took the course and now I can fix my own appliances and I can even make money out of it if I want to. As a matter of fact, there's enough money in fixing these things, I'm tempted to quit show business and go straight.

Think I'm kidding about the money? Just check out the receipts on your last repair bills. And then ask anybody if they know a good reliable repairman. You'll find they're scarcer than doctors who make house calls. If there ever was a field crying for good men, this is it. Opportunity is knocking louder than my car's engine, and it could be knocking for you.

If you've ever toyed with the idea of making it on your own, with your own repair business... NRI has a low-cost, home study plan that really makes sense. You can hang in there with your present job while you're learning, and you'll find NRI's course is quick, easy, and cheap.

Let's say you have trouble just plugging in your electric shaver. You'd better start with the basics... and the NRI course starts right there. First they tell you what electricity is, and you can't get any more basic than that. They take you by the hand, step by step, as fast or as slow as you want to go. If you get an attack of the stupids, there's always an NRI expert waiting to give you a hand. They do everything but turn the pages for you.

Like I say, I took the course and it turned out to be even better than they



said it would be. Sure they pay me for writing this ad, but it ain't much, believe me. I could make more in a month by fixing things for the neighbors... and I'm not kidding. It's just that I believe in seeing guys make it on their own. If you follow the simple texts and the big pictures, you can be a technician in no time. They even send you a professional appliance tester with the course.

You don't have to stop with toasters and irons. They'll even show you how to repair air conditioners, refrigeration units, commercial appliances, power tools, and small gas engines. That's where the big money is.

Take Henry's advice and send in the coupon. It's nice to find out you've got some hidden talents. And you'll save a bundle... or make it... or both.

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Let C.W. McCall tell you about one of his Midland Convoy Buddies.

The "Wizard of Ohms" Discovers Midland CB.



I've got this Good Buddy everyone calls "The Wizard



of Ohms" 'cause if it runs on electricity, he knows all about it. This is the kind of guy who could build a color TV out of an old radiator and three pop tops.

The Wizard kept putting off buying a CB radio because the ones that met his high standards cost too much and the ones he could afford weren't sophisticated enough. The



Wiz is a stickler for electronic perfection.

But, one day, The Wizard gave me a call and told me to come over because he'd finally discovered a CB good enough for him. I figured if it was good enough for The Wiz, it must be a honey.

When I got there, I found out he had a Midland 830 just like mine! I got it because it was the easiest to use. The lighted S/RFO meter, TX light and big, easy-to-read lighted channel selector are on top, right in sight. I like all those lights to be where I can keep an eye on them.



But The Wizard said it was a highly advanced piece of equipment.

Besides AGC, ANL, a tuned RF stage and all those other refinements to clarify reception, the 830 has a phase lock loop frequency synthesizer for greater stability and reliability.

Then there's features

you usually find only



on more expensive units, like external CB and PA switches which let you switch CB reception to a speaker outside your car or use your CB as a public address system. The Wizard likes all these sophisticated components. But I still like the little lights on top.

And I like my Convoy Buddies. When you join the Midland Convoy, you get over a million Convoy Buddies 'cause that's how many good people have bought Midland CB's.

People like my buddy, "The Wizard of Ohms."



The Midland Model 13-830. Like all Midland 23-channel CB's, it's rugged, 100% solid state and FCC type accepted for full 4 watts of output power. Visit your Midland CB Convoy Buddy Headquarters and see the broadest total communications line around.

When you get a Midland CB, You get a Convoy Buddy.



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LETTERS

TO THE EDITOR

Signs of the times

Nino LoBello, in *Signs of the Times Point Every Which Way* (page 193, April '76), apparently does not realize that in most cases those confusing signs are kept to enable local cops and judges to suck the blood of strangers with fines.

MANDAS WM. MYERS
DETROIT, MICH.

Mr. LoBello must not know anyone who rides the champion of fuel savers, the motorcycle, or he'd realize that if there were more freeways utilizing reflector bump markers as lane dividers, the terrible traffic statistics on motorcycling would be even worse.

With only about 25 percent as much rubber in contact with the road as most cars have, and that balanced on two wheels, even the white stripes are hazardous to us bikers, especially if they're wet.

STEVE L. EPP
OKLAHOMA CITY, OKLA.

Yes, let's do something about this horrendous "si(g)ns of the times" situation in America. What a project for the Bicentennial! With multimillions being spent on the highways themselves, it ought to be possible to make them "navigable" by spending a few thousand on traffic sign improvement.

PRESTON W. SNOWMAN
SALISBURY CENTER, N.Y.

The high cost of wasted fuel

Conrad Miller's article on vapor recovery (*Putting Waste Fuel Back in Your Tank*, page 56, April '76) was timely and interesting, but not completely correct. The sentence, "At a typical tank farm pumping 10,000 gallons a minute, the volume that escapes as vapor amounts to 800 gallons a minute," is definitely incorrect. This amounts to an 8 percent loss!

Our company has been loading and unloading gasoline for many years and has a loss experience each year of usually less than 1/2 percent. The industry would have perfected a vapor recovery system years ago if losses amounted to 8 percent on a typical tank farm. No business can afford this kind of loss, and it embarrasses me to think a national

magazine could believe us so inefficient.

PIERCE STOCKMAN
GREENWOOD, S.C.

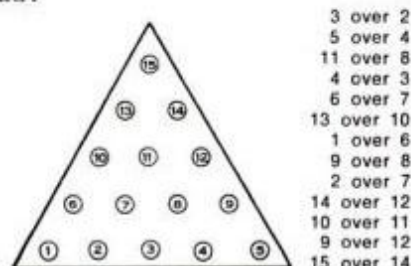
Sorry, our goof. The writer gave us "80 gallons a minute." A typo resulted in the incorrect figure.

For terminals that require refrigeration-type vapor-to-liquid converters, the cost of required hardware can run as high as \$200,000 per terminal, plus shipping and installation. For individual stations, the cost approaches \$20,000. Once gasoline prices are decontrolled, all these costs are certain to be passed on to consumers in the form of higher prices at the pump.

C. BRODERSEN
NATIONAL PETROLEUM NEWS
NEW YORK, N.Y.

More tee game madness

A line of type that slipped into the wrong spot left many of our readers puzzling over the tee game solution sent to us by Harold H. Moderhack of Rockford, Ill. (*Letters*, page 6, May '76). The solution should have read:



Shooting safety

My husband and I are both N.R.A.-certified rifle and pistol and hunter safety instructors. Our courses stress safety and your article, *Shooting Tips That Win Olympic Medals* (page 84, April '76), covered everything we teach. The first and most important thing is safety and this should be stressed to all shooters.

MRS. ELLEN DE WITT
ATHENS, PA.

World's longest canal?

I live in Oregon and thought I'd learned my way around this Northwest country, but in *It's New Now* (page 112, April '76) I found that a canal connects Puget Sound with

Find your car. There's your AC-Delco Tune-Up Kit.

**Drive a 1973
Corvette V8 350?
You can use
AC-Delco Tune-Up
Kit No. 398-05.**



engine's specifications. They're a matched set of AC-Delco tune-up components that can help restore an out-of-tune car's performance and help improve its gasoline mileage.

The AC-Delco Tune-Up Kit helps eliminate component mis-matches and mistakes

**The AC-Delco
Tune-Up Kit. A matched
set to end mix-ups.**

that can wipe out all the good a tune-up's meant to accom-

In fact, if you drive any of the cars built in this country from 1963 through 1974, it's 91.6% certain there's an AC-Delco Tune-Up Kit made for it. (Our 34 kits cover just about every U.S. car manufactured during that period.)

Clearly marked at the top of each kit is its application — car make, model, year and number of cylinders. So you can spot the kit you need at a glance.

Inside the kit made for your car, you'll find the correct type and number of AC Spark Plugs and the Delco-Remy Points and Condenser engineered to your

plish in the first place. Now a single, easy-to-find box gives you all the tune-up parts you need, sparing you the hassle of hunting for all the components separately. Look for it wherever quality tune-up parts are sold.

It's another very good reason to go with the names you know.

Fits 8 Cyl. 398-05
General Motors Products

**Tune Up Kit
A Matched Set**



8 AC Spark Plugs
1 Delco Remy Contact Set
and Condenser

**Go
with the names
you know.**



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If one of them says "no,"
it doesn't leave
the factory.



Each person who has a hand in making a Schrade knife also has a hand in rejecting it. Each knife is subject to more than 100 hand operations. More than 100 inspections. If there's a flaw of any kind, the knife doesn't get out the door. That's why you can put your confidence in the ones that do.
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by Schrade**

GET INTO THE STEAM OF THINGS

This steam engine kit is an ideal project for these cold winter evenings. It machines on a very small lathe such as the Unimat or the Sears/Atlas 6" and will prove that you are a better machinist than you think. Or, it makes a great project for school shop. The kit has all the parts you'll need, including complete drawings and instructions. It's a lot for \$6.95, postpaid.

The hobby of building engines like these is called Model Engineering, order a copy of our FREE catalog or start with some books like these: **THE BEGINNERS WORKSHOP, \$7; BUILDING A STEAM ENGINE FROM CASTINGS, \$2; MODEL STATIONARY AND MARINE STEAM ENGINES, \$7; VIRGINIA, Live Steam Locomotive Construction, \$10.95.**

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LETTERS

(Continued from page 6)

Lake Union, Ore., a lake none of the natives ever heard of. What a canard. It must be a world record for length. Where is it?

E.F. DUVA
ESTACADA, ORE.

As a number of proud Washingtonians have hastened to point out, Lake Union is in the heart of metropolitan Seattle. We appreciate the geography lesson and regret the error.

The other side

I was really bugged to read the comments by the four readers who disapproved of your February cover (*Letters*, page 187, April '76). As soon as that issue arrived, I just knew that you'd be in for some hard knocks by stony-faced readers who couldn't see a spoof.

I for one thought that the cover was wonderfully outrageous, and increased the respect I have for your publication. I admire anyone who shows a keen sense of humor and is not afraid to thumb their nose at convention.

Perhaps those who were "offended" should quietly retire to 1955.

MICHAEL BENCHE
HOPATCONG, N.J.

I must not be becoming the dinosaur old man (at 72) that I thought might be happening. Perhaps I am in too much of a hurry to see what is inside of PM, so I do not pay too much attention to the cover.

Since my PMs are handed on to a good friend, I guess I will never know what was on the February cover. I'm sure it wasn't that bad. But there will always be nitpickers.

WILLIAM J. FRIED
ERDENHEIM, ILL.

She'd rather fly

We rode on the jetfoil (*Ocean Flight by Jetfoil*, page 75, April '76) and the experience was very unpleasant.

The ride was far from the advertised smooth. Many people became seasick, and two women required oxygen. The service was poor and inadequate; the cabin mates were untrained. They lacked the poise and experience to help the passengers. The atmosphere was one of boredom and illness, not music or joviality for the two hours.

We returned to Oahu from Maui by air and found the service terrific. From our experience, people wishing a pleasant and quick trip would do well to fly.

MRS. CHESTER DEW
OSSEO, MICH.

Less tar than 98% of cigarettes—and it's a PALL MALL

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tar.



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selling filter king)!

Trade in your old smoke for new
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*PALL MALL EXTRA MILD... "tar" 8 mg.—nicotine, 0.8 mg.
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*Of all brands, lowest "tar" 1 mg.—nicotine, 0.1 mg.

*Av. per cigarette by FTC Method.

8 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.

Warning: The Surgeon General Has Determined
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"I wouldn't try this with any other epoxy."

"We used Elmer's® Epoxy to cement a pane of acrylic to the lip of that water-filled bucket. Then we let it dry—and up-ended the whole thing. I've used Elmer's Epoxy for years, and I know it has incredible holding power." For all kinds of adhesives, you know you can trust Elmer's.



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NEXT MONTH IN PM . . .

- **Early warning against lightning strikes**
- **How to eavesdrop on cloak-and-dagger radio**
- **10 woodworking tips**
- **Complete plans for PM's stylish greenhouse**
- **Vacation driving tips from an expert racer**
- **How to build two back-yard tables**

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Here's what one customer said about the rugged trail fun-machine he made with a Kit by Heald.

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John J. Pyles, Jr., Venice, LA

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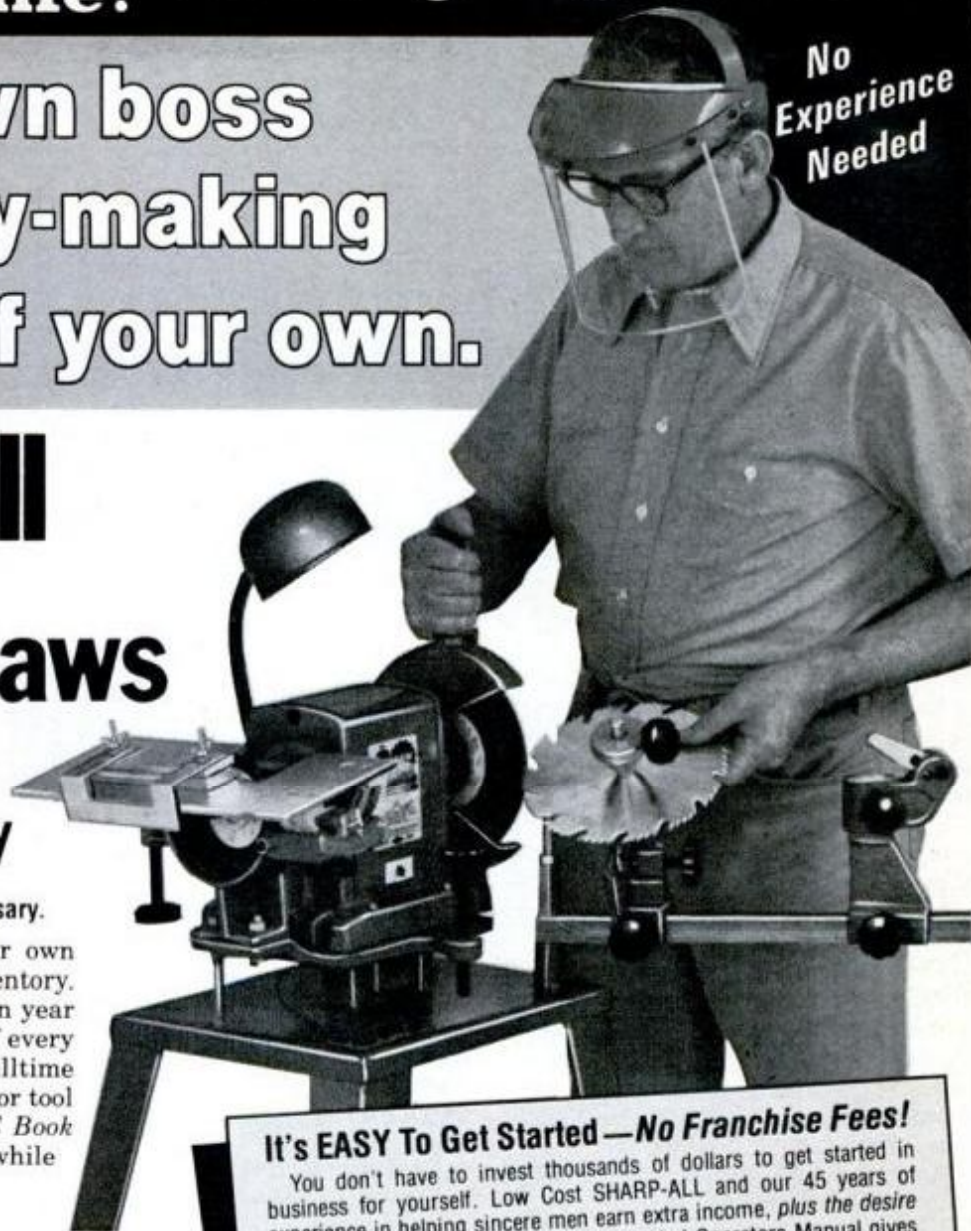
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IMPORTS AND MOTORSPORTS



Honda's hot setup

If you like VW Sciroccos and Toyota Celica GT Liftbacks, you'll do a double-take of this new front-wheel-drive Honda. If you're *fed up* when you *add up* the extra-cost options on most cars, you'll appreciate the \$3995 package price. If you want a five-speed, 1600-cc sporty hatchback, you'll flip over the Accord CVCC.

The Accord just joined Honda's Civic models in the showroom. Like them, it gets terrific mileage (36 mpg highway/city) even with its larger, more powerful, stratified-charge, ohc, in-line Four; and it rides and feels heavier than 2000 pounds.

On a brief, twisty, test drive around the Monterey Peninsula I felt quite secure powering through the tight ones, and I liked the fact that the car I was driving was equipped with radial tires, front discs, four-wheel independent suspension and rack-and-pinion steering—all standard.

Downright startling, though, was the fact that also *standard* are AM/FM radio, tinted glass, rear wiper and washer, side window defrosters, opening rear quarter windows, built-



in seat-belt retractors, reclining buckets, full carpeting, locking fuel filler door, remote hatchback release, hood release . . . and so on, right down to the lighted glove compartment and coin box with lid. There's a maintenance-reminder feature on the instrument panel and lights to warn of an open door or tailgate and other situations.

Styling is cleaner than most Japanese cars (despite four badges on the rear deck alone), and trim is well secured (I found only one sharp spot). The "big" Honda (162.8 inches long, on a wheelbase of 93.7 inches) measures up nicely.



Do-it-yourself car

Bradley Automotive has sold more than 5000 GTs since 1972 (see *Drop a New Body on the Old Buggy!*, page 110, Oct. '73). Next month, the Bradley GT-II, shown above, will join the GT in Bradley's two-car lineup. Both are built on VW chassis and the kits are \$3000 and \$4500, respectively.

The GT-II is easier to assemble,

stronger, safer and sharper looking. There's more headroom and seat space, tinted glass all around, double latches on the gullwing doors and steel-reinforced roof. In August more specifics such as colors will be available. Bradley Automotive, 76 Washington Ave. South, Edina, Minn. 55435.

Do-it-yourself parts

Imported car parts are easier to get than before. In most cases, you don't even have to leave home to hunt down what you need. You don't have to go to the auto parts store a few miles away, or to the new-car dealership even farther down the pike: You can get it mail-order.

or, better yet, by phone. Sears, Roebuck and Co. has simplified ordering by printing a separate catalog for imported-car replacement parts and accessories.

The 1976 catalog is good through March 31, 1976 and lists all essentials plus goodies like custom-styled wheels, luggage and ski racks, driving lamps, carpeting, seat covers and so on. It's free at all Sears stores nationwide.



Free pit passes

This season the CBS television network jumped onto the grid with big feet, and they're doing a bang-up job of covering the major motorsport events worldwide. Here's the schedule for the rest of the season:

EVENT	EVENT DATE	SCHEDULED AIR DATE
Pocono 500 (USAC)	6/27	7/3
French Grand Prix	7/4	7/10
German Grand Prix	8/1	8/14
Superbowl of Motocross	7/24	8/14
Austrian Grand Prix	8/15	8/28
Champion 400 (NASCAR)	8/22	8/28
Dutch Grand Prix	8/29	9/18
DuQuoin Dirt Champion-	8/29	9/18
ships (USAC)		
Italian Grand Prix	9/12	9/25
International Superbike	8/1	9/25
Championship		
Canadian Grand Prix*	9/26	10/2
U.S. Grand Prix	10/10	10/16
and Review of 1976		
Texas Twin 200 (USAC)	10/24 or 31	10/30 or 11
Road Race of	11/5-7	11/13
Champions (SCCA)		
L.A. Times 500	11/21	11/27
(NASCAR)		

*Carried only if World Championship is at stake



Read what the experts say about Renault 5

(before you buy a Rabbit, Civic or Chevette).

"Best MPG car we've ever tested."

—"Car and Driver" Magazine

If you want something more stingy with gasoline, you should consider a motorcycle! The Renault 5 can chalk up an incredible 40 miles per gallon on the highway, 28 city. (Remember, these are EPA estimates. Your mileage may vary depending on the type of driving you do, your driving habits, your car's condition and optional equipment*.)

"... seems built like a tank."

—"Road Test" Magazine

The Renault 5 has unitized body and chassis plus factory-applied rustproofing and undercoating. Simply put, this car is built to last. Which is one big reason why 1,200,000 Europeans bought one.

"Hold off for a while if you're considering a car like the Chevrolet Chevette, Volkswagen Rabbit or Honda Civic."

— Dan Jedlicka, Syndicated Automotive Columnist, "Chicago Sun-Times"

Renault 5 gives you road-hugging front-wheel drive. Chevette doesn't. Renault 5 has a hatchback door which opens down to the bumper for easy loading. Rabbit, Civic and Chevette hatchbacks don't. And the Renault 5 starts at only \$3,295. (P.O.E. East Coast. Renault 5 TL. Price excludes transportation, dealer preparation, taxes or optional equipment. Stripe, Mag wheels, Sunroof and Rear wiper/washer optional at extra cost.)

"Dips that jolt most small cars are mere ripples to the Renault 5."

—"Road & Track" Magazine

Renault 5 gives you the longest wheelbase of any hatchback in its class. Longer than the Rabbit, Civic or the Chevette. This means you don't sit as close to the wheels where the bumps are the hardest. Road Test Magazine says, "... blasting across a railroad track at full speed becomes not only possible, but delightful."

"... an artfully engineered piece of machinery."

—"Car and Driver" Magazine

The Renault 5 comes with rack-and-pinion steering, 4-speed synchromesh transmission, fully independent torsion bar suspension, front disc brakes, 31.5 cubic feet of cargo space, with rear seat folded, and Michelin steel-belted radials. And Renault has the unique toll-free Parts Action Line—which means most parts can be rushed to you anywhere in the continental U.S. within 48 hours.

Find out why Motor Trend Magazine says it's "... love at first drive around the block." Test drive the new Renault 5 today. It just may be the best car you've ever driven! Call 800-631-1616 for your nearest Renault dealer (in New Jersey call collect 201-461-6000).

RENAULT 5

The incredible little car
over a million Europeans drive!



*California EPA mileage estimates may differ from above. In California, Renault 5 will be available after June 1, 1976.

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WHAT'S NEW IN THE CB JUNGLE? THE TIGER MARK 2.™



Everybody is clawing away for your CB buck.
The big names and the no names.

But now, the people with real experience in
personal two-way communications are ready to
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The Pearce-Simpson Tiger Mark 2.

Wherever you go in the CB jungle, it comes
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"The Frequency Combination Lock" — and

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superior communications, but superior adjust-
ment to receive signals from "off-freq." sets.

There isn't room to cover all the other features
of the new Tiger Mark 2. But your Pearce-
Simpson dealer would love to fill you in on every
one of them. For our latest brochure, write
Box 520800, Biscayne Annex, Miami, FL 33152.
In Canada, Scotcomm Radio, Inc., 4643
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ALL OUTDOORS

WITH BILL McKEOWN



Bicentennial bits

In addition to the spectacular parade of tall-ship windjammers scheduled for a July Fourth parade through New York harbor, a Bicentennial rendezvous of at least 100 of the eastern seaboard's finest antique and classic power and sail boats is planned for Connecticut's Mystic Seaport on July 31 and Aug. 1. Craft built before 1940 are invited to participate and prizes will be awarded in various categories. Interested owners may contact the public affairs office of the Seaport. Spectators and skippers alike should enjoy the event.

A special issue of Winchester Bicentennial 30-30-cal. cartridges in red, white and blue boxes has been announced by the Winchester-Western Div. of Olin. Each cartridge has a "W '76 W" commemorative head stamp.

CB for RV

Newest and best Citizens Band improvements we've seen for recreational vehicles are hand microphones that incorporate a channel selector as part of the mike. With eyes on the road and one hand on the wheel, you can pick up your mike, call on one channel, make contact, agree to switch to a less busy frequency and then make the change without leaning down and trying to read the tiny



Pickup with punch, Chevy's half-ton Step-side is now available in four-wheel drive.

channel numbers on compact units.

Not only is channel choice in the palm of your hand—a safe and convenient aid while driving—but you actually don't need to see your set at all or to mount it where anyone else can see it and want to steal it. Hide your rig well up under the dash—just pull out the mike and leave it within easy reach near your seat while you drive. As an extra precaution, you can use a clamp-on or magnetic antenna that you put out of sight at night to keep from attracting CB snatchers at parking lots and campgrounds.

So far we've seen two sets with channel-chooser mikes. One comes from Realistic, sold at Radio Shack stores. Its mike doubles as a speaker and has the channel selector plus built-in volume, on/off and squelch

(Please turn to page 16)



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Adelindo Orsi, Jr.,
Azusa, Calif.



"The lessons, materials and instructors were EXCELLENT... I really enjoyed the Locksmithing course. Am telling my friends about the course, as it is well worth the tuition."
Frank R. Bishop,
Holt, Mich.

ALL OUTDOORS

(Continued from page 15)

controls. The other set is a Hy-Gain model that has a disconnecting mike so you can really hide your set and just mount a mike jack on your instrument panel. For RV use, I prefer an intercom arrangement so you can switch to talk with passengers riding in the back of your motor home or, as required in some states, with any riders back in your pickup camper.

I haven't yet tested the Realistic One-Hander or the Hy-Gain, but the idea of remote control for the road sounds great. 10-4?

Pointers in print

Down on Florida's Biscayne Bay where they're out afloat all year, a skipper learns the difference quickly between beauties and beasts in boats. Part of this comes from experience on the water, but some of it happens at home, reading *Miami Herald* boating columnist Jim Martenhoff. Now Jim has put it all together in a new book for Winchester Press called *The Powerboat Handbook*, and at \$8.95 it's the best straightforward introduction to the sport we've seen. Covering selection, maintenance and

operation, it tells in useful detail how to get the most performance and fun for the money. In the crowded field of books, here is a particularly useful one I can fully recommend.

In Alaska, they're sometimes called "tundra daisies"—those ubiquitous 55-gallon oil drums that litter the landscape so many places where recent civilization has passed. Best uses we've seen for them are the tuned steel-band instruments of the Caribbean and the sourdough stoves of the Northwest. Now a short and excellent book, *How to Build an Oil*

Barrel Stove by Ole Wik, is available for only \$1.95 from Alaska Northwest Publishing Co., Box 4-EEE, Anchorage, Alaska. The stoves can be used for warmth, cooking or as water heaters, and the well-illustrated instructions even point out that ear protectors are required when pounding on the drums. This is a text for every homesteader or camper—and whoever wanted to be.

National Hunting & Fishing Day

This year the activities are Saturday, Sept. 25th. ★★★



Seamaster, a sleek, slim 22-foot offshore outboard which rated impressively several years ago in PM tests is now going into production. Information is available from noted boat designer Bob Whittier, P.O. Drawer T, Duxbury, Mass. 02332.

Varmint power you can gentle down.



Model 766 "American Classic"—with a couple of pumps it's gentle enough for indoor practice. Ten pumps give over 700 fps velocity for plinking or pests.

The long-stroke double-action lever lets you power-up easily. (It's "hidden" in the forearm, so the rifle keeps its sleek looks.)

The 766 shoots .177 caliber Super Pells® and Super BBs®... with a rifled barrel for accuracy.

For styling and for performance, pneumatic power never looked better. Look for it in "Sporting Goods."

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The box isn't important.
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A lot of cigarettes come in a crush-proof box.
Only one has the Winston taste inside: Winston Box.
Winston gives me real taste and real pleasure.
The box is one thing. But taste is everything.
For me, Winston is for real.

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

20 mg. "tar", 1.3 mg. nicotine av. per
cigarette. FTC Report SEPT. '75.

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Howard Nelson
Iowa Falls, Iowa

"Last week I was 20 miles from home in the middle of the night, and the hydraulic brakes went out on my car. The brake line to the back wheels had a leak in it.

"VISE-GRIP to the rescue. I broke the line, doubled it over and pinched it shut with my VISE-GRIP tool. Then I wired everything to the frame of the car and had good brakes in the front wheels to drive home safely.

"I'm going to always be sure of having a VISE-GRIP locking pliers in my car."



VISE-GRIP tools are the most versatile hand tool you'll ever own.

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BY EUGENE A. SLOANE

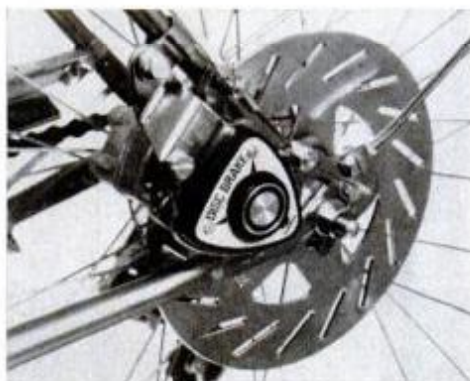
THE BICYCLE SHOP



Disc brakes, anyone?

I would like to install a disc brake on my bicycle. Can I do it myself? Is it worth it? How much would it cost and where would I get the parts?—Dave Holliday, Albion Oval, Mahopac, N.Y.

You can install a disc brake yourself if you know how to spoke and true a new wheel, because the disc brake requires a special hub with threads on the left side for the disc and threads on the right side for the five-speed gear cluster. Otherwise, this would have to be done by a bike shop, which also carries the brake assembly. The Shimano disc brake does give improved stopping power,



especially in the rain when ordinary caliper brakes are almost useless. Also, brake pads last practically forever, so maintenance is minimal. Step-by-step instructions come with the brake set, so if you can lace and true a new rim, you should be able to install this brake.

Shimano will soon have a new version of its disc brake that is self-energizing and self-adjusting; this is the one I would install. Retail cost is about \$16.50. This is less any shop labor for relacing the wheel with the new hub, which would come to about \$8 with new spokes. I don't know whether the expense of a disc brake is worth it or not; it depends on your personal preference. It's a lot of brake for the money.

Pedical madness

I wrote to a company that made a vehicle called a Pedicar which had an enclosed body, and which two people could pedal. The company does not answer my letters. Considering the fuel situation, a small car one

can pedal seemed such a good idea I wonder if you could tell me what happened to this product?—Wayne H. Ronning, Cadott, Wis.

I would like to be able to tell you that the company is still in existence and that the product is okay. I can do neither. So far as I know, the Pedicar you describe was very short-lived and is made no more. I tried to pedal one, with my strong teen-age son, and I can tell you it took all we had to pedal just a few blocks and we are both in good shape. The idea was fine, but so far I have not seen anything that is reasonably easy to pedal, that has a light plastic body, removable all-weather roof and grocery-carrying space. Come on, you inventors, there's a market out there!

A cranky question

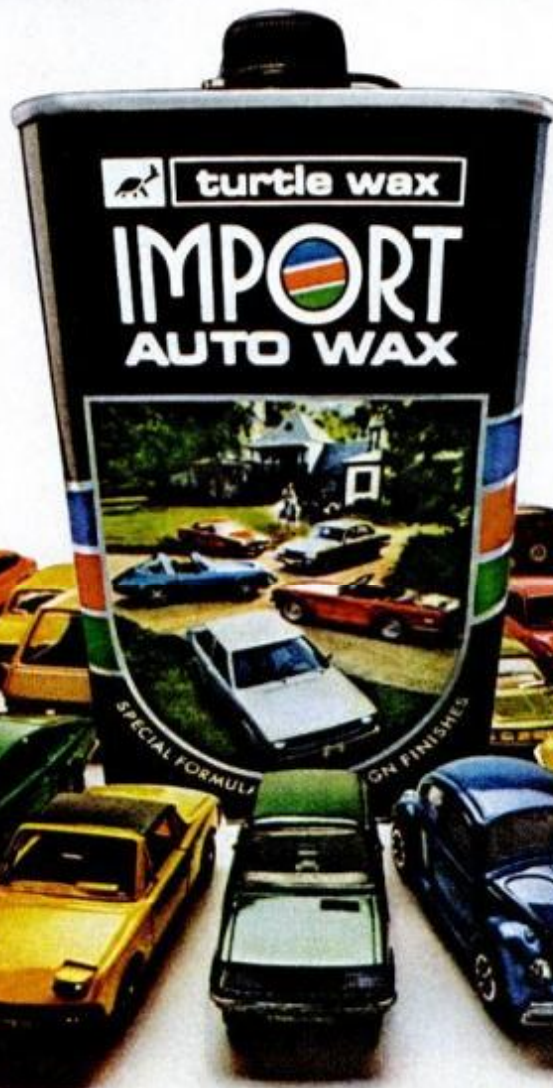
I have a Schwinn Super Sport with a steel crank which is awfully heavy. Can I convert this to an aluminum crank set and would it be worth the cost?—Tom Martell, Neenah, Wis.

You can and it would. You would save at least one pound in weight and improve the appearance and "feel" of the bicycle immensely. Schwinn dealers sell a LeTour conversion axle spindle for the bottom bracket for around \$7. You use the old bearings, cups and fittings. You will then need a double LeTour aluminum alloy crankset, which sells for around \$32.95.

You will also need new pedals, because the old one-piece steel cranks are threaded 1/2-in. x 20 TPI (threads per inch), whereas the alloy cranks are 3/16-in. x 20 TPI. A reasonably high-quality aluminum and steel pair of rattrap pedals with toe-clips and straps would cost about \$25 a pair, although you can go as high as \$50 a pair for Campagnolo. I recommend the KKT Pro-Ace alloy pedals for around \$35. My calculator says all this totals to \$74.95 with KKT pedals. ★★★

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.

THE FINISH ON YOUR FOREIGN CAR IS DIFFERENT. SHOULDN'T YOUR WAX BE, TOO?



If you drive any European car or Japanese car, you've probably been using the wrong wax.

You see, American waxes are actually alien to foreign cars. That's because they're formulated to shine the porous acrylic finishes Detroit sprays on its bodies.

But the harder, less porous import finishes (mostly melamine-alkyds, nitrocellulose, or urethane) require a

special wax. And now, for the first time, that product is here. Import Auto Wax, developed in Turtle Wax's European laboratories.

It won't streak import car finishes. Retards oxidation. And of greatest import, the bond it imparts to imports stays brilliant far longer than American waxes. Far-reaching claims? Sure. But Turtle Wax

unconditionally guarantees a visible difference on your different finish, or your money back.

Liquid or paste, Import Auto Wax (with easy-to-use applicator included) means a brighter future for neglected foreigners in America. Because it's oceans apart from the car wax you're using right now.

Vive la difference!

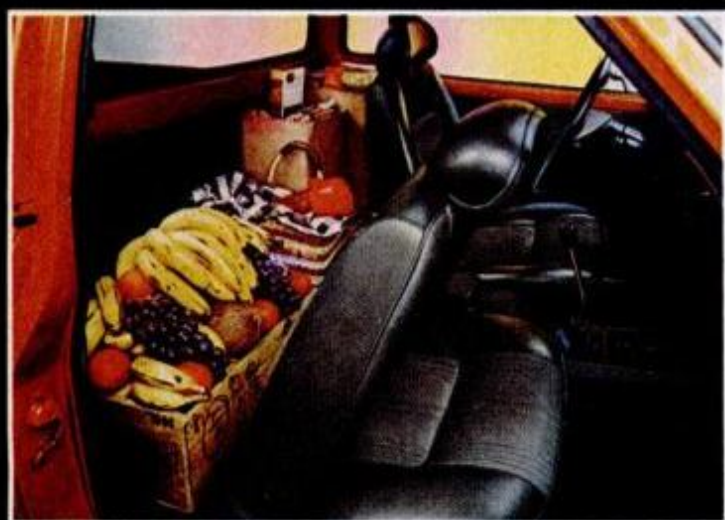


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DATSUN

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DATSUN'S NEW DELUXE PICKUP HAS ALL-NEW CREATURE COMFORTS.

King-sized cab features more legroom and luxury than any other small pickup (more than some full-sized trucks). Plus a foot of storage space behind the seats.

WORLD'S FIRST

Meet the newest, roomiest and most comfortable small pickup around. Datsun's all-new Li'l Hustler Deluxe. It's all decked out with the kind of innovations and features you'd expect from the maker of America's #1 Selling Small Pickup.

GARGANTUAN LEGROOM.

We stretched out the cab to give you more stretch-out room. And to keep you comfortable, we put in fully reclining bucket seats (no other pickup in the world has 'em).

TREMENDOUS INSIDE STORAGE SPACE.

Behind the seats, there's up to 11.3 cu. ft. of usable space for things like groceries,



PRESENTS

KING CAB

TM



BIG CAB IN SMALL PICKUPS.

golf clubs, or a toolbox full of monkey wrenches. (Sometimes it's nice to stash stuff inside when the weather's not nice outside.)

COLOSSAL HALF-TON LOAD BED.

All that room in front doesn't mean you don't get room out back. Our new Deluxe still hauls a full half-ton of cargo. So you can keep on trucking and have your comfort, too.

VERY CIVILIZED COMFORT.

Besides plush bucket seats, KING CAB™, comes with lots of other extras that don't cost extra. Like full carpeting, console, even little things like a package tray. Because little things mean a lot. If you want even more creature comforts, air conditioning and an automatic

transmission are available.

See the new Datsun Deluxe with the roomy KING CAB, along with Datsun's other two fine pickups (alias Li'l Hustler Standard and 7-ft. Stretch).

NOW SHOWING AT YOUR DATSUN DEALER

Datsun Dave



DETROIT LISTENING POST



Plenty of action at Ford

Ford is looking at two types of follow-up cars it could pull off the Fiesta body after the new mini is introduced in April 1977. One of the pull-offs would be larger than Fiesta, the other smaller. The more-mini version isn't given much of a chance because Ford doesn't see a U.S. market for a true two-seater with a wheelbase of less than 90 inches during this decade. But the bigger version has a good chance of making it in 1978 or '79. Very likely as a station wagon.

Other in-the-works projects at Ford: While most automobiles are shrinking in size, Ford will stretch some of its future cars. Mustang II and possibly Pinto/Bobcat will have a longer wheelbase—eight to 10 inches—when a new body is introduced in the fall of 1978. Maverick/Comet will also have a new body in '78. But they will be smaller, tighter cars than current versions.

Ford has reactivated plans to add station wagons to Granada and Monarch. These cars were originally scheduled for last fall, but became sidetracked when the auto biz went into a slump. They are now scheduled for the '78 model year.

Riviera to get FWD

GM will have three front-wheel-drive luxury cars in 1978. Buick Riviera is expected to go to FWD on the '78 model, like Olds Toronado and Cadillac Eldorado.

Fuel meter for Chrysler 4

Chrysler has confirmed it is working on an electronic fuel-metering system—not to be confused with electronic fuel injection—for its 360-cu.-in. V8. This will be used on the '78 cars. The fuel meter will also be used on the new four-cylinder engine Chrysler is working up for 1978-79, although the company hasn't said so officially.

Engine update

If any engine stands a chance of cutting in on the old internal combustion job within the next few years, it will be the diesel, with the turbine a close second. It won't be the Stirling or Wankel. And whether it's the diesel or turbine, it will be a case of toe-in-the-door and not a takeover

from the internal combustion. Each U.S. auto company has a pet engine project and knows more about that particular engine than the other companies. With GM it's the diesel, Chrysler the turbine, Ford the Stirling and American Motors the Wankel.

GM and Chrysler are nose-to-nose on development of their respective favorites, but GM has more bucks to take the plunge on the diesel than Chrysler has to put on the turbine. American Motors is in the same position on the Wankel. Even if AMC could get the bugs out of the Wankel, a feat GM was not able to accomplish, the company would be hard-pressed to come up with the hundreds of millions it would take to put the rotary in production.

Ford recently held a where-we-stand review on the Stirling and said a production version of the external combustion engine is at least 10 years away. If then. The Stirling, incidentally, is the engine a resigned President of the United States touted as being "just around the corner" several years ago. That was his own idea and not based on any promise made by Ford Motor Co.

New names for Chrysler

Chrysler will put new names on eight of its 12 cars over the next three years. The only names expected to survive after the company completes its down-sizing program are Aspen, Volare, Chrysler and Cordoba. Everything else will be renamed to go with the new look and new size.

More square lights for '77

The people who make replacement headlights raised a royal ruckus when GM put rectangular lights on some cars two years ago. Before GM went to the new shape, a gas station had to stock only three or four different lights to provide a replacement for any car built in the United States. If GM was allowed to use square lights, the lamp companies argued, the replacement problem would become complicated. The Government got involved in the dispute and eventually ruled in favor of GM.

Now that the squared-off look has become accepted, Ford and Chrysler will use the lights on some '77 cars, Chrysler will have them on its inter-

mediates and Ford will put them on Ford LTD II and Cougar (LTD II is Torino under a new name and Cougar replaces the Montego nameplate). Ford and Chrysler will stack the lights, over and under.

Alcohol and gas do mix

Alcohol and cars don't mix, right? Right if you mean drunks shouldn't drive. But alcohol is a good mixer with gasoline, as a substitute fuel. Ford is modifying engines to operate on a mixture of 80-percent gasoline, 20-percent alcohol. The engines will not be used in cars sold in the United States. Not immediately, anyway. They will be used in cars sold in Brazil and elsewhere in South America. Two of the big crops in Brazil are sugar beets and manioc, both of which are easily processed into alcohol.

Return of the stick shift

It used to be a status thing with the auto companies to tell the customer he couldn't have a manual shift. The prestige cars came with an automatic transmission as standard and if you didn't want it, you could take your business elsewhere. This was part of the "upgrading" process, a bend-your-arm technique to increase sales of accessories.

With the emphasis on economy and squeezing more mileage out of a gallon of gas, the companies have done a complete about-face on the manual shift. They are putting or trying to put manual gearshifts in cars that haven't had them in 25 years. Those EPA numbers on fuel economy look a lot better if you test the car with a manual. You'll see more makes offering manual shifts over the next few years. One company, American Motors, may go so far as to offer a four-speed on every car it makes.

Free, take one

Chrysler has a giveaway book that tells you how you can improve gas mileage. The information applies to all cars, not just Chrysler makes. Title of the book is *Guide to Fuel Economy* and you can get a copy at any Chrysler, Plymouth or Dodge dealer or by writing Chrysler Corp., Box 7749, Detroit, Mich. 48207. ★★

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1.2 mg. nicotine, av. per cigarette, FTC Report Nov. '75

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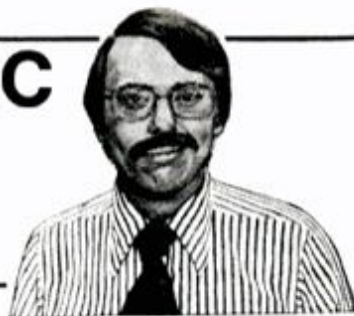
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APPLIANCE CLINIC



QUESTIONS ANSWERED BY PAUL MANN

A study in contrast

I plan to replace door seals on my Frigidaire model FDS-13T-2 refrigerator. After purchasing seals, I've been told that alignment will be disturbed once the holding screws are loosened. Is this true?—Edward Tobin, Palatine, Ill.

I hope we're talking about the same thing, and if we are, I can't see how the alignment will be affected unless you tackle the job like a Larry Csonka going through the line. Just handle it with finesse, like an O.J. Simpson, and you'll have it made.

Loosen the seal retaining screws. The seal has a bead on it to keep it locked into the metal channels, which need not be removed. Slide the old seal out and the new one into place. Run the screws up, tightening them slightly. Close the door and check alignment. The seal should be pressing evenly against the frame; see that there is no gap between the seal and frame. If there is, loosen the screw. Open the door, tightening screws a bit more. Close the door and repeat this procedure until the seal is tightened and seated evenly around its perimeter.

Avoid putting hand or foot pressure on any part of the door as you tighten screws, as this will throw alignment off.

Toastless toaster

The top two heating elements of our General Electric Toast-R-Oven have burned out. Where can I get new ones? How do I replace them?—Myra Kurshan, Sands Point, N.Y.

Getting the heater assemblies, called calrods, is the easiest part of the job. You can obtain the calrod

heaters at your local General Electric Service and Parts Center. Keep the address in mind. You may want GE technicians to do the job for you if it seems too complicated.

I don't know which model you own, but the A5T93 sketched below is representative. However, I caution you not to assume that all models are the same. They are not.

Remove the shell and plastic base ends after you take off the control knob. Withdraw the two screws that hold the central assembly cover on the bottom and snap the cover from place by unlatching the top.

Remove the crumb tray, then the shell, by unscrewing the two front and two rear screws. Then take off the right-hand plastic base end after you withdraw the two screws at the bottom. Withdraw the two line screws on the main switch assembly and the two base end screws to remove the left-hand plastic base end and line cord.

Remove the two heater element channels, snipping leads to the calrods. Slide out insulators and calrods and insert new ones.

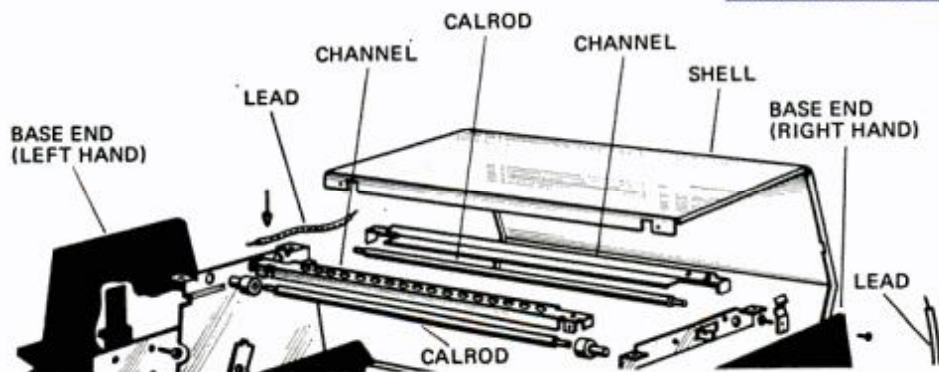
Important: All connections must be silver-soldered in place. Use an asbestos shield to protect the parts from dripping solder.

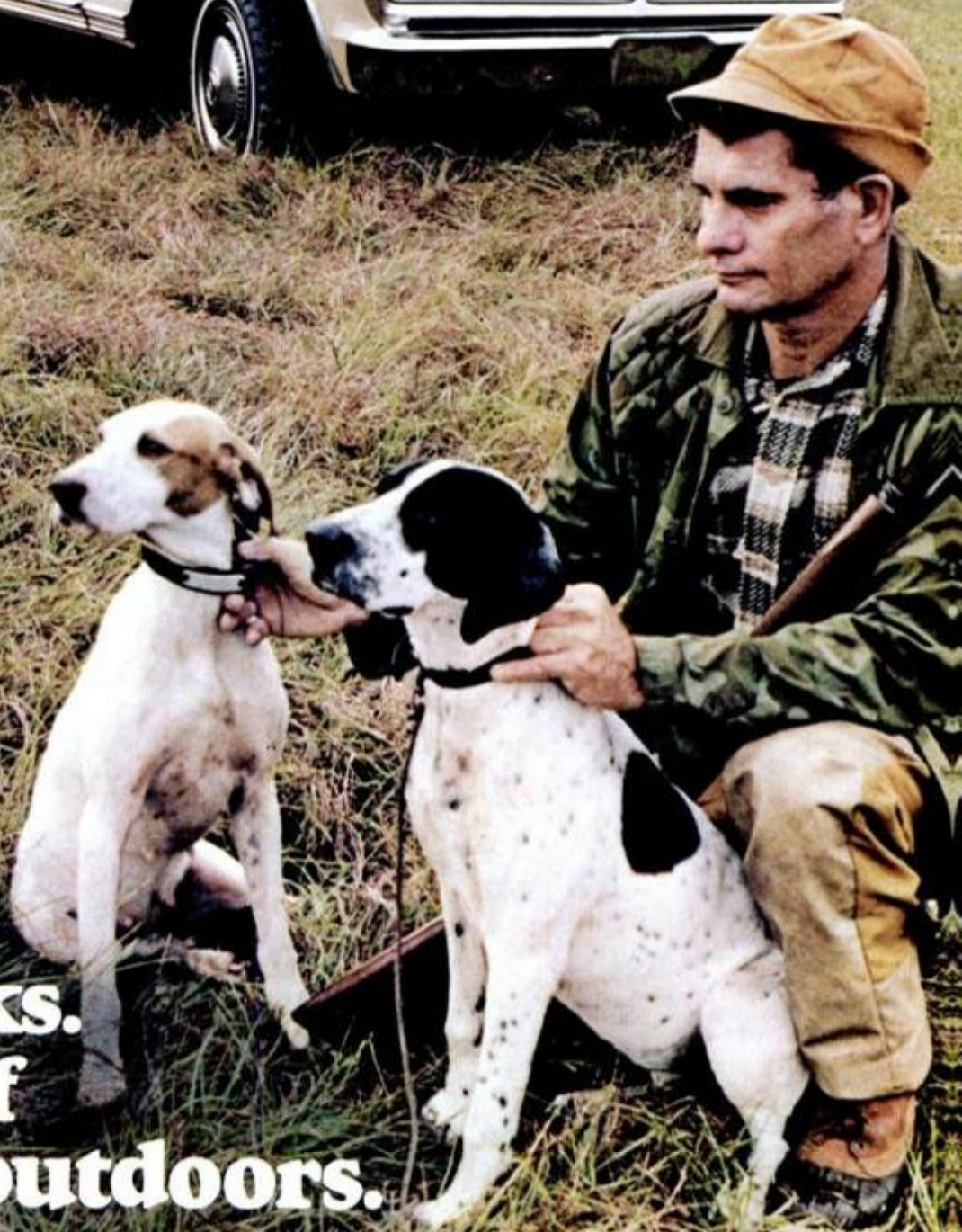
Another important tip: before you reinstall the control assembly cover, set the control lever in the "Top Brown" position to protect the top-browning switch from damage.

Once spun is not enough

Our Whirlpool automatic washer operates properly through all cycles, but the wash isn't as dry as it should be after the spin cycle. By restarting the cycle, additional water drains, so

(Please turn to page 29)





**Ford trucks.
A part of
the great outdoors.**

Sportsmen and Ford trucks. They go together.

Ford declares "open season" on getting away and enjoying the great outdoors. Get there in tough Ford trucks. They'll take you where you want to go.

Whatever kind of sportsman you are, wherever you live, or wherever you're going, Ford's got your truck.

The Ford F-150 4x4 shown below is just one example of America's widest choice of regular and 4wd pickups, and they're all built Ford tough.



Ford Ranchero is a versatile pickup with a great combination of brawn and beauty.

F-150 uses any gas!

Ford's heavy-duty half-tonner goes where you want to go on any type of gas, and now comes as a rugged 4x4 too.

Twin-I-Beam front suspension gives you *two* forged steel axles for toughness on and off the road. And it's a Ford exclusive!





Bronco—the lean machine

Designed to go many places bulkier 4x4's can't. V-8 power is standard on every Bronco.



93 out of 100 of all Ford trucks registered in the last 12 years are still on the job.

SuperCab, super room!

The only 2-door pickup with room enough for an optional full-width back seat; optional twin jump seats are also available.





The great outdoors machines from Ford.

Best V-8 pickup mileage ratings.

Ford's F-100 with optional 302 CID V-8 and manual transmission has EPA estimates of 24 mpg highway, 16 mpg city. Of course, your mileage may vary depending on your truck's condition, equipment, how and where you drive. California ratings lower.

The gutsy little Courier.

Ford's new little import that's now got a bigger cab than before, new optional 5-speed and soft-ride package.



Ford's Club Wagon

Room with a view is just a part of the beauty of the Ford Club Wagon. Club Wagon comes in two lengths and can seat up to 12 even with 8,000 lb. in tow.



FORD

FORD DIVISION



APPLIANCE CLINIC

(Continued from page 24)

the wash is ready to dry. What's wrong?—C.C. Schmidt, Toledo, Ohio

I can list several possibilities; one should answer your problem:

- Overloaded machine.
- Kinked or blocked drain hose.
- Plugged filter.
- Loose or slipping drive belt (adjust for a deflection of 1/2 in.)
- Worn pump impeller.
- Basket clutch out of adjustment.

You need a clearance of 1/16 in. between the lining and surface when the clutch is disengaged. If your machine uses three clutch pads on the basket drive discs, line up one pad with the clutch shaft before making the adjustment. A clutch adjustment nut is provided. The illustration shows a typical layout of parts.



Saving watts and therms

Here are three good tips to save dollars you spend for energy:

- Shift your refrigerator away from the kitchen range or other heat source. Placed in the coolest spot in a kitchen, a refrigerator runs less often and uses less energy.
- Undersized extension cords are a safety hazard and also waste energy. Use only heavy-duty cords.
- Vegetables cook just as well in small amounts of water as they do in a potful. And foods that are cooked in a minimum amount of water heat faster, save energy and retain more nutrients.

Tootin' our horn

Can you recommend an appliance repair book?—Stan Smith, Stamford, Conn.

Try *Popular Mechanics Complete Appliance Repair Manual*—available at your local bookstore, or send \$8.95 to Popular Mechanics Books, Box 1575, Dept. MX03, Radio City Station, New York, N.Y. 10019. ★★

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.

Shakespeare Powers the Citizens Band

No other factor—not even the cost and quality of the CB radio set itself—makes such a dramatic difference in CB performance as the antenna that puts out and takes in the signal.

A Shakespeare pre-tuned fiberglass antenna can increase your talkpower over ordinary

antennas. On both transmit and receive. So don't let a "do nothing" antenna put a muzzle on your Citizens Band communications.

Power up with a gleaming white Shakespeare antenna, and get top performance everytime you go on the air. They're in a class by themselves.

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MIDGET PRICE

Lifts Over 150 Lbs.

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Tie a line to our powerful ceramic magnet and haul up treasure from the sea. 4 ceramic magnets, in series, between 4 steel plates. A 1-lb. "giant"!

No. 42,318H (1 x 1 1/4 x 4 3/8") \$9.95 Ppd.

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Weights just 3 lb., lifts up to 500 lb. . . . and gives you no-lift capability the instant you cut the current of its 2 "D" cells (not included). Just 3" dia., 2 1/4" long.

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No. 60,435H (Similar, w/200 lb. pull) \$22.50 Ppd.



DELUXE SPECIALLY DESIGNED PVC COATED MAGNET

6 stacked ceramics . . . hefty 3 1/4" gripping surface. PVC coating protects from corrosive action by chemicals, acids, etc. 101 uses!
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HOMEOWNERS' CLINIC



Replace the joist bracing

In redoing our basement we had to remove the crossed braces between the floor joists. Should I replace them?—Robert W. Tuckey, Philadelphia

By all means, but you can't put them back as they were. Cross bridging is normally installed before the subfloor, which now interferes with nailing the upper ends of the braces. Your best bet is to use solid pieces of 1x8 or 2x8 bridging between each pair of joists and offset them alternately so you can nail through the joists and into the ends of the cross blocking.

Repair that throw-away

I'm about to toss out an heirloom table with drop leaves. One leaf is split, the latter offset. I've tried regluing, but no way. Or is there a way?—Richard Kelton, Beatrice, Neb.

The detail shows one way worth a try. Clean debris out of the crack with a solvent such as lacquer thinner. Work it into the crack with a toothbrush, a thickness of cloth, or anything that will clear out the accumulation. Then quickly work glue into the crack. Position a bar

clamp and C-clamp as indicated, tightening them alternately a turn at a time. When the glue is dry, center a $\frac{3}{16}$ -in. hole in the crack to a depth of 3 to 4 in. Put a few drops of glue in the hole. Flatten the dowel as shown and tap it home. Sand flush to finish.

Another method is to mortise a steel mending plate flush on the underside so it bridges the split, put glue in the crack, draw it tight with a bar clamp and drive short screws in the mending plate.

Noisy water

My family room is in the basement with the kitchen directly above. Water pipes leading to the kitchen are in the family room ceiling and the noise when water is being drawn makes it almost impossible to hear my TV. Pipes are accessible for doing whatever must be done to achieve quiet. But how?—Allen L. Myer, Littleton, Colo.

Insulating the pipes will achieve at least a measure of quiet, and is probably cheaper than any other step you might take to reduce the noise of running water. An air chamber will reduce the hammer, of course, and the two combined will likely achieve the desired result.

Sweaty shower stall

A shower stall that's located just off the bath and adjacent to the utility room has a condensation problem. What can I do to dry the place out?—J. Wilton Primeaux, Lafayette, La.

The stall has improper ventilation and is sorely in need of air circulation. If you install a ventilating fan in the brick-veneer wall near the shower ceiling and operate it for half an hour or so immediately after showering, I'm quite sure it will solve the problem.

Insulation between furring

I want to panel two outside walls of a room in wood over furring strips. What insulation should I use?—John Agias, Toronto, Ont.

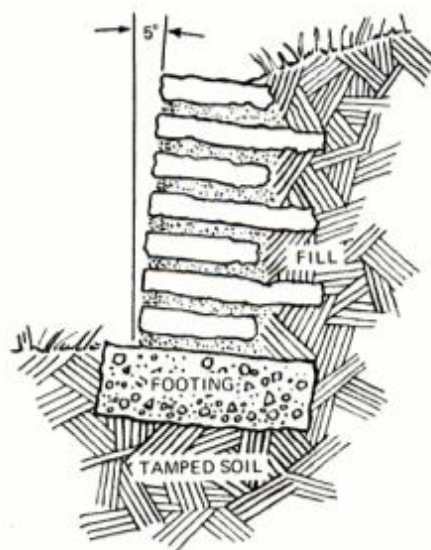
Use a blanket type of insulating material placed so that the foil facing (vapor barrier) is on the room side. Be sure that you space the furring strips so the insulating

"blanket" will fit snugly between them, tacking the lip of the facing over the wooden strips to form an effective moisture barrier.

Build a retaining wall

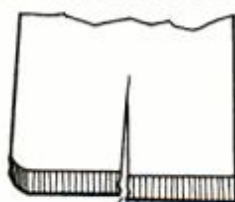
Part of my lawn is too steep for safe mowing with a power mower. I want to build a stone retaining wall about 25 feet long and 30 inches high at the highest point. I would add fill to ease the slope. How do I build the wall?—J. Thompson, Cincinnati, Ohio

First, "notch" the slope and dig a trench for a concrete footing. Use the dirt for backfill, then lay up the wall as shown on a concrete footing of the proportionate size indicated. Use concrete mix for the footing and

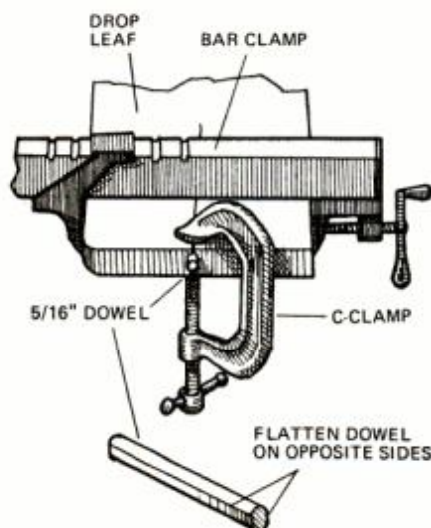


mortar mix to lay the stones. Weep holes should be provided in the wall every 10 or 12 feet to relieve hydrostatic pressure. The holding or "key" stones should be at least twice the depth of the wall. Tilt the wall inward toward the slope about 5°. Allow plenty of time for the footing and the mortar to cure before backfilling and tamping the fill behind the wall and under the footing. ★ ★ ★

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.



OFFSET CRACK IN DROP LEAF



DROP LEAF BAR CLAMP

5/16" DOWEL C-CLAMP

FLATTEN DOWEL ON OPPOSITE SIDES

“Why Viceroy? Because I’d never
smoke a boring cigarette.”

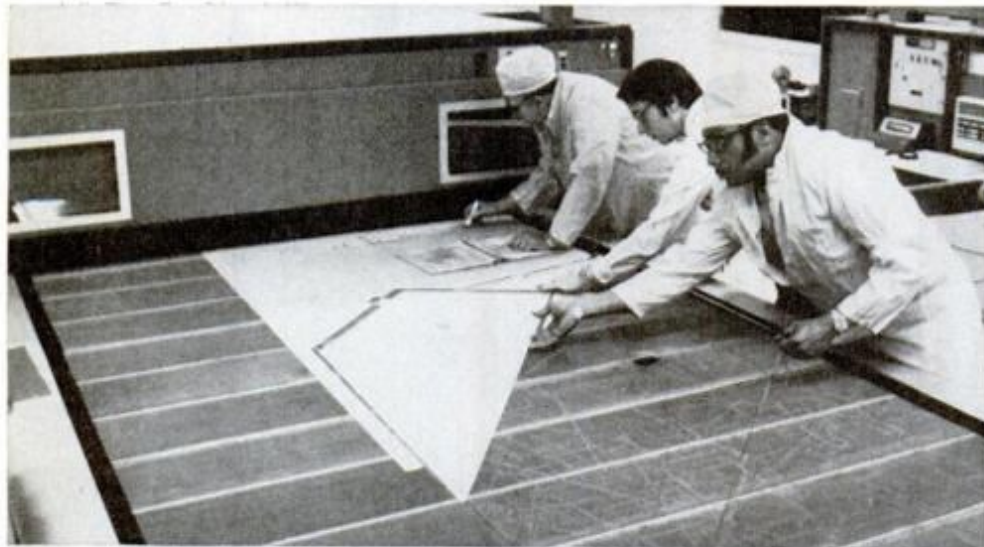


Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

16 mg. "tar," 1.0 mg. nicotine,
av. per cigarette, FTC Report Nov. '75

Viceroy. Where excitement is now a taste.

SCIENCE WORLDWIDE



Hot from the laser

Components for the rudder skin of the McDonnell Douglas F-15 air superiority fighter are now being cut by a computer-controlled laser. Recently installed on the production line at the company's plant in St. Louis, this \$750,000 laser unit cuts the components out of sheets of boron epoxy as shown in the accompanying photograph above).

In addition to being very precise, the laser is a great time-saver. It can process an epoxy sheet in just four minutes—a small fraction of the eight hours that previously were required for the manual cutting of rudder-skin components.

Heavy, but can they travel!

Pulsars—those superdense space objects that have puzzled space scientists ever since they were discovered in 1968—are also superfast travelers with measured velocities of more than 1.25-million mph. This information comes from University of Massachusetts astronomers who have been studying pulsars for more than five years.

Using an array of four 120-foot-diameter telescopes, they recently observed 12 pulsars that are streaking through space at velocities ranging from 30 miles per second (approximately the speed at which the Earth travels around the sun) to as much as 350 miles per second or 1.25 million mph.

Pulsars are extremely dense bodies that have been compressed from a

mass the size of our sun into a sphere less than 10 miles across. They are formed from the collapse of the central regions of stars following the huge explosion that marks the end of a star's life. Just one teaspoon of the material from these tiny "neutron stars" would weigh an estimated one billion tons!

New Biblical finds in Syria

Archeological finds at Ebla in northwestern Syria may prove to be more important to Biblical scholarship than did the Dead Sea Scrolls, according to David Noel Freedman, University of Michigan professor of Biblical studies.

Among the finds are 4000-year-old cuneiform tablets that may throw light on a period going back some 500 years before the time of Abraham, says Prof. Freedman. They may also provide some background on the destruction of Sodom and Gomorrah, perhaps tying that event with the end of the kingdom of Ebla around 2250 B.C.

There is so much archeological material at the Syrian site, according to the University of Michigan scholar, that it will take decades to complete the study.

Fossils and continental drift

Plants that grew in southern Illinois and in southern France some 300 million years ago are "absolutely identical," reports Tom L. Phillips, a University of Illinois botanist. The identification is evidence that the

two areas were then part of one continent that later split in two, says Prof. Phillips. The tropical swamp in which the plants grew extended eastward across the prehistoric continent from an area that now includes Illinois. The swamp, which swept through the eastern United States and into France, Germany and even Russia, was located at the equator, according to Prof. Phillips. As the continental chunks drifted apart, they also moved northward.

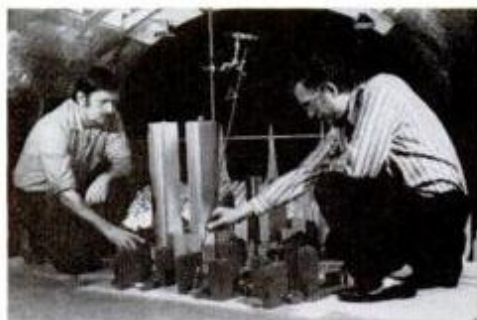
The scientist's findings are based on plant fossils found in the seams of coal.

A modest proposal for dogs

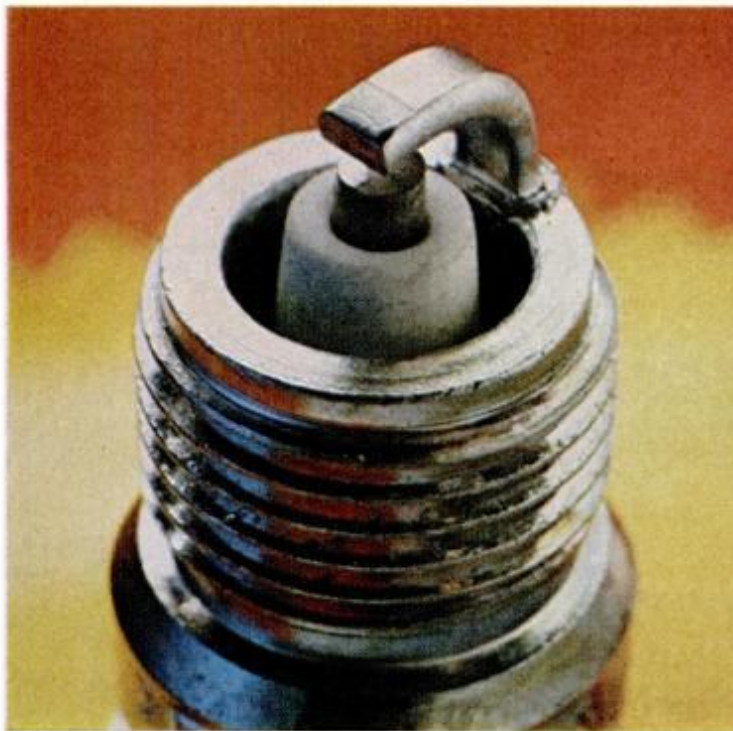
The number of dogs in the United States should be drastically reduced in order to cut down on cases of dog bite. That's the opinion of Robert M. Goldwyn, M.D., expressed in an editorial in a recent issue of the *Archives of Surgery*. The Brookline, Mass., physician points out that at least 1 million persons—most of them under 12 years of age—are bitten annually. "Some of them will bear emotional, as well as physical, scars for many decades," he states. Dr. Goldwyn proposes that "in this country the population growth of dogs be halted and reversed by appropriate birth-control measures."

MIT studies Manhattan winds

Scale models of buildings in lower Manhattan are used by researchers at the Massachusetts Institute of Technology to determine wind problems at the proposed site of a new



apartment complex. The models are set up in MIT's Wright Brothers Wind Tunnel. In photo, researcher adjusts an anemometer used to measure wind velocities at street levels. ★★★



Improve your mileage without knocking out your car radio.

What in the ever-loving blue-eyed world does mileage have to do with radios? Stay tuned.

First about the mileage.

A fresh set of Champion spark plugs can help improve your car's mileage. A series of nationwide tests have shown that 3 out of 4 cars can get better mileage when worn plugs are replaced with fresh Champions. Better by an average of 4.8%.

And when you compare the cost of gas you may be wasting to the cost of a fresh set of Champions,

you can be money ahead with fresh plugs. Still with us? Hang on.

Now, about the radio.

When electricity runs through a wire (as it does in your engine), it sets up an electromagnetic field. This field can play hob with FM radio, citizen's band radio and TV signals. The solution is something called a resistor. Its job is to suppress the field.

All U.S. car makers use resistors in some form . . . either in the spark plug wires alone or combined with resistor spark plugs. The folks that use resistor plugs in their late-model cars and trucks are primarily Ford, GM and IH (plus some '76 Chrysler Corp. cars and trucks).



The connection.

If you want to improve the mileage of your late-model car or truck, and it uses resistor plugs, be sure to get a box of Champion resistor plugs. A regular plug will make your FM or CB radio sound like a chain saw. And you'll put TV sets on the fritz wherever you drive.

Now, wasn't that simple? Just remember: If your car or truck uses resistor plugs, replace them with fresh Champion resistor plugs. They'll help save your money—and your eardrums.



Fill 'er up
with Champions.



THE PM GARAGE



Attention, speeder

yourself
vice:
ps on
start
is a
s on
tible
ight
ead.

...or more
... tickets, the \$90 Senturion
would pay for itself (and if you
gather speeding tickets in such
clumps, you'd also avoid losing your
license!). I think it's a handy thing
when driving test cars which I push
a bit fast at times, but I don't feel I
need it when driving my own car.

I had to go out of my way just to
test it, listening for the locations of
police radar units on the morning
radio news. It works all right. I al-
ways got the alert before spotting
the speed trap ahead. But in all cases,
I was on level roads and the traps
were not over the crest of a hill or
around corners, in which case the
alert could possibly come too late for
you to slow down, radar waves being
line-of-sight in nature. Radatron
Corp. 2424 Niagara Falls Blvd.,
North Tonawanda, N.Y. 14120.—
B.H.

Supertorque

It's frustrating to want to do a job
yourself and find that you can't be-



cause you lack the right tool. That
was the case for a friend with a VW
who was trying to loosen his axle
nuts. Typically, they were so frozen
that only the Six-Million-Dollar Man
could bust 'em. But there is a tool
that can give you the torque for
these 36-mm nuts. It's K-D's No.
2377 axle nut wrench. It's \$4.95. K-D
Manufacturing Co., 3575 Hempland
Road, Lancaster, Pa. 17604.—B.H.

Wax for imports

As a rule, Detroit uses acrylic enam-
els and lacquers, and the imports use
melamine-alkyd, nitrocellulose and
urethane paints. The latter polish up
best with no streaking when you use
a wax designed for them. I found



out about the harder, less-absorbent
import finishes using Import Car
Wax Paste from Turtle Wax (there's
a liquid, too). About \$4. Turtle Wax,
5655 West 73rd St., Chicago, Ill.
60638.—B.H.



Tape head cleaner

How many car owners with 8-tracks
remember to get out the Q-Tips every
so many hours of operation to clean
their head and capstan drive? Not
many I suspect. The job is a whole
lot easier and easier to remember
with a neat new cartridge: the Klean
Machine. It can be kept with your
other tapes, and after 10 hours of
tape playing you just slip it into your
tape player for 10 seconds and the
job is done. The attached capsule

comes filled with isopropyl alcohol
and is easily refillable. It's a \$3 con-
venience product from Sears (free
with its Dashmate tape players).
Sears, Roebuck and Co., Sears Tower,
Chicago, Ill. 60684.—B.H.

No more huff and puff



There's an easy way to get up to 60
p.s.i. of air pressure at home for car
and bike tires, soccer balls, air-assist
shock absorbers and anything else
you might need it for. The Goldmark
Puffy air compressor I've been using
is the 12-volt type that plugs into
your cigaret-lighter socket or clips
on your battery (there's also a 110-
v.a.c. model). I used it recently to
find a slow leak and saved myself
several trips to the local service
station's air pump; neither did I
have to spend time and energy with
the hand pump. \$36. Dana Corp., Box
500, Hagerstown, Ind. 47346.—B.H.

Slick kit for car needs

It's got a very appropriate name:
Mini Trunk. It reminds me of those
slick tool trays that BMW uses. This
kit—in a plastic briefcase—contains
jumper cables, fire extinguisher,
spotlight, safety flares and other
needs for a highway emergency. It's
\$33. Oak Grove Enterprises, Box 47A,
Foristell, Mo. 63348.—B.H.



Try this Shell "Fact or Myth" Quiz.

The right answers could save you some money on your next oil change.

Which is fact and which is myth? If you don't know you could be overspending when you change your oil.

Fact or Myth?

Motor oil must be changed when it looks dirty

Myth. Just because your oil looks dirty doesn't mean it's dirty enough to require changing. High-detergent motor oils like Shell Super X[®] 10W-50 motor oil, Shell X-100[®] Multigrade, and Shell X-100[®] can suspend about a pound of engine dirt and contamination before they need changing.

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.

Fact or Myth?

Motor oils made from Pennsylvania crude oil necessarily perform better

Myth. Where oil comes from has very little to do with the quality of the finished product. The key things that make one motor oil better than another are how well it's refined, and the additives that go into it. Those are the things that make Shell's high-detergent motor oils good enough to meet and exceed all U.S. car makers' tough requirements.

One way to tell if the oil you're using meets your engine's requirements is to look for Service Classification "SE" on the can. You'll find an "SE" on every can of Shell Super X 10W-50 motor oil, Shell X-100 Multigrade, and Shell X-100.

Fact or Myth?

When choosing a motor oil, you should consider the way you drive

Fact. How and where you drive determines how hard an oil will have to work.



The Shell Answer Man helps you choose the right motor oil for your car.

If you do a lot of heavy-duty driving, like stop-and-go or trailer towing, try **Shell Super X**. Its 10W-50 rating is the widest multigrade range you can buy. That means high-temperature protection plus low-temperature startability.

If you drive in all kinds of weather, **Shell X-100 Multigrade** could be right for you. With it, there's never a need to change oil with the seasons.

If you drive in weather that's fairly consistent from season to season, maybe all you need is a good single grade motor oil like **Shell X-100**. It's available in SAE 10W, 20W-20, 30 and 40 grades.

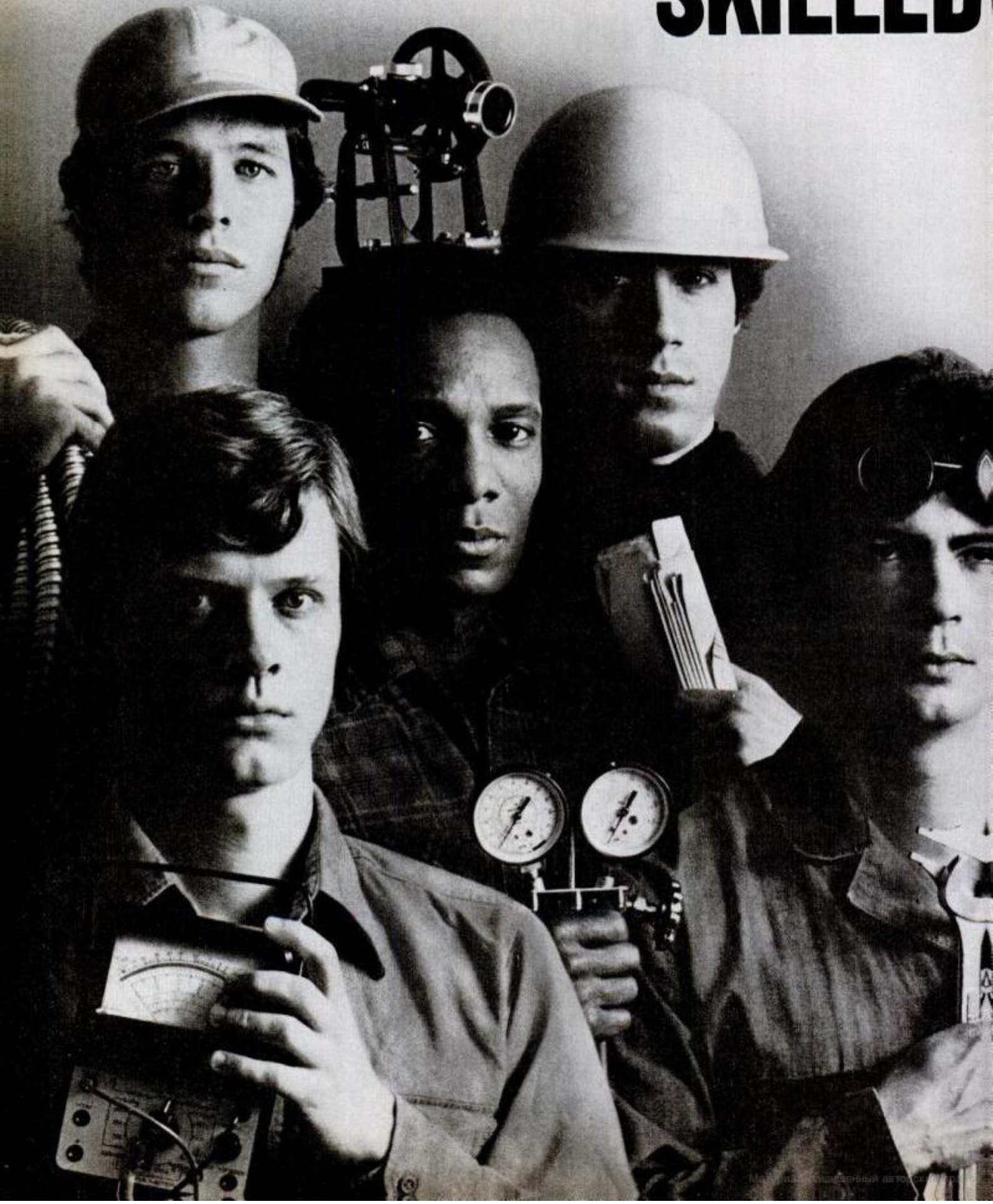
Look for Shell motor oils at Shell service stations or wherever fine motor oils are sold.

If you would like more information on motor oil, write for the free booklet, "Questions and Answers About Motor Oil." Shell Oil Company, P.O. Box 61609, Civic Center Station, Houston, Texas 77208.



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But you're never alone. If you ever want to talk to an instructor, you can call ICS from anywhere in the continental United States, using our toll-free Dial-a-Question® service.

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And the ICS Center for Degree Studies is authorized by the Pennsylvania Department of Educa-

Careers	Average annual job openings, 1972-85†	% increase new job openings, 1972-85†
Auto Mechanics	22,300	18.4%
Air Conditioning Refrigeration and Heating Mechanics	13,100	96.3%
TV and Radio Service Technicians	4,400	18.1%
Electricians (Construction and Maintenance)	20,900	30.0%
Engineering and Science Technicians	39,600	48.9%

*Source: U.S. Office of Education publication, "25 technical careers you can learn in 2 years or less."
†Source: 1974 U.S. Dept. of Labor Occupational Manpower and Training Needs

tion to grant the Associate in Specialized Business degree in Accounting and Business Management, and the Associate in Specialized Technology degree in Civil, Mechanical, Electrical, and Chemical Engineering Technologies.

These degree programs are not mere stepping-stones to higher education nor are they primarily intended for transfer toward more advanced degrees. They are practical, career-oriented programs designed to help you reach your objectives without further academic training.

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CAR CLINIC

BY MORT SCHULTZ



Life story

How would you like to be told, "You're lucky to be alive"? This was the statement I was greeted with following a mess that started in 1974 when I took delivery of a new Pontiac LeMans. From the beginning I got noise from a wheel, the sound resembling a bearing grinding itself to powder. The car was returned to the dealer many times, always with the same outcome: They could find nothing wrong.

... Things came to a head last weekend when my wife refused to drive in the car, saying she was scared. I was given an ultimatum: Get it fixed or get rid of it. The dealer picked up the car and in due course I was informed the trouble had been found and corrected.

When I got to the garage I noticed that the spare tire had been installed. I was told that one of the GR 78x15 radials had been defective. It must have been, because the noise had disappeared.

I took the bad tire to a dealer representing the tire manufacturer to get a replacement. He told me some manufacturers were having a problem with radial-tire bead separation and showed me that the separation in my tire was a foot long.

"The lower speed limit probably prevented an accident, because at higher speed the tire would have blown," he said and added, "You're lucky to be alive."

I'm relating my experience to you, because the next guy may not be so lucky. Please include this warning in your column: If you hear a noise from the wheels, check your radials. It may save your life. Thank you.—Fred Black Jr., Oskaloosa, Iowa

It's we who thank you, Fred. And we do.

Beltin' out gospel

I drive a 1972 Chevrolet Malibu with 302-cu.-in. engine, power steering and airconditioning. The car has only 20,000 miles, but has had three new water pumps. Two were installed by different garages, and the last one by me. I can now rock the fan slightly up and down, which indicates to me that the pump is going to the dogs again. I know the belt is not too

tight. Can you help me?—Al Iannone (address not given).

Perhaps, but you will have to reverse your apparently adamant stance concerning the "belt." You refer to "belt," singular. Are you overlooking the fact that the air-conditioner compressor drive belt is also involved? All belts must be adjusted exactly to specification if you are to avoid placing excessive strain on water-pump bearings. The tendency has been to tighten belts, especially the airconditioner compressor belt, as much as possible.

Belt adjustment should be done with a professional belt-tension adjusting gauge to avoid guesswork, especially in your case since you have been having a problem. New fan, power steering and AIR pump belts should be adjusted to 125 ± 5 lbs. Belts that have been in use should be adjusted to 75 ± 5 lbs. A new air-conditioner compressor belt should be adjusted to 140 ± 5 lbs, while a used belt should be set to a specification of 95 ± 5 lbs. Check the tension of new belts a week after they have been installed, readjusting if necessary to the "used belt" specification.

Now, if it really is determined that belt "loading" isn't excessive, the problem is either an unbalanced fan or fan clutch, or a faulty mounting surface. Either can cause runout, putting a load on the water pump and causing premature failure.

Leaf and learn

Our 1974 Mazda RX-4 station wagon is great, but we do have one complaint. When there are passengers in the back seat the rear suspension squeaks. Our dealer's cure lasts a day or two. Is there a permanent remedy?—Warren Unland, Long Beach, Calif.

Sure is. Under pressure, the leaves of the rear springs misalign themselves, causing metal-to-metal rubbing, although they are supposedly held together by two shackles (clips). The dealer is probably tightening shackles as much as he thinks possible, which would suffice under no-load or light-load conditions. However, when a load is pretty heavy (rough estimate: 350 pounds or more), the leaves shift.

To really tie things down, leaves should be lined up straight and shackles tightened by pressing them together as much as possible with large locking-type pliers. If you really want to insure "permanence," add another shackle or two to reinforce holding power.

In that gray area

I have a 1975 Buick Apollo V6, which has gone 5500 miles. The engine uses a quart of oil in 1000 miles. Do you consider this excessive? I would like to know while the car is under warranty.—J. Paul Magnuson, Newton Center, Mass.

The manufacturer claims that using a quart of oil every 850 miles may or may not be normal. It depends

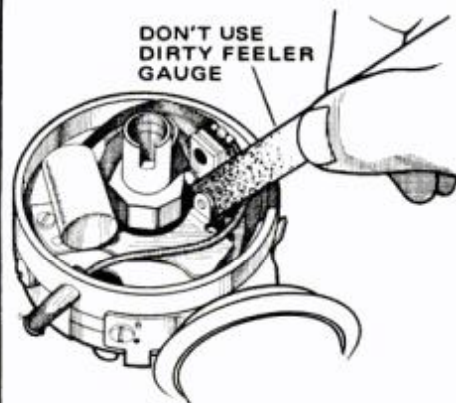
(Please turn to page 42)

Point of order

Everyone doing his own engine tune-up work knows that the distributor breaker points should be kept as clean as possible; otherwise, they burn prematurely. However, sometimes a guy makes a slip and uses a feeler gauge which looks as if it had been used as an oil dipstick. Oil or grease is then deposited on points and before you know it the guy is wondering why his points went pf-f-t. Keep it in mind: Before slipping that feeler gauge between those points, wipe it off. And if the blade won't come clean with a simple wipe, wash it in cleaning solvent and then water. Be sure it's dry before using it.



DON'T USE DIRTY FEELER GAUGE



CAR CLINIC

(Continued from page 41)

on whether or not the engine has a defect.

With a new car, you should wait until 8000 to 10,000 miles have been racked up before making any assumption. Then, sparkplugs should be removed to see if any have oil-fouled. If so, the loss of a quart of oil every 850, 1000, even 2500 miles is *not* normal. The engine has a defect—probably a cracked valve-stem seal that should be replaced. Attention should also be paid to exhaust to determine if oil loss is being caused by failure of piston rings to seat properly.

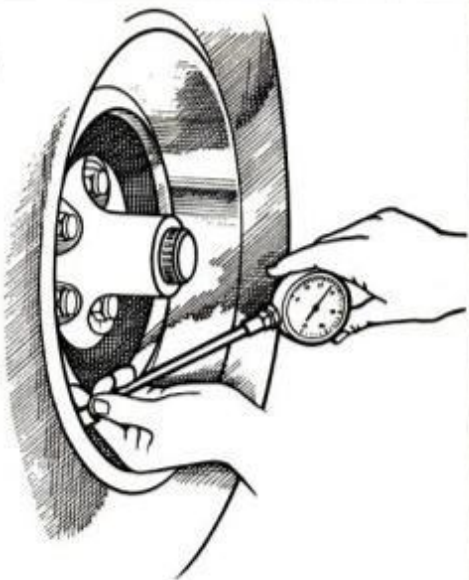
If I were you, I would go on record now with your dealer as a Buick owner who seems to be having an oil consumption problem. If he sloughs you off with any "normal" jazz, demand to have a factory field representative called in to judge the matter. Then, even should your warranty expire before trouble fully develops, you will have recourse.

I hope you're checking oil properly. Wait until the engine's been shut off a few minutes so oil drains back into the crankcase. The dipstick should be inserted with the handle loop to the

Tread right

Here are several reminders about tires that will surely let you get longer tire life:

- Check tire pressure often. Tires should be cool (the vehicle should not have been driven for at least three hours).
- The pressure specified by the maker in your owners manual is gospel. It should only be exceeded when you are going to do sustained highway driving. Then add four pounds pressure to the normal recommendation, but never exceed your tires' maximum load rating.
- Avoid underinflation. Low pressure causes extreme tire flexing and allows excessive heat to build up—which is the main cause of tire failure.
- Do not reduce pressure if tires are hot.
- Buy yourself a good tire-pressure gauge. It is an inexpensive instrument that will pay off in dividends if used often.



rear of the engine to get an accurate reading. And, of course, you should allow oil level to reach the ADD mark on the dipstick before adding a quart.

First, faltering steps

From the first day I took delivery, I've been getting a rattling noise

from my 1976 Dodge Colt at higher speeds. Do you know anything about this? The dealer is no help.—Bob Silver, Fort Lauderdale, Fla.

Your letter and Dodge service bulletin 11-02-76 arrived almost simultaneously. The bulletin calls attention to a "rattle chattering-type noise . . .

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when the engine rpm is between 2000 and 3000." The noise is made by the heat-deflector shield touching the exhaust pipe. The solution is to open the clearance between them to 3/16 inch. Bet your dealer knows about it now. Try him.

Grand antics

I have a most unusual problem with my 1973 Pontiac Grand Am that none of the five Pontiac mechanics I've consulted has pinpointed. The trouble started after my first tune-up at 11,500 miles. Since then, the car has burned up a set of distributor points every 3000 to 4000 miles. I've had the entire electrical system examined four times, plus coil, condenser, wires and regulator. Nothing. The car is equipped with a 400-cu.-in. engine and two-barrel carburetor. Mechanics say my problem is one in 10,000. I say baloney—if they made it, they should know what's wrong with it. They laugh. Help.—Leonard J. Gebaldo, Warren, Mich.

Funny it's not. Hasn't anyone picked up that clue of yours—that the trouble started after the first tune-up? I can't say for sure, but to me it seems like an odds-on favorite that whoever did that first tune-up damaged the calibrated resistor wire

that runs from the ignition switch to the primary side of the coil. The job of this particular resistance wire is to limit the voltage to the points, thus preventing the exact trouble you're having: premature burning.

Either that, or he installed a wrong condenser and everyone has just been assuming it's the right one.

The resistor wire is housed in a harness, but it does branch out at both ends where it attaches to the switch and coil. Get a sharp electrical guy to test the wire with an ohmmeter at 80° F. Resistance should be $1.80 \pm .05$ ohms. If the wire turns out bad, find out which is cheaper—having the harness sliced open to replace the wire or having the entire harness replaced.

If the resistance wire tests out okay, check the part number for the condenser and replace the one now in the distributor with one that you know is correct. Then see what happens during the next 3000 to 4000 miles and let me know.

SERVICE TIPS

■ Goodyear warns those who drive with racing tires on their passenger cars that they're playing with fire. A car with rac-

ers has absolutely no traction on wet roads, and the tires have no resistance to heat. This is why racing tires are clearly marked: "For racing purposes only—not for highway use" on their side-walls. For the sake of all concerned, get those slicks off.

■ Chevrolet has revised the toe specification for 1975-76 Vegas and Monzas to prolong tire life. The target spec now is 1/16th-inch toe-out. Remind your mechanic. He may not have gotten the word.

■ Mustangs of 1975-76 vintage with 2300-cu.-in. engines and C3 automatic transmissions are having, here and there, problems of erratic shifting or no upshifting because of a fouled rubber vacuum hose at the engine. This hose joins the metal fuel loop to the manifold fitting. It's supposed to be 3¾ inches long and straight—no kinks, crimps or loops. Some cars get into the field with 7-inch-long hoses that have a way of getting all tangled up. When a hose is crimped, the vacuum signal to the transmission is blocked. Check it out. ★★

GOT A PROBLEM WITH YOUR CAR?

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

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PHOTO HINTS

FROM READERS

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—Ken Patterson

Clip holds camera-case lid



Does your camera-case cover get in your way when you shoot? Take it off—but don't set it down and take the risk of losing it because you might forget to pick it up. Instead, hang it on a belt loop, purse strap or your gadget bag strap with a snap-hook fastened to the lid with a rubber band.—Ruth Anne Hanley

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How much of your house would your insurance rebuild at today's prices?

We asked State Farm agent, Mal Twitty of Schaumburg, Illinois, to help us make an important point about homeowners insurance. The Roselle Lumber Company in Mal's area cooperated in setting up this display.



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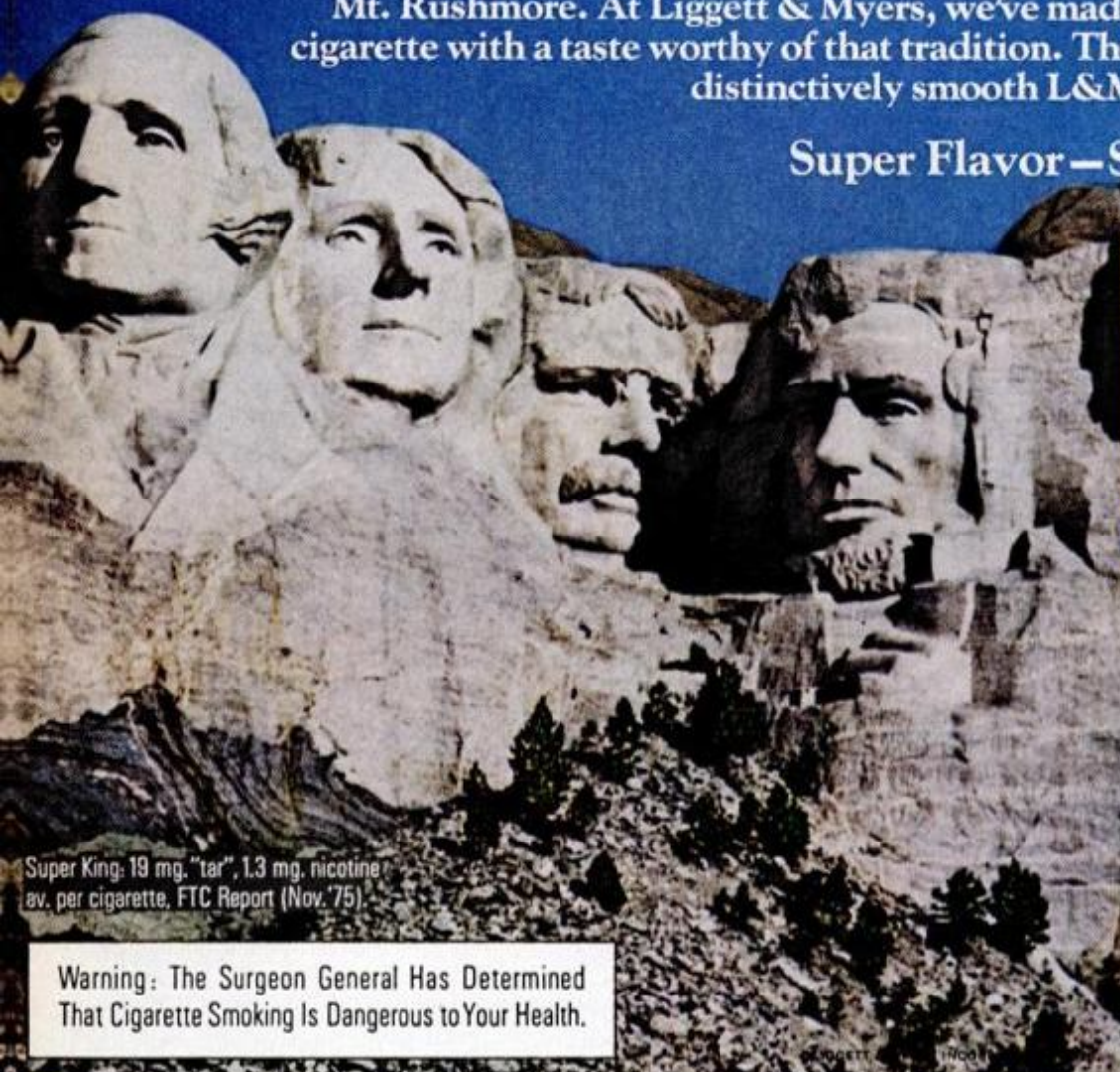
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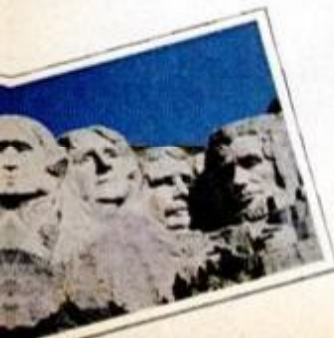


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How they're watching us

They—the Soviets—use exotic gear, from microwave system to spy satellite, to keep tabs on us. But when it comes to space-age spying, they're still rated only second best.


by Edward Hymoff

Spying isn't what it used to be. Gone are the days when it was considered something of a game for dashing cloak-and-dagger operatives ever on the prowl for secret documents. Science and technology have changed all that. For the most part, the daggers are sheathed and the cloaks are in mothballs. Today, intelligence agents spend their time more profitably in analyzing reams of computer printouts, studying aerial and satellite photos and listening to tapes of intercepted conversations.

The recent microwave controversy is a good example of what goes on. Early this year the United States protested against the Soviet practice of radiating the upper floors of our

Moscow embassy with microwaves. Though our diplomats didn't say so, it was thought that the Russians were either trying to reduce the effectiveness of antennas on the embassy roof (antennas for monitoring equipment) or were using the microwaves in an attempt to intercept conversations.

Microwaves are short radio waves that travel by line of sight, like an FM transmission. They are employed in long-distance telephone communications, in radar operations and in the latest type of home cooking oven. They also are used in connection with resonators to eavesdrop on conversations in rooms that are in the line of sight of the listening post. Reson-



• **Spy-in-the-sky satellites** are used by both Russia and U.S. America's ERTS satellite (left) has taken shots of rocket base near Moscow.

Listening post: Roof of Soviet embassy in Washington, D.C., sprouts antennas that reportedly enable Soviets to monitor long-distance phone calls, radio signals.

ators—small metal canisters or metal sheets—may be buried in the walls, ceiling or floor of a room. Metal wastebaskets, airconditioning ducts or other metal devices also function as resonators.

A resonator vibrates in response to pressure changes in the air, changes produced by sounds, including conversation. When microwaves hit a resonator, they "pick up" the vibrations. Reflected, the beam travels back to the receiver operated by the eavesdropper. Electronic processing is then used to reproduce the spoken words.

U.S. embassy bugged

Powerful microwave pulses, such as those utilized by military radars, are harmful to human beings. They can burn human cells as readily as they cook a roast in a modern microwave oven. But the official U.S. protest was directed at the relatively weak radiation that Soviet agents were using. Over a period of time, these weak beams can cause a variety of human complaints, ranging from headaches to irritability and insomnia. Long-term effects may be more serious.

It has been known for years that

Sight on microwave generator enables the operative to aim unit at resonating surfaces in office he's monitoring—a neat way to listen in on conversations.

foreign diplomats in Moscow are the targets of KGB (Soviet secret police) surveillance. More than 15 years ago, for example, the Soviets presented a replica of the Great Seal of the United States to our diplomats in Moscow. This insignia is displayed in all United States missions, and so the Soviet gift was hung in an office in our embassy. Some time later it was discovered that the handsome plaque was bugged.

But all this was ancient history when the latest microwave operation surfaced. Stung by unfavorable publicity, the Kremlin finally owned up to the fact that the American em-

Global spying is a duel of sophisticated electronics

Russian surveillance of U.S. embassy in Moscow includes beaming of microwaves in an attempt, some experts say, to monitor conversations.



Soviet "freighters" loaded down with sophisticated electronic gear have a habit of showing up in waters where American forces are conducting weapons tests.

bassy was being hit by microwaves, but attributed the radiation to "the functioning of radio and television stations, other means of communication and some industrial enterprises . . . There is nothing unusual about it. It is a physical phenomenon known to every schoolchild." The Soviet

(Please turn to page 104)

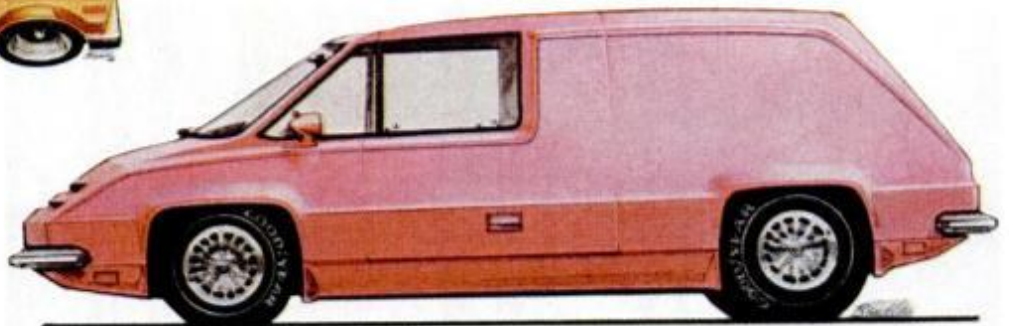


In 1960, Ambassador Henry Cabot Lodge displayed at the United Nations a replica of the Great Seal of the United States. A present from the Soviets, it had hung in our embassy in Moscow. Ambassador Lodge points to hidden listening device.

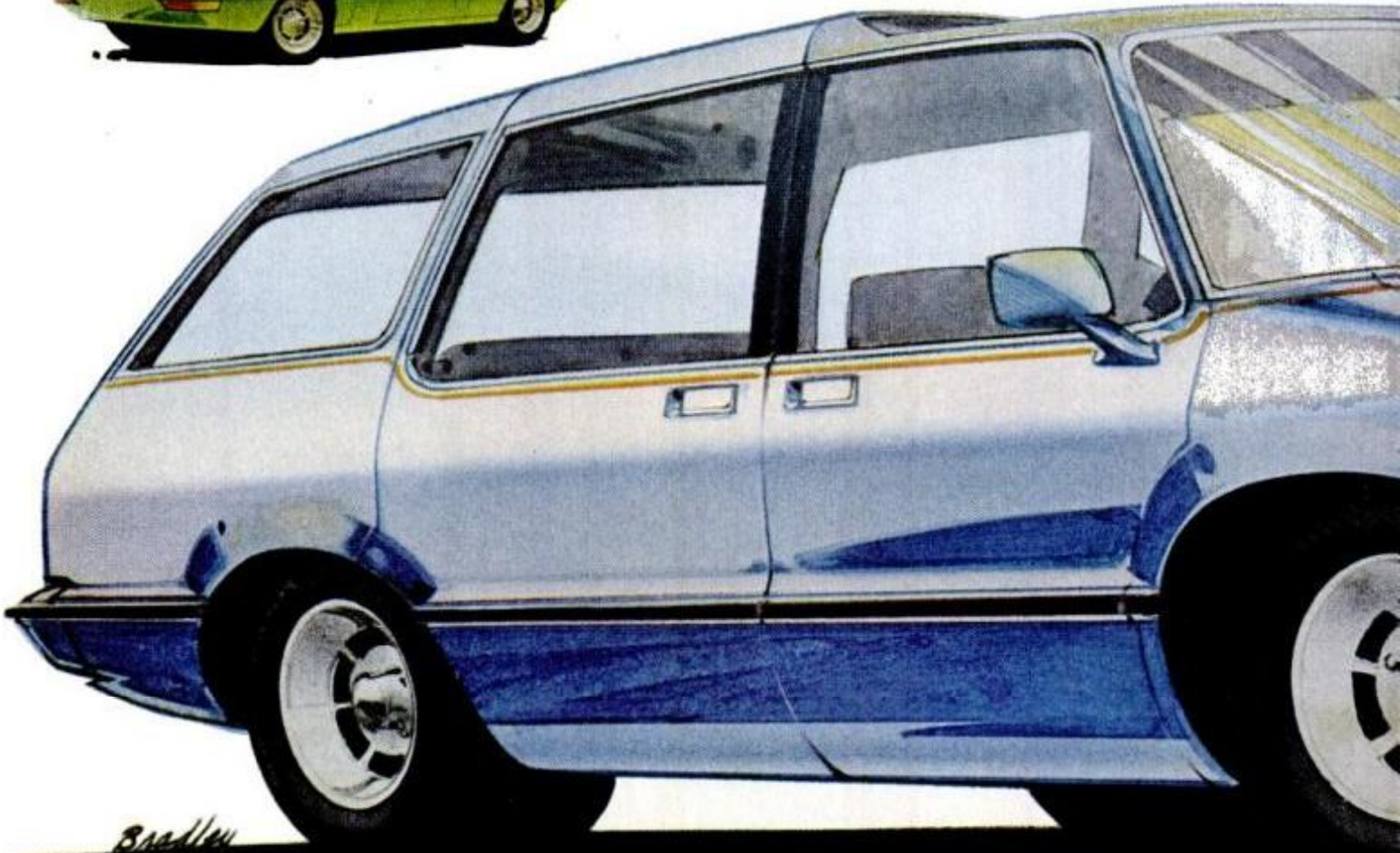
Sensor-equipped satellites orbiting hundreds of miles above the Earth, spy ships, microwave generators and receivers, tiny listening devices—they all play a role in today's espionage operations. To a great extent, the cloak-and-dagger operative has been replaced by the engineer and technician.



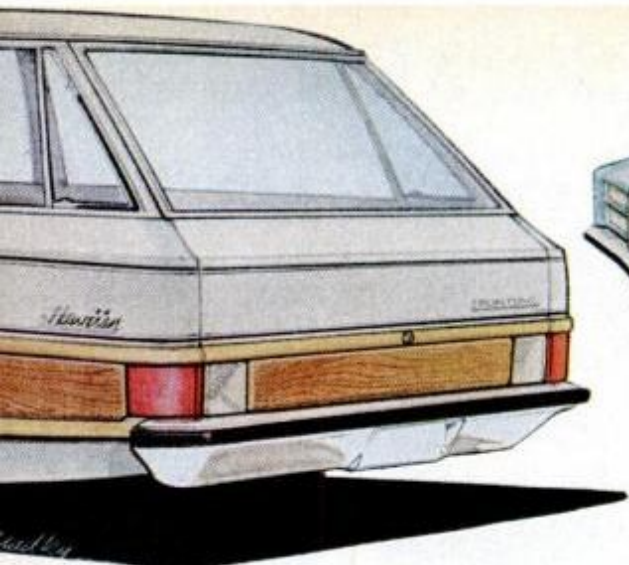
Tiny Honda Life (above) uses Civic front-wheel-drive (fwd) running gear, is now sold in Japan, may appear in United States to cash in on van boom. Right: Elite's 49er Mini-Van stands but 49 inches tall; has gullwing doors, VW floorpan, engine. Below: Fiat's spacious Bertone six-door maximizes space places small-bore engine in rear.



Art: Harry Bradley



Bradley



GM's X-bodied wagon/vans were originally due with rotaries for 1977, but now will have Buick V6 and fwd. They will share major chassis components with that year's Nova-sized compacts; four GM divisions will likely offer them.



Toyota's cross between a van and wagon, the MP-1, stopped Tokyo Auto Show last year, uses Crown engine, but was initially intended for front drive.



Call them mini-vans

Some are scaled-down vans, others are more like station wagons, but they're all very practical and they're on the way to the production line.

With the van boom booming and no sign of abatement, Detroit and the importers are headed for a second generation of vans—smaller ones this time. These will come in addition to existing sizes.

The price of full-sized vans has doubled in the last five years, yet vans are selling at a brisker clip in this country than sports cars. If the car companies can bring prices down, they'll open up a whole new market segment. And mini-vans will not only cost less to buy; they'll be cheaper to drive, maintain and (in some states) license.

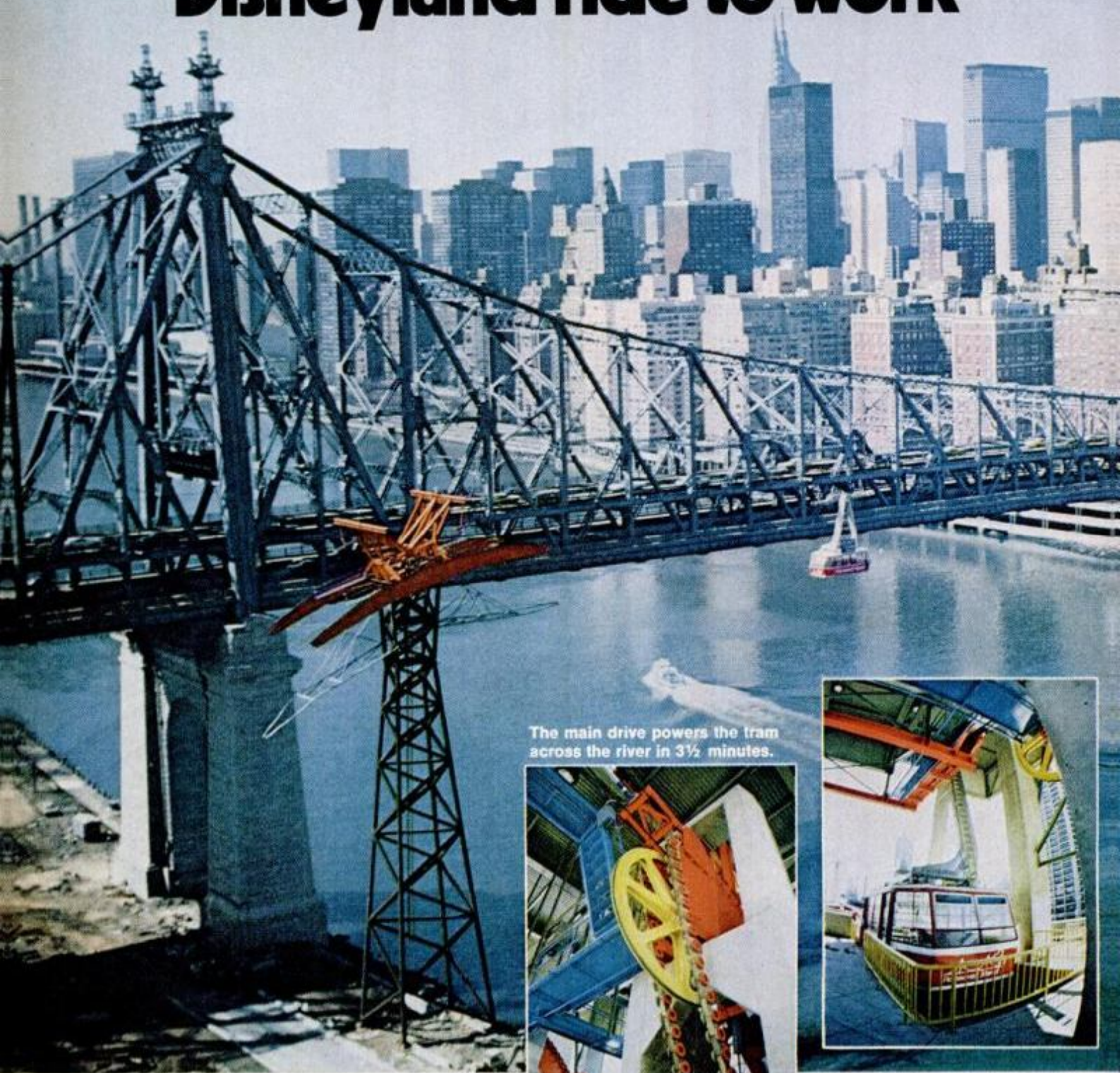
According to industry figures, today's average van owner is 22½ years old, recently married, and spends about \$850 a year buying van accessories. Van conversion outfits can't keep up with orders.

Detroit loves the van boom, and there's presently a battle royal between the Big 3: Ford, Chevy/GMC and Dodge/Plymouth. Van clubs and van meets have swept the country.

In Detroit, the first new small van will come from General Motors. GM plans to go with a front-wheel-drive (fwd), V6-powered compact mini-van on the 1978 X-body, which currently serves GM's N-O-V-A quartet (Nova, Ventura, Apol-

(Please turn to page 118)

Airborne commuters take a Disneyland ride to work



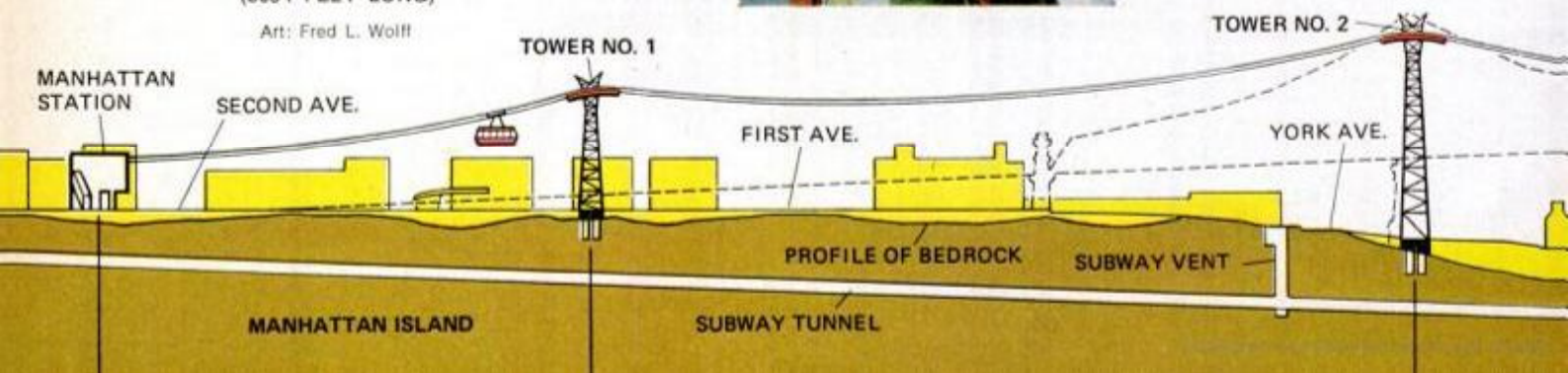
The main drive powers the tram across the river in 3½ minutes.



The gondolas settle into brightly painted stations for loading.

PROFILE OF TRAMWAY CIRCUIT (3094 FEET LONG)

Art: Fred L. Wolff



by Mike McClintock

ASSOCIATE HOME AND SHOP EDITOR

The world's first mass-transit tramway now carries commuters on a wonder ride between two islands in the heart of New York City—Roosevelt and Manhattan. In a spectacular 3½-minute skyride, travelers from Roosevelt Island in the East River literally fly by the city's horrendous rush-hour traffic, touching down in midtown Manhattan.

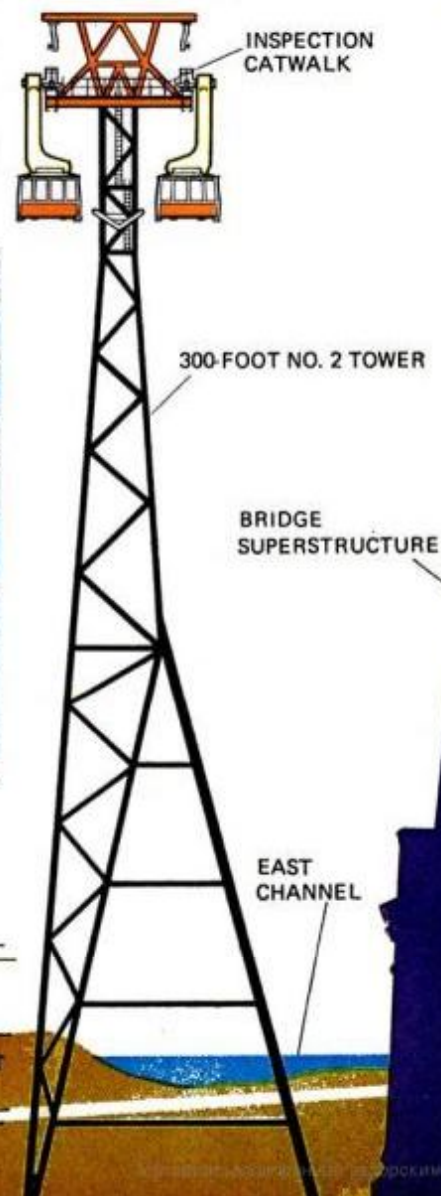
The tramway builder, the New York State Development Corp., hopes the unique facility will be a two-way street across the rushing river. It will serve those living in the corporation's newly built residential community on Roosevelt and those walled-in Manhattan apartment dwellers, who will have easy access to Roosevelt's recreational areas.

Passengers to and from the islands will travel in two synchronized gondolas (each holding 125 people) that load simultaneously at opposite ends of the circuit. Each cabin has an op-

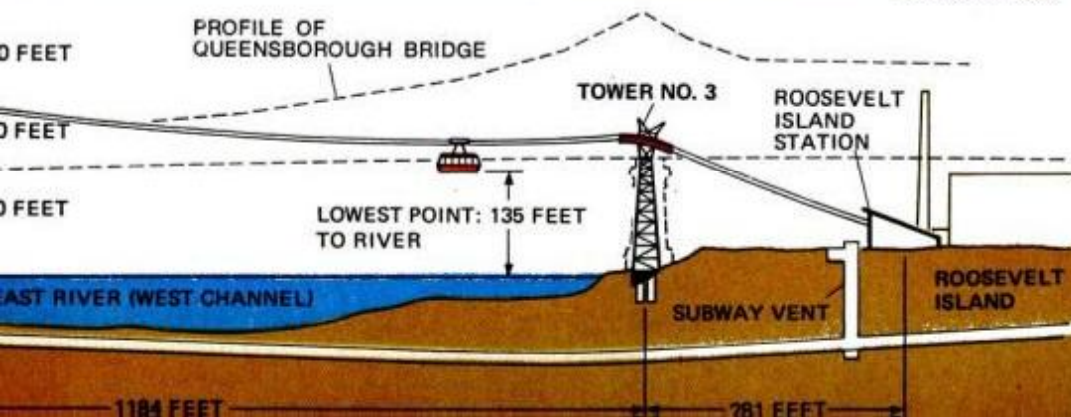
(Please turn to page 112)



HEAD-ON VIEW, TOWER AND BRIDGE



Photos: Tom Grill



Upbeat gear for diving down



Dry suit for added warmth where it's wet, the Unisuit from Poseidon Systems U.S.A. is reported to allow comfortable diving under ice, easily compensate for required buoyancy and help lift heavy objects with tank air.

CYCOLAC-PLASTIC AIR INTAKE VALVE

THREE-FINGER DRY GLOVES

INDEPENDENT SUIT-INFLATION-SYSTEM BOTTLE

ATTACHED HOOD

AIR-RELEASE VALVE FOR BUOYANCY ADJUSTMENT

5000-P.S.I. TANK PRESSURE GAUGE

TANK BELT

FULL FACE MASK WITH CYKLON 300 REGULATOR

WEIGHT BELT

ATTACHED RUBBER BOOTS



New tank systems, regulators, masks, suits, BC vest, gauges are from the Aqua-Lung Div. of U.S. Divers.

by Stuart James

Things are looking up down under. A sudden boom in technology has hit scuba diving and new gear—from inflatable dry suits to electronic digital depth/ascent indicators—looks like props for a new run of *Star Trek*.

"The inflatables will set the trend for future diving," claims Dave Townsend, a Florida Keys diving instructor. "They're expensive, but slowly coming on for the serious diver."

"You're going to see more innovative developments for scuba gear," says Gary Heller, a representative of Farallon Industries, a California company that engineers scuba equipment. "We're making it easier and safer to dive in comfort."

The wet suit, when it arrived in the '50s, was a godsend. Before that, scuba divers went dry—struggling into a one-piece suit with a single opening. It was like cutting a 12-inch hole in an inner tube and trying to crawl inside. It took several friends to get a diver suited. Then came the wet suit with its zippers, two pieces, snug fit and a nice layer of warm water between suit and skin.

And now, 25 years later, the dry suit is back in refined form, made of tough neoprene instead of latex. About 10 brands are now on the market and all can be partially inflated with air to prevent squeeze and give a layer of warm insulation.

Zipper wizardry

It was a simple thing like an improved zipper that signaled the breakthrough in diving comfort. Originally designed for NASA, the

new slide fastener (made by Talon and Dynat) is gas, water and pressure-proof. Parkway was the first to adapt this zipper to diving when it introduced the Unisuit 10 years ago. Acceptance was enthusiastic, but sales were minimal.

When the U.S. Navy got interested, however, the diving industry and public began to pay attention. The Navy tested the Unisuit in a pressure chamber with refrigerated water at 40°F. and dropped two divers to a simulated depth of 70 feet. After 35 minutes, one diver in a custom-fitted wet suit was on the verge of tissue damage from the cold, while the other diver in a Unisuit was still warm and comfortable. The results were convincing, and commercial divers began switching to dry suits.

Inflatable suits

Now made by Poseidon Systems U.S.A., a division of Parkway Fabricators, the Unisuit has improved over the years and is one of the more popular dry inflatables. Like the other models, it has an air-intake valve that attaches to your air tank. To inflate the suit, you simply press a button and air flows from the tank. A purge button releases air from the suit. You achieve positive buoyancy at any depth just by pressing buttons.

Most suits can be equipped with a small compressed air bottle just for inflation, and many have oral inflator hoses. Suit prices range from about \$250 to more than \$600, with an average sport model about \$325—versus a good wet suit at about \$100.

The big difference between dry suits is the position of the entry zipper. The White Stag Thermal

Suit, for example, has a 50-inch zipper that makes it one of the easiest to put on. The U.S. Divers model has no zipper, and entry through the neck is more difficult. Seatec's suit zipper runs across the back and down to the waist. Sub-Aquatic Systems has a zipper across the back and a buddy is needed to help the diver in. Sea Suits has a chest zipper, as does the Bayley Aquastatic; O'Neil Super-suit and Imperial Bubblesuit run it across the shoulders in back. The Unisuit zipper runs from the back of the neck down under the crotch and up to the waist in front.

New developments

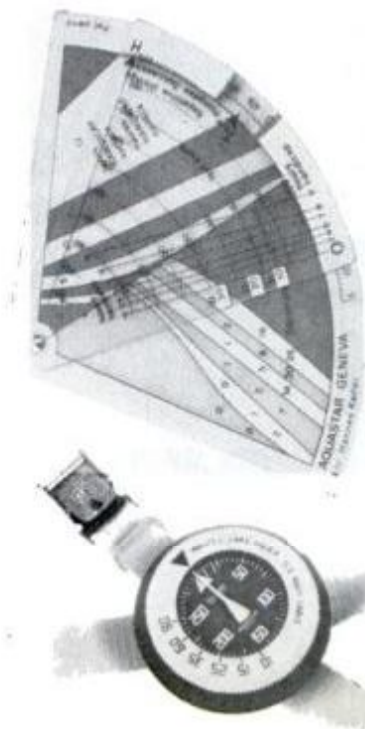
While dry suits are big news, just about every piece of equipment has undergone development. A diver's needs are basically the same as when Jacques Cousteau invented the Aqua-Lung; the difference is in what new gear can do. Fins haven't changed much, for example, but Farallon has added a brace and piston system that transfers leg power directly to the fin, allows a fin surface at least 30 percent larger, and is claimed to almost double propulsion power. This increased frogpower costs \$59, more than double an ordinary fin set at \$22.

Face masks are shallower and more comfortable. Most companies offer the low-volume mask that fits closer to the face and takes less effort to clear of water. Scubapro now markets a face mask of nonallergenic rubber. Farallon has new snorkels that can be custom-fitted to your mouth by first softening the mouthpiece in boiling water. To correct dry-mouth discomfort from breath-

(Please turn to page 110)



Treasure hunting while diving is the claim for the Amphibian TR-8 Goldmaster from White's Electronics. The \$270 instrument has an eight-inch underwater loop with a land probe option available. Settings are for metals, minerals.



Underwater instruments now include aids for estimating safe submersion. Hannes Keller Decompression Slide Rule (left) gives sport diving times. Depth gauge has oil-filled bourdon tube. Aquadive Navigator Panel mounts compass, depth gauge, watch.



Equipment from World Wide Divers, New York City

How CB can make your vacation better

by Ivan Berger
ELECTRONICS EDITOR

Drive down those old, familiar roads, and you know just when and where to expect traffic, where to find good coffee while you wait the jams out, which gas stations honor your credit cards and which stay open late. And of course you know where all those roads are going.

But pile the family into your car to head off for a vacation somewhere new, and you're on your own again, a stranger. Ever ride down a back-country highway in the dusk looking for gas, a place to eat or someone to give directions?

With CB though, you're not a stranger any more. Pick up the microphone, ask for help or information and pretty soon some good buddy or another will provide. Last we heard, about half the trucks in the United States have CB rigs, and about one in every 20 cars. Those numbers are rising rapidly, too. And the more time a vehicle spends on the road, the more likely it is to be CB-equipped—and to help you.

Not only can you get help, you can be a good Samaritan yourself, passing on information about traffic jams, calling in if you see a roadside emergency, even relaying messages to travelers farther down the road (it's legal as long as CB messages travel no more than 150 miles).

And it does, thank goodness, take your mind off what the kids are doing in the back seat.

It's educational, too. Listen as you

A mobile CB unit in your camper, and a walkie-talkie model outside, can help keep the family in touch with each other and

their roving home base when parked at campsites—or, even more important, when wandering around at roadside stops.



Most milestones in the auto industry are cause for celebration. When the 50,000th car comes off the line, the 100,000th transmission, the first this, the last that, Detroit goes through a little ritual of celebration and self-congratulation.

There's a milestone coming up in a few months that will pass unobserved by the auto firms. No mention of it, no acknowledgement. What's the occasion and why the cold shoulder?

The occasion is the 10th anniversary of the National Highway Traffic Safety Act. The Act became effective in September 1966.

The reason it will pass uncelebrated is that the Traffic Safety Act, more than any other piece of legislation, has humbled and humiliated the car companies, caused a few auto execs to lose their jobs or suffer demotion and, the deepest hurt of all, cost carmakers untold millions, if not billions, of dollars.

The Act created a new government agency—the National Highway Traffic Safety Administration (NHTSA)—and empowered the agency to force car producers to recall and repair defective automobiles.

In the 10 years NHTSA has been watchdogging Detroit, carmakers have recalled 41,292,109 U.S.-made cars and 7,786,205 foreign vehicles, for a total of 49,078,314. That was the count as of last Jan. 31.

That's not all

NHTSA isn't the only government agency in the recall business. The Environmental Protection Administration (EPA) can order cars recalled to correct defects in pollution control equipment.

EPA has issued recalls or the auto companies have voluntarily recalled at least 2,700,000 cars and trucks to adjust or repair antipollution devices.

The two agencies together have been responsible for recalls of more than 51,700,000 vehicles during the past 10 years.

How can one industry go wrong 51,000,000 times?

Who's responsible for the blunders? How do they happen? Why do they happen? What have carmakers learned from 10 years of goof-ups and 51,000,000 fixes?

While Detroit's record is pretty bad, it isn't quite as bad as the numbers indicate. The companies haven't really produced 51,000,000 bums.

The figure is inflated because some cars have been recalled two, three or more times. For example, in 1972, Chevrolet had three recalls on Vega in three months. So some cars have been counted again and again every time they have been recalled. No one has a figure sorting out multirecalled cars from those that have been recalled once.

The 51,000,000-car count is misleading in another way. Thousands of cars are recalled that do not require fixing and are counted as recalls even though they are not defective. The reason for this is that manufacturers frequently have to recall vast numbers of good cars to find a few lemons. A company might have to recall a run of 100,000 cars to find 15,000 problem cars. The company knows the 15,000 defects are somewhere in the batch of 100,000. But there's no way of locating the botched pieces short of doing a one-at-a-time inspection of the entire lot.

Misleading figures

If the government figure overstates the case against Detroit, it also understates it. Cars can be recalled for only two reasons: safety defects and failure of pollution controls. The companies have turned out cars with problems that don't fall under those headings. Because the problems were not safety-related or pollution-related, there was no recall and the cars never appeared on any list of faulty automobiles.

Even after allowing automakers credit for whatever exaggeration there might be in the government count, the car companies still come off looking like the champion mudlars of all time.

Why so many dud cars, so many call-backs?

The chances for error in producing an automobile are virtually unlimited. From the time an auto company or supplier receives the raw materials that go into making an automobile until the finished product is shipped to a dealer there are millions of opportunities for error.

The companies make mistakes in designs and engineering, in the fabrication process, in the assembly process, in preproduction testing. Workers make mistakes in putting the pieces together. Production equipment can malfunction, testing equipment

can go haywire. One small part can have as many as 100 specifications. Multiply that by the 15,000 parts in a car and the chances for error become astronomical.

There is no way of checking every nut and bolt at every stage of putting a car together. There is no way of anticipating how every car will be used or abused in the hands of the ultimate owner. A car can be put through every test and torture the engineers can think of, only to have it called back when a corn farmer discovers the windshield wipers won't work when they get plugged by a certain type of dust found only in grain elevators only under certain atmospheric conditions.

Small parts, big money

In addition to human error and the unforeseen, recalls also result from carmakers being penny wise and pound foolish. Spending two cents when they should spend a nickel. When you make a million of something, pennies become important. Fractions of pennies become important. If you use 12 washers to a car and can use a washer costing 6/10ths of a cent, instead of a penny, and can freeze the design of the washer so the same item can be used over several model years, you're talking big money. But if the washer fails, leading to a recall, the company is in big trouble.

Recalls attributable to penny-pinching still happen, but they aren't as common as they were a few years ago. The companies would rather spend the extra 4/10ths of a cent than risk a call-back.

Auto manufacturers are unhappier over recalls than car owners. To a car owner, a recall is largely a nuisance. The owner has to make an appointment with a dealer to have the car checked or repaired, give up time to take it in and possibly give up use of the car for X hours. Prior to De-

(Please turn to page 127)





If you rent your vacation car, carry a CB in a suitcase, plug it into the lighter socket and stick on a magnetic antenna.

eye on them every second. It's handy for calling them back to supper, too. Part of the fun of a vacation is getting away from your worries—and CB helps.

Walkie-talkies help adults, too, letting them get away from the camper once in a while, or helping to find out where the fish are biting.

It's also a handy way to check out those little-known tourist sites printed in tiny type on road maps. Some of them are rather dull—I've used CB to tell one inquisitive tourist that an historical marker he was searching for was not worth breaking his way through a scrubby New England wood to see.

But some of those out-of-the-way sites can be more than worth the visit, if not always for the reasons you expect. I don't know if the Rhode Island CBer who told me that Gilbert Stuart's birthplace rated a detour was right or not—the neat colonial house was closed tight when I got there. But I'll never forget the sight I did see there: a crystal stream jam-packed with tiny fish, all elbowing their way upstream like morning commuters getting off the subway.

And that was the densest traffic I got involved in that whole holiday weekend—thanks to my CB.

(Please turn to page 136)

MORE CB CHANNELS AND FASTER LICENSES

Faced with a licensing backlog of three months or more—and thousands of CBers rushing onto the air illegally while they're waiting (and thousands more who never even apply)—the FCC has a new licensing plan: If you're eligible for a license and have applied for one, you can get a temporary call sign by sending in FCC form 555-B. Your temporary call will be the letter "K," your first and last initials and your zip code (we'd be KPM10019, for example).

And since all the newly licensed (and unlicensed) operators are clogging the CB band, the FCC is planning to add more channels, probably by January. But it's unsure just how many channels there will be, and at what frequencies they'll operate. Various proposals have been offered for enough new channels to bring the CB total up to 50 or 99 or 105 or 115 channels, by extending the current CB band or taking some frequencies from the business radio band or from now-unused frequencies in the 900-MHz region. Current sets using digital and phase-lock-loop (PLL) circuits may be adaptable to at least new channels added to the present 27-MHz band. Meanwhile, new 49-MHz channels for low-power walkie-talkies are already here.

CB LINGO—IT'S ENGLISH, SORT OF

Three things you're never supposed to say on CB are swear words, your real name or ordinary English. Here's some of what you do say:

COMMON 10-CODES

- 10-4:** Okay, affirmative, I got it.
- 10-10:** Negative
- 10-13:** Advise weather, road and traffic conditions.
- 10-20:** What's your location?
- 10-34:** Correct time (also 10-36).

CB SLANG

- Back:** Over. Back to you.
- Back door:** Rear of vehicle, or last vehicle of group.
- Back down:** Drive slower.
- Back out:** Stop transmitting.
- Bad scene:** Crowded channel.
- Ballet dancer:** Swaying antenna.
- Barefoot:** Using legal power.
- Beam:** Directional antenna.
- Big Daddy:** The FCC.
- Big 10-4:** Enthusiastic okay.
- Bleeding:** Interference from next channel.
- Bodacious:** Shamelessly strong.
- Boulevard:** Interstate highway.
- Break:** Let me talk.
- Camera:** Police radar.
- Catch:** Talk to.

- Channel 25:** The telephone.
- Charlie:** The FCC.
- Chopped top:** Short antenna.
- Clean:** No bears (police) in sight.
- Clear:** Done talking.
- Come again:** Repeat, please.
- Come back:** Return call.
- Come on:** Go ahead and talk.
- Copy:** Hear, understand.
- Covered up:** Blocked by interference.
- Cut out:** Leave the channel.
- Drop the hammer:** Step on the gas.
- Ears:** CB set.
- 18-wheeler:** Truck, semi-trailer.
- Eights:** Warm goodbye.
- Eyeball:** Face-to-face meeting.
- Feed the bears:** Get or pay a ticket.
- Final:** Last transmission.
- Five-five:** 55 mph (speed limit)
- Flip-flop:** return trip.
- Four:** OK (as in "10-4").
- Four-wheeler:** Automobile.
- Front door:** First vehicle in a group.
- Getting out:** Transmission being heard.
- Gone:** My last transmission on this channel.
- Green stamps:** Dollars: tolls or fines.
- Hammer:** Accelerator.
- Handle:** CB nickname.
- Holler:** Call.
- How about . . . ?** Calling . . .
- Linear:** Illegal signal booster.
- Mail:** Overheard CB conversation.
- Momma bear:** Female police officer.
- Mercy sakes:** CB substitute for swearing.

- Modulate:** Talk with.
- Negative:** No.
- Negative copy:** Couldn't understand.
- Negatory:** No; emphatic no.
- One time:** For a short contact.
- Over your shoulder:** Behind you.
- Overmodulating:** Too loud, distorted.
- Peanut butter in ears:** Not listening to CB.
- Pedal to the metal:** Accelerator to the floor.
- Picture taker:** Police radar.
- Piggy bank:** Toll booth.
- Ratchet jaw:** Nonstop talker.
- Radio check:** Reception report.
- Read:** Hear, understand.
- RFI:** Radio frequency interference.
- Rockin' chair:** Middle vehicle of group.
- Roger:** I acknowledge.
- Roller skate:** Small car.
- Seventy-three:** Best regards.
- Shout:** Call.
- Smokey Bear:** Highway patrol.
- Stepped on:** Blocked by another's transmission.
- Tijuana taxi:** Well-marked police car.
- Threes:** Seventy-threes, regards.
- Throwing:** Transmitting.
- TVI:** Television interference.
- Twenty:** Location (see 10-20).
- Walked over:** Overpowered by a stronger signal.
- Wall-to-wall:** Loud and clear.
- Wrapper:** Color of car.
- X-ray machine:** Police radar.

ive your way cross-country and u'll hear the constant shift of ac- nts from one region to another, e differences not polished down as ey are on commercial radio sta- ons. You'll learn a bit about what e's like in each area, too, as your eside and riverside travels put u in contact with small boats, or ur rural roamings let you talk to rmers—yes, even tractors are being B-equipped.

Then there are those psychological zzzles. What do those handles—CB cknames—mean, and how did their ners pick them? Is that guy on e air to convey real information, just for an excuse to ta'k? And that resonant, self-assured, rich- unding voice coming from the sleek, ensive Porsche ahead, or from the ttletrap old Chevy right behind u?

A few hundred miles of that, and u should be ready to settle in some-

where for the night. CB will help there, too. Talking to other travelers can help you find a good place to bunk down. And if you need to make a reservation, confirm one you've already made, or let a motel know you've been delayed so they'll still honor your reservation, get on your CB. Chances are you'll be able to find some CBER with a base station who'll pick up the phone and make a call for you. Possibly, you may even reach your goal directly: Quite a few campgrounds (and many marinas, if you're vacationing by boat) already monitor CB channels, and I wouldn't be surprised if some motels did, too.

Help when you need it

Garages, especially on or near interstate highways, often monitor CB, which can be a godsend if you break down on the road. I've even heard of one motor-home owner who, with his tank nearly dry, managed to

catch a gas-station operator who was just about to close up and go home. The station stayed open another 10 minutes, and the RV filled his tank and sped off into the night.

In small towns, taxis often use CB, too. So if you don't quite make the gas station, you may be able to take a cab there for less than the cost of a mechanic's call. Or you may just prefer to take a cab into some town where you don't think there's parking for your motor home.

If you have kids, CB can be a big help. Use it to find out which campgrounds have playgrounds or pools, and you can assure yourself a few quiet moments while your kids are burning off the energy you don't want them trying to burn off in the back seat tomorrow. If they're homesick, see if you can find a base station with a phone patch and the willingness to put through a call to their friends back home. By the time they've finished telling what a good time they're having on the trip, they may even believe it themselves.

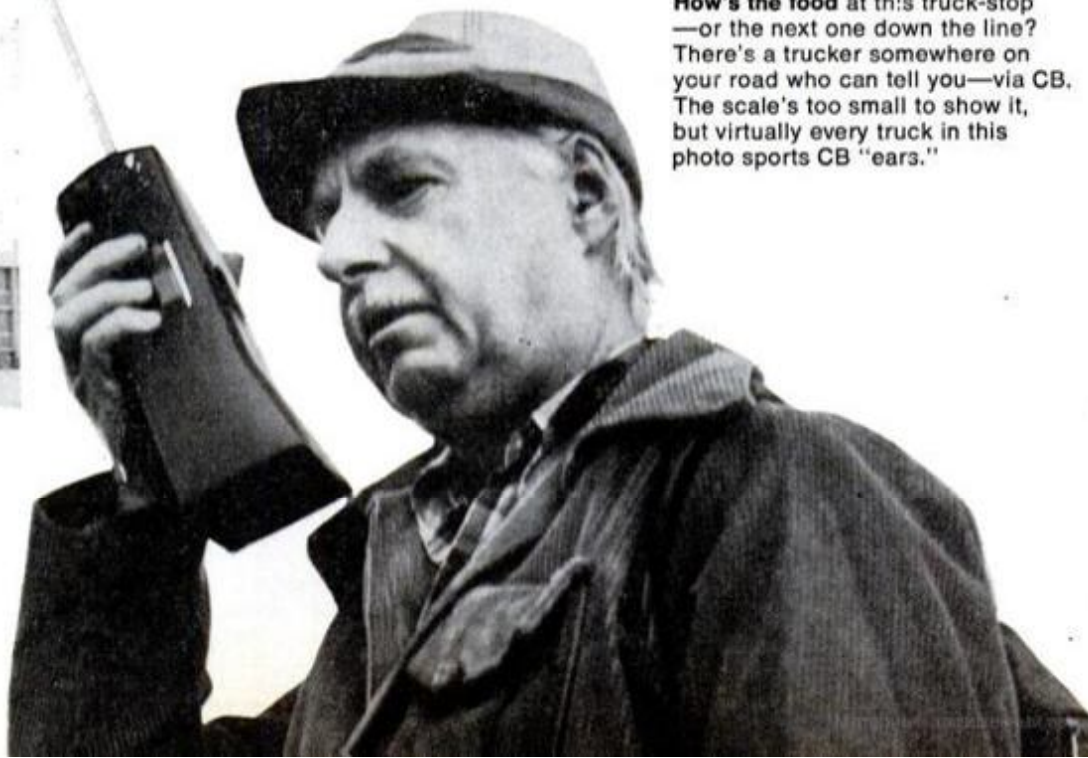
Give the kids a walkie-talkie and a watch, tell them to check in by radio every half hour (or every time the big hand points straight up or down), and you can relax and let them play without having to keep an



Photo: Lance Braithwaite

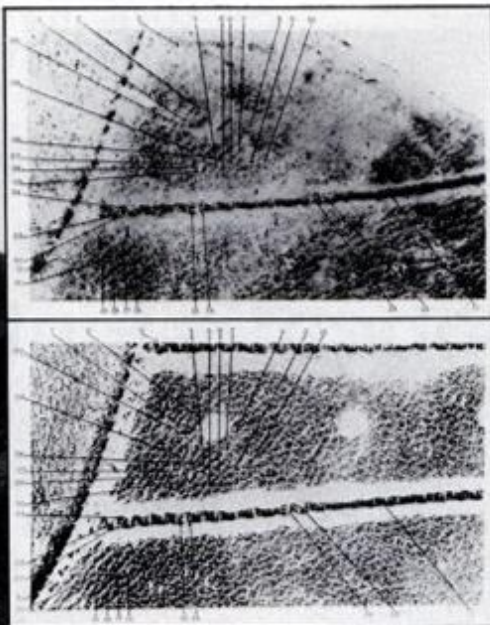


rtability-plus can range from ikie-talkies like the ones in e child's hands above or e fisherman's at right, to gnet-mount antennas that can shifted from one car to other to make sure your ation vehicle is equipped.



How's the food at this truck-stop—or the next one down the line? There's a trucker somewhere on your road who can tell you—via CB. The scale's too small to show it, but virtually every truck in this photo sports CB "ears."

IT'S NEW NOW



To catch a criminal—try 'gloveprints'

Criminals who wear gloves to avoid detection are in for a surprise these days in Britain. Scotland Yard experts have discovered that—like bare fingers—no two gloves leave exactly the same impression. Distinctive differences in leather texture, stitching, minor imperfections and embedded dirt and oils all combine to produce identifying marks. Shown here are two matching prints, one found at the scene of a crime, the other made by a glove taken from a captured suspect. Such prints have already been used in court as evidence to obtain convictions against criminals.



Treasure detector for old buildings

For sophisticated treasure hunters, a new metal detector with special controls that "zero out" mineral content in rocks and soil will—according to the makers—"home in" on the kind of metal folks once hid behind masonry and under earth floors. The unit uses a special loop so it doesn't have to be held at a constant distance from the surface being explored. Detector is powered by 14 penlight batteries and responds to all ferrous and nonferrous metals at the same setting. Price: \$399.50. White's Electronics, 1012 Pleasant Valley Rd., Sweet Home, Ore. 97386.



A dry camera is in the bag

Flexible camera housings for underwater photographers are lighter and less costly than rigid cases. But many leak and handle awkwardly at depth. Now there's a flexible "Aqua Housing" that's leakproof to 30 feet and provides easy focusing and shutter release. For 35-mm cameras with flash, price is \$40; for camera only, \$30. Spiratone, 135-06 Northern Blvd., Flushing, N. Y. 11354.



Portable private phone line

These battery-powered phones with built-in buzzers are said to operate up to 20 miles loud and clear. The portable units clip to a belt and plug into jacks wherever needed. Each phone runs on two penlight batteries, and up to seven sets can be connected in parallel. Cob Industries, 152 Chambers St., New York, N.Y. 10007.

Tabletop 'grow' light

Indoor plants and flowers will bloom under a single 30-watt fluorescent "plant growth" lamp. It's a new 24-inch unit with adjustable reflector that illuminates a two-foot-square area. Lamp operates on standard house current. GTE Sylvania, 100 Endicott, Danvers, Mass. 01923.

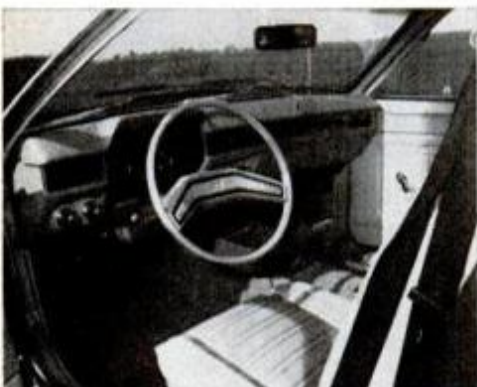




Both wagon and Runabout have liftgates, fold-down rear seats, low loading sills.



Bobcat V6 is \$500 more than Four, adds 17 horses, handles accessories better.



Front comfort rates tops, but some owners prefer gauges, revised shoulder belts.

PM OWNERS REPORT: 1976 MERCURY BOBCAT

Styling, handling and silence outweigh Bobcat's Pinto ancestry

A nationwide survey based on 891,808 owner-driven miles.

by Michael Lamm
WEST COAST EDITOR

It's no secret that Mercury spells Pinto B-o-b-c-a-t. You pay \$138 more for the Bobcat three-door runabout and \$278 more for the wagon. Add the Capri V6 and it's another \$500.

This \$500 includes the price of an automatic transmission.

Who buys Bobcats? And why?

Our survey shows a very consistent age distribution. Bobcats appeal to all age groups equally, and that's rare in this day of specialized cars.

About twice as many Bobcat owners are male as female. More white-collar workers buy Bobcats than any other group (41.1 percent), followed by blue-collar, professionals, and retirees, in that order. Only 6.9 percent are

Doctors, lawyers and educators make up 11.4 percent of owners.



homemakers, 4.5 percent military, and 3.0 percent students.

Why did they go for Bobcats?

Economy of operation ranks as the primary selling point. The initial price rates low as a reason for buying (only 8.4 percent), which translates, "If we'd really been after price, we'd have gone for a Pinto."

Styling, the one thing that differentiates a Bobcat from a Pinto, enticed nearly 40 percent of our respondents.

What are some of the best-liked features?

"It moves in and out of traffic easily, **takes curves nicely**, and is easy to park," says a Mississippi schoolteacher.

A Florida pilot: "Doesn't feel small on the highway; good fuel economy."

A Colorado fast-food store manager: "Roomy, very quiet for a small car, great ride, looks good, fine performance for a small engine (the Four)."

How about least-liked features?

"Gas mileage is lower than anticipated."—Illinois research supervisor.

"The car runs rough and diesels because of the smog equipment."—Texas housewife.

"Can't get any transmission but the automatic with the V6. I'd prefer a four-speed that would get better mileage. Also I consider the detail workmanship poor."—California pharmacist.

Comfort, especially in the front seat, got considerable praise. "We found the Bobcat **more comfortable than expected**, especially on

Handling ranks as the Bobcat's best-liked feature.

Rattles were mentioned by a small but vociferous percentage.

Mechanics are often too rushed to check their repairs properly.

Six-footers say there's as much room in the front seats as in any other car.

the long trips," exudes an Illinois R&D man.

"While this little wagon is used mainly for errands and short trips, we have also traveled 200-400 miles at a time in great comfort. I would not hesitate to make even longer trips, but only with one passenger," states an Illinois teacher.

On the topic of workmanship, these comments.

"Excellent workmanship except for a rattle in the radio."—Arizona banker. "Windows and doors don't fit snugly."—Texas CPA. "Compared to other cars of this size and price, the Bobcat is one of the better made."—Alabama engineer.

"We've owned two Capris, and both were very quiet. This 1976 Bobcat wagon has **many rattles and squeaks**. The noises depend somewhat on the weather—more in hot than cool."—California electronics inspector.

Dealer service received generally good reviews from Bobcat owners. (66.7 percent rated it good or excellent). Here are representative comments.

"We've had small trim items replaced promptly. Very courteous, helpful service."—California manager.

"Prompt, courteous and expensive."—New York homemaker.

"Engine knocks not corrected in three visits. Why can't they fix things the first time?"—Utah welder.

How about dealer sales practices? Here, 79.9 percent of those who responded to our survey

Wagon's rear windows slide open, but the hatchback's are fixed. Options include hinged rear panes, sunroof, styled wheels, air, and fancy trim packages.

Photos by the author





Best-liked feature of Bobcat is its handling, say owners. Comments include praise of handling at speed and in parking and other tight-maneuver situations.

thought that they were good to excellent. Typical comments:

"Didn't feel pressured when I bought the car. They were courteous, and I feel I got a good deal."—California dental technician.

"After shopping, I got the Bobcat for less than I would have paid for a Pinto Squire. The Mercury dealer sold me this car for his cost plus \$100."—Virginia attorney.

What changes would Bobcat owners like to see?

"More comfortable shoulder harness," recommends a Virginia budget clerk. A California art supervisor suggests "... a back seat that can accommodate something more than a watermelon." "Better gas mileage," says a Missouri retiree. "Front-wheel drive to get rid of tunnel."—New York bookkeeper.

"Make the rear windows openable." "Five-speed trans." "Four-door wagon." "Less body tuck to make lower panels less vulnerable to flying stone and mud."

Several owners mentioned that they'd tried both the Pinto and the Bobcat and settled on Bobcats because they were quieter and better insulated.

A Missouri R.N. sums it up by saying, "Size is perfect, payments are about what I wanted, the car runs efficiently and smoothly, and from a feminine viewpoint it's a cute car; also peppy and fun to drive." ★★



More upright grille marks major difference in body appearance between the Bobcat and Pinto. Styling accounted for nearly 40 percent of Bobcat's sales.



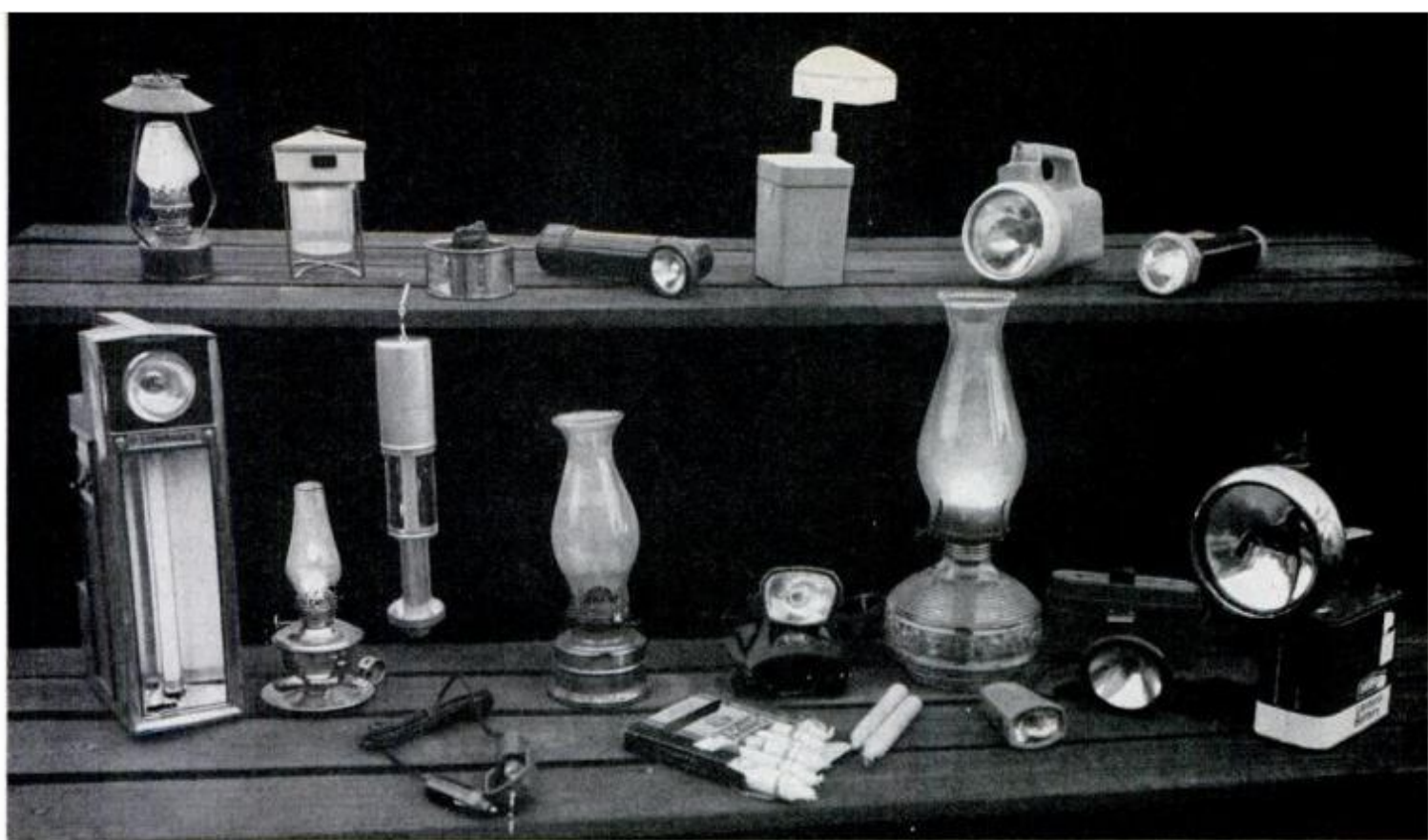
Spare tire lies flat under floor of station wagon and is covered by carpeting. Owners are mostly happy with wagon, but some want to see four-door version.

← **Patience—Ford's small Fiesta will offer fwd early next year.**

Summary of 1976 Mercury Bobcat Owners Reports*

Total miles driven 891,808	Economy	44.4	Good	45.1	Had any mechanical trouble?	
Average miles per gallon	Styling	38.0	Average	18.9	No	57.2%
2.3-liter Four	Comfort	18.5	Fair	4.9	Yes	42.8
In town (EPA, 24 manual) . . . 20.0	Riding qualities	17.1	Poor	4.9	What type of trouble?	
Long trips (EPA, 34 manual) 25.5	Specific dislikes:		Comfort opinion (front seats):		Dieseling, pinging	26.1%
2.8-liter V6	Mileage below expectations	24.3%	Good to excellent	93.8%	Transmission	11.4
In town (EPA, 17 automatic) 15.2	Lack of power	8.4	Fair to poor	6.2	Oil leaks	6.8
Long trips (EPA, 25 automatic)	Too little rear legroom	8.4			Hard to start cold	5.7
19.3	Rattles	6.4	Comfort opinion (rear seat):		Did you repair it yourself?	
Engines:	What changes would you like?		Good to excellent	37.3%	No	97.7%
2.3-liter ohc Four	Revamp shoulder harness	10.9%	Fair to poor	62.7	Yes	2.3
2.8-liter ohv V6	Improve seat shape	8.9	Number of vehicles owned:		Dealer repairs satisfactory?	
	Increase gas mileage	8.3	Bobcat only	34.1%	Yes	61.5%
	Increase rear legroom	7.8	Two cars	47.4	No	38.5
Transmissions:	Dealer service opinion:		Three cars	11.8	Age distribution of owners:	
Four-speed manual	Excellent	36.1%	Four cars	5.2	15-29 years	34.0%
Automatic	Good	30.6	Five or more cars	1.4	30-49 years	32.5
Why did you choose the Bobcat?	Average	12.6	Makes of other cars owned:		50-plus	33.5
Economy	Fair	9.3	Ford	23.9%	Would you buy another Bobcat?	
Styling	Poor	11.5	Mercury	20.3	Yes	66.1%
Size	Workmanship opinion:		Chevrolet	19.6	No	33.9
Price	Excellent	26.7%	Buick	9.4		
Specific likes:						
Handling						
46.8%						

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



Illuminating options for any outing: At top left, mini kerosene lamp and tent light can sit or hang; scout candle uses wax and cardboard wick in tuna can; flashlight, Eveready Swivel Lite and two spotlights use batteries. At bottom, Lowrance spot-and-flood can be recharged; wick lamp uses lighter fluid; hanging candle lantern shields flame; emergency extension light uses lighter socket. Larger table lamps, Ashflash and utility headlamps are behind long-burn candles and palm flash. Spotlight that mounts on 6-volt lantern battery even burns underwater.

New light for camping

Improved gear sheds a brighter glow for outdoors after dark.

by Bill McKeown
OUTDOORS EDITOR

Camp light used to mean a flashlight and a Coleman lantern. Improved models of these nighttime standbys are still first choices after dark, but there are now a number of other bright options, and a well-equipped outdoorsman carries several. Coleman's latest, 76 years and 28 million lanterns since the first one, is called the 275 and has frosted globe stripes for softer light. Accessories include a tree bracket that will hold the lantern out so it won't singe the bark. Reflectors for some models keep glare away from neighboring campsites.

But the real trend is to LP-gas

lanterns small enough to backpack, battery lights of assorted sizes, head-band lamps that leave both hands free for cave climbing or pitching a tent at midnight. Some camp stores even carry miner-type carbide lights that are inexpensive to burn and are available for use either as hand or headlamps.

Backpackers, who add up every ounce, may choose a palm-size flashlight and small camp light like the Primus Explorer Minilanter with cartridge can of propane gas that

can be switched to an infrared heater head or a tripod pack stove. Some hikers are changing from alkaline to MSR lithium batteries. Though one D-cell costs \$7.75, the dependable double life is reported to be worth it.

Car campers and RV owners are in luck. Old-fashioned kerosene lamps, cigaret-lighter extension-cord lights, dual-purpose battery/110-volt fluorescent and standard lamps are all suitable. For all campers, long-life 45-percent stearic acid candles are always in style. ★★★



Latest lantern from Coleman's long line, twin-mantle Model 275 gasoline burner, has semi-defused globe, new styling. Primus Explorer Minilanter, right, regulates from dim up to equivalent of 75-watt bulb, can hang from chain, weighs just over a pound with eight-hour cartridge can.



Protect your boat from the 5 big hazards

Theft, fire, sinking, explosion or going adrift can be guarded against today.

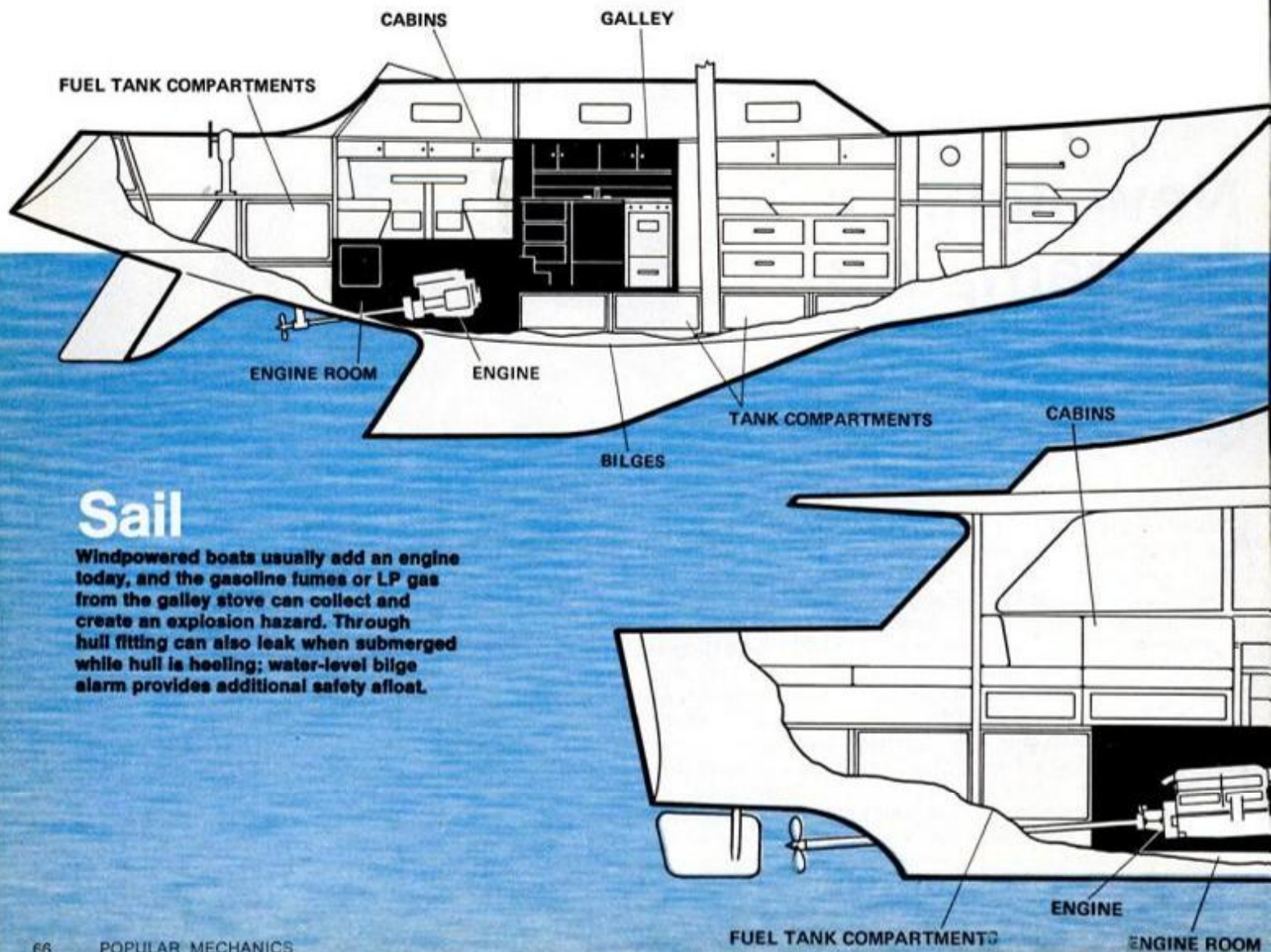
by Mort Schultz

The statistics are scary. According to Coast Guard figures for the years 1970 to 1974, there were 2038 pleasure-boat accidents that involved flooding and sinking, 737 fatalities, 146 injuries, and \$4,973,200 in property damage. Fire or explosion of fuel aboard recreational craft caused 1705 accidents, 85 fatalities, 662 injuries and \$13,845,000 worth of property damage.

"Early warning detection alarm systems can prevent many accidents and deaths," states Lt. Frank Sambor of the Coast Guard's Boating Safety Branch on Governor's Island, N.Y.

By discovering well in advance that danger is building up, a boat owner could ventilate an engine compartment to purge fumes, repair a gas leak, plug a leaking hull, or simply make for shore as fast as possible.

Though there is no law that requires a boat owner to outfit his craft with warning systems, in light of statistics it's clear that those who don't are flirting with danger. No one is immune to explosion,



Sail

Windpowered boats usually add an engine today, and the gasoline fumes or LP gas from the galley stove can collect and create an explosion hazard. Through hull fitting can also leak when submerged while hull is heeling; water-level bilge alarm provides additional safety afloat.

drowning or hypothermia (sudden loss of body heat from intense cold). The hazards of exposure to the cold are suspected of claiming the lives of hundreds who suddenly find themselves in the water, and the Coast Guard estimates that one-third or more of all drowning deaths result from this. It's apparent that bilge flooding and subsequent sinking and explosion or fire in the engine room are major threats to boat and passengers. Fortunately, highly sophisticated and reliable detection-alarm systems are available which monitor both.

Alarm systems come either as single units that perform one function, or console models that monitor a number of functions. Single-unit systems are supplied to accommodate boat owners who need to monitor only one danger. For example, if your boat is powered by an outboard, has an open cockpit with no enclosed engine compartment, and there is no place for explosive fumes to accumulate, you purchase a simple bilge alarm system to warn of a leak. With enclosed engine and fuel-tank com-

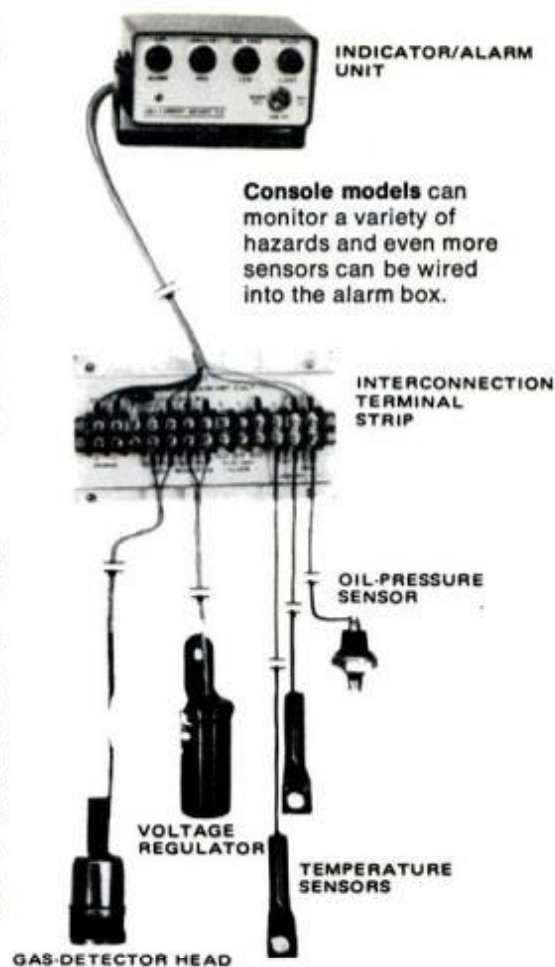
partments, you would want a fume detector to warn of gasoline leaks or spills as well.

Although not as dramatic as a bilge alarm system or vapor-detection unit, sensors that monitor engine oil pressure and temperature serve an important function. If trouble in one of these areas goes undetected, your powerplant will be ruined. Detectors which monitor engine temperature and oil pressure are simple sensors like the ones you have in your car. Afloat, they are wired to an alarm bell or indicator light.

Burglar alarms, too

There are also available as single units or in consoles with other detectors fire and intrusion (burglar) alarms. Fortunately, most pleasure boats are small and open enough so that passengers and crew can spot fire in its early stages. If you wish the protection of a fire-alarm system and none is offered by your marine supply store, you can investigate equipment made for the home. Most are detectors that sniff smoke created

(Please turn to page 126)



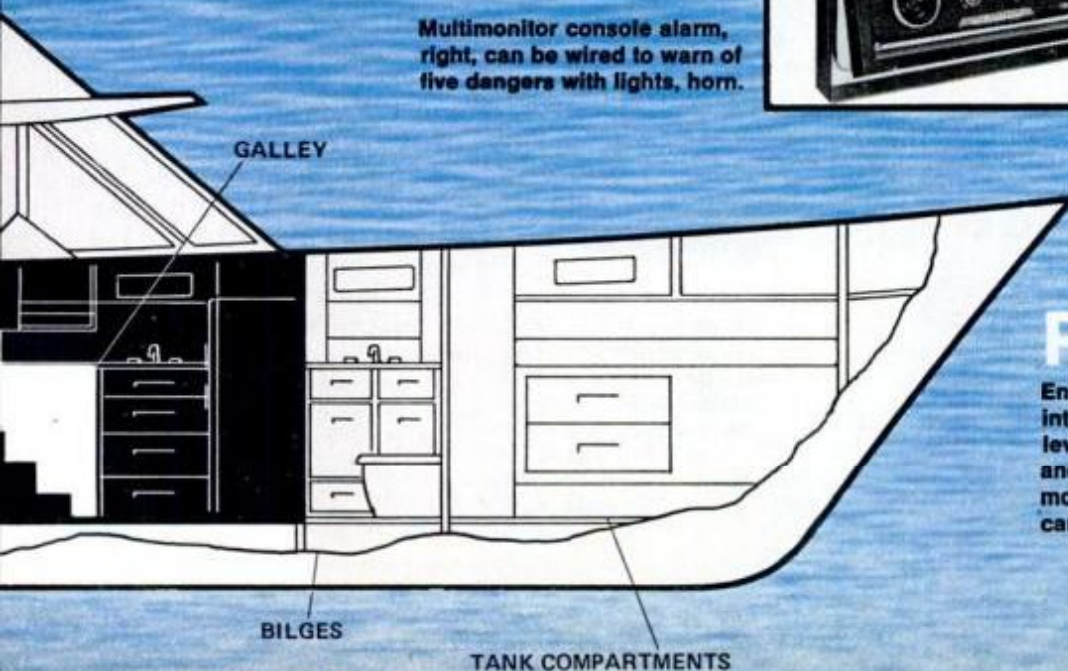
Fume detector alarms can sense explosive gas conditions. Sensor should be placed in engine room or bilge where explosive fumes accumulate.



Multimonitor console alarm, right, can be wired to warn of five dangers with lights, horn.



Sensors, like the three above that warn of fire, oil-pressure drop or engine overheating, can be mounted as required and wired to alarm signals.

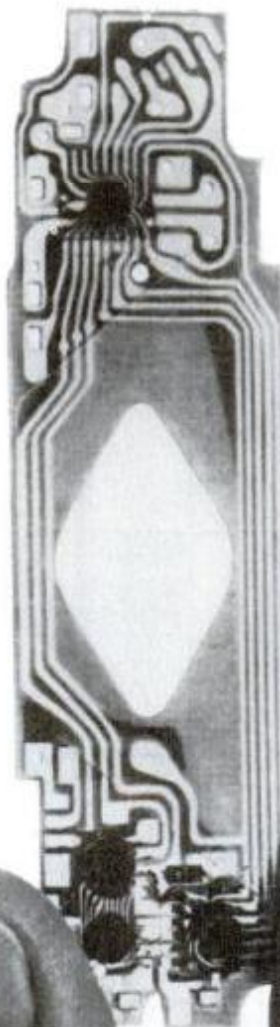


Power

Engine heat and engine-room fumes, intrusion into cabins, rising water level in bilges, vapor from fuel tanks and galley gas, parting of dock and mooring lines are all dangers that can now be monitored electronically.

New electronics make photography a snap

by Ron Schneiderman

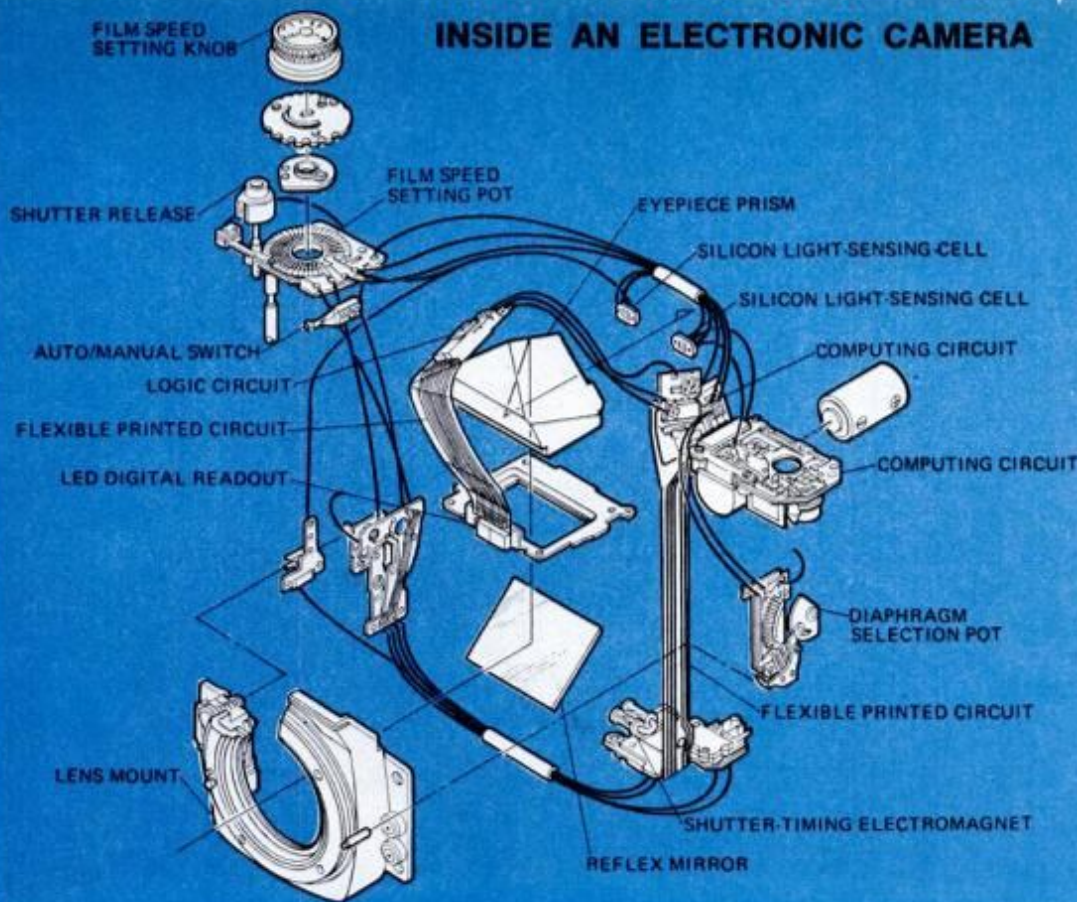


Integrated circuits (left) shrunk the sea of circuitry beneath Polaroid's SX-70 (top) until all its functions would fit inside the camera in boards like the one at left. Even cameras that look more conventional (above) are electronic, now.

The simple camera is disappearing—the camera that's simple on the inside, that is. The insides of cameras from top-of-the-line 35-mm reflexes to the smallest 110 pocket models are being stuffed full of complex, miniature electronic circuitry to make their outsides—and their operation—simpler. Not only that, Electronics are making these cameras quicker, more responsive, more versatile, more durable and lighter.

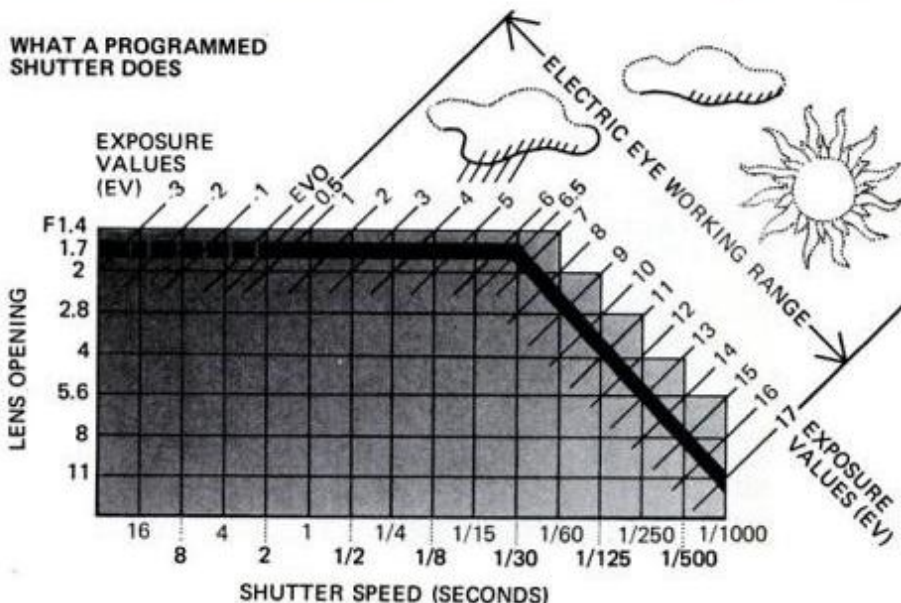
In the past year, at least a third of the 15 million cameras sold throughout the world contained some electronic components: checking and setting exposure, controlling flash recording sound, governing speed

INSIDE AN ELECTRONIC CAMERA



Computer? Not exactly—it's the electronic heart of Fujica's ST-901 reflex. The computing circuits weigh the light readings they get from the silicon blue cells against the 7-stop setting you've selected and the film-speed (ASA) setting you've programmed into the camera. Then they send out two sets of directions: One set, through a circuit in the near upper corner of the camera, tells an electro-magnet how long to hold the shutter open. The other set, through a logic circuit just above the eyepiece prism, tells a 3-digit LED readout to display the shutter speed that has been selected.

WHAT A PROGRAMMED SHUTTER DOES



Programmed shutter changes both f-stop and shutter speed to minimize problems of focusing and camera-shake; set of blades doubles as shutter, diaphragm.

running motor drives and synchronizing the cameras' own internal operations.

The reasons for all these features should be obvious: The easier they make it for you to get good pictures consistently, the more cameras and film you'll buy.

More compact, durable

But the reasons why these features are electronic may not be so obvious. Every time mechanical parts are replaced by electronic ones, the de-

vice becomes more compact, more durable, and better able to withstand vibration, shock, dirt and dust. They need less maintenance, too (ever hear of a transistor that needed oiling?)—if you don't count battery replacements.

Sometimes, the replacement of mechanical components by electronic ones is visible, as when light-emitting diodes (LEDs) replace the fragile, mechanical meter needle in a 35-mm reflex (page 182, Nov. '74).

(Please turn to page 134)

Spend a few nights (and dollars) building the kits on these pages, and your car will be a bit less likely to be burglarized, somewhat less likely to be run into if it breaks down on the road at night, and a lot less annoying to drive in a drizzle.

Burglar alarm

The break-in insurance comes from Heath's GD-1157 Auto Intrusion Alarm, which can either blow your car's horn or set off an optional siren whenever anyone opens the hood, trunk or doors. Once the alarm is armed by a convenient but hidden switch, you can leave the car and re-enter—but if you don't disarm the alarm within 1 to 30 seconds (it's adjustable) after re-entering, the alarm screams its head off for two minutes.

After two minutes of blaring, there's little chance that the would-be thief will still be hanging around, so the alarm shuts itself off—no sense in keeping the neighborhood awake or running down your battery. But it rearms itself in case of another intrusion.

If you should reopen the door after it rearms itself, the alarm goes off at once, letting you know that someone's been there before you.

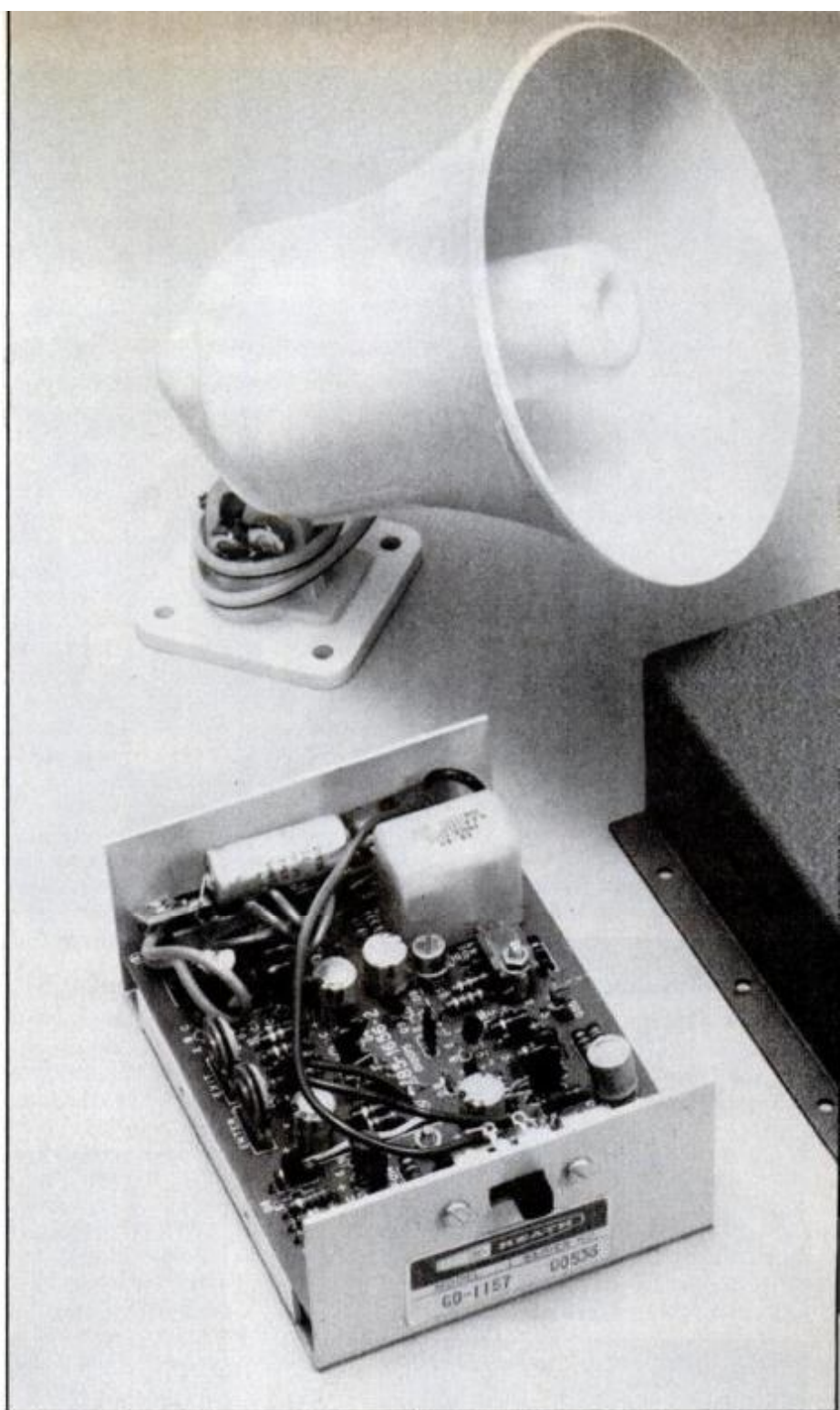
The basic alarm costs \$25, plus \$3 for a horn relay if your car doesn't have one already. The siren adapter (whose circuitry fits on the main alarm board) is \$20 more. It takes a bit over two hours to assemble the alarm and siren adapter, and about an hour and a half to install them. Heath's installation instructions would seem to cover just about any car made.

Emergency flasher

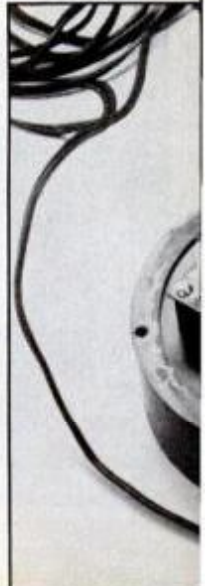
Heath's GD-1026 Emergency Strobe Light will fit any car that has a cigarette-lighter socket for power (you could also tap in elsewhere, if you had to). The light's magnetic base clings to any metal surface—car roof or trunk lid. If you break down on the road, just unfurl the 12-foot cord from its neat hiding place inside the base, screw the rubber-covered magnetic baseplate back on, place the light on your car and plug the cord into your lighter socket.

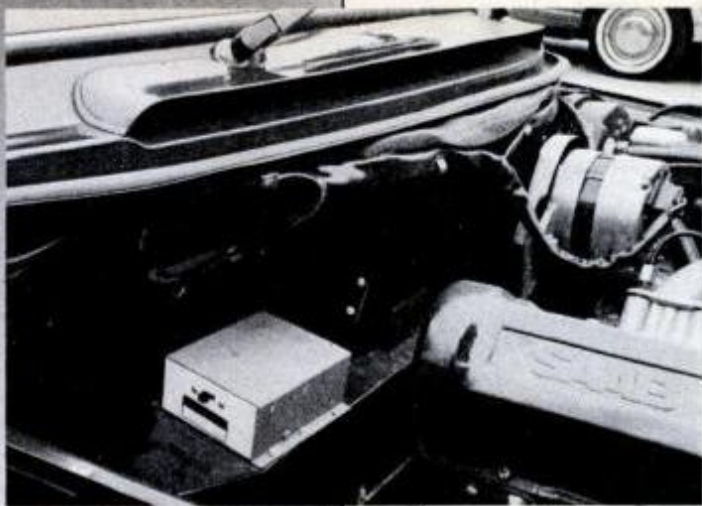
The bright strobe light is visible for a considerable distance through its amber lens. The light costs \$30 plus an hour or so of your time. My only cavil is that its magnetic base can pick up a lot of metal particles when stored in your trunk, so cover

(Please turn to page 116)



Emergency strobe light from Heath plugs into your lighter socket, clings magnetically to your roof, and flashes brightly to tell other motorists you're stopped. Its 12-foot cord stows in the base when not in use. Kit takes about an hour to build, costs \$30.

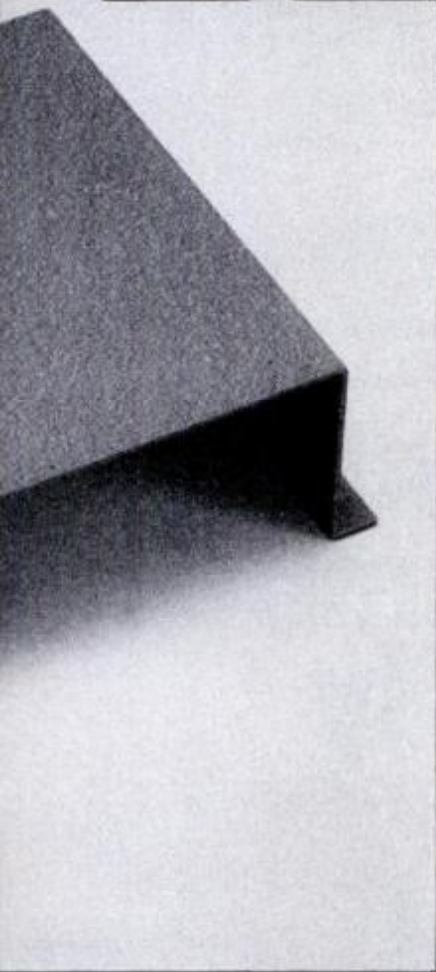




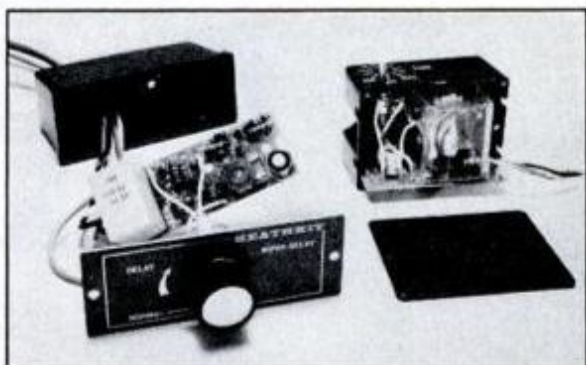
Car alarm goes off if your doors, trunk or hood are opened, but gives you time to re-enter quietly and turn off its hidden switch. Main circuits, shown, can be hidden beneath a locked hood or in the trunk. Optional siren goes under the hood, and switch is hidden inside the car.

4 kits for car safety and security

by Ivan Berger
ELECTRONICS EDITOR



Photos: Benn Mitchell



Wiper delay kits operate your windshield wipers intermittently on damp days to prevent streaking. Heathkit (above) mounts above or below dash with double-stick tape or swing bracket supplied; Amtron (left) mounts with screws; if mounted below dash, its dial markings will be upside down, as shown. You can put either together in about one hour.

Totaling them out



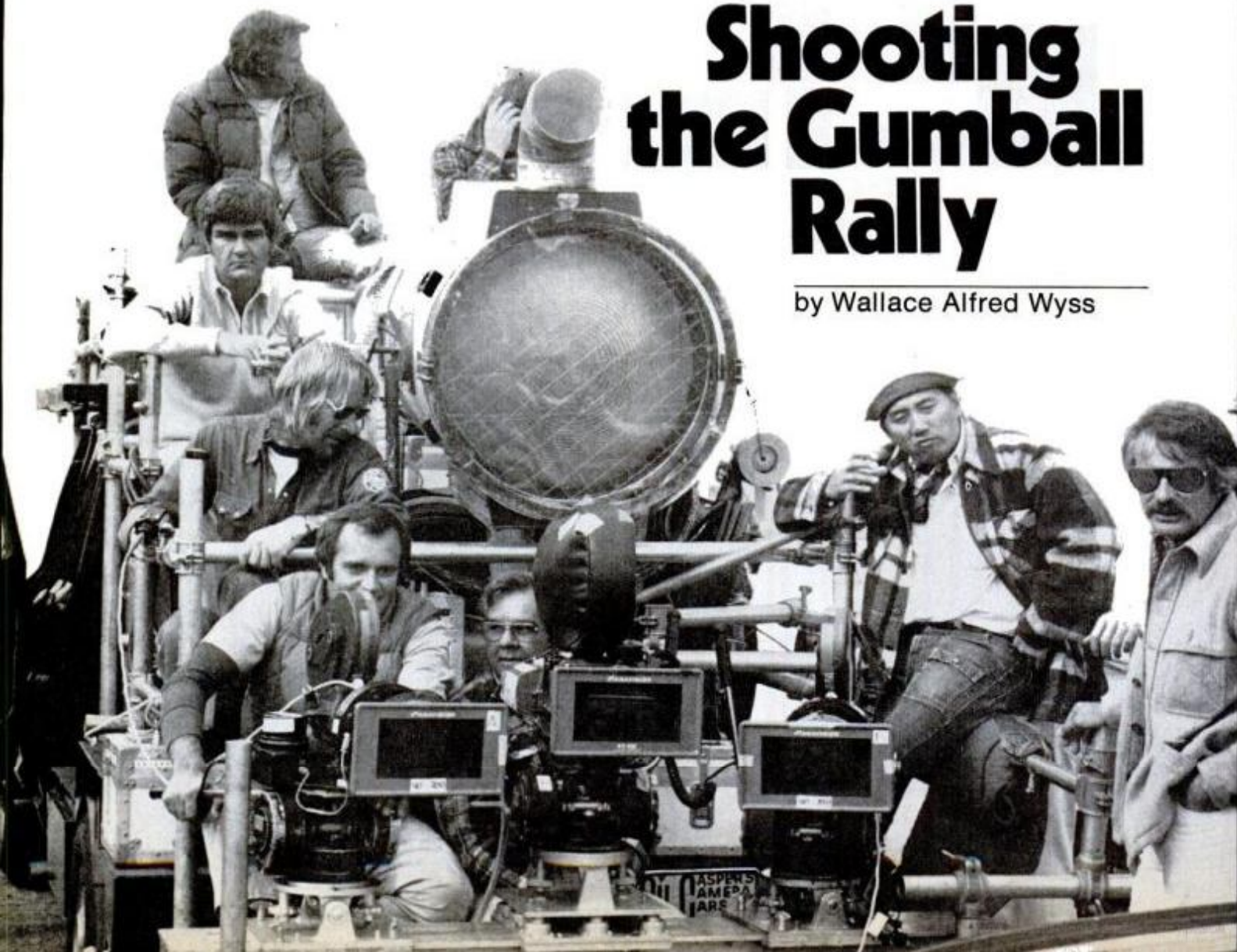
It had to happen. The ultimate driving movie. Oh, there have been movies *with* driving, like *French Connection* or *Vanishing Point* or *Bullit*. But never a movie about what's happening right now, out on the street from coast to coast with America's outlaw racers:

"I was reading the paper one day and there was this article about a bunch of screwballs that drove from New York to the West Coast in 30-some hours," recalls Chuck Bail, a Warner Brothers producer-director. "I thought it would make a good con-

(Please turn to page 122)

Shooting the Gumball Rally

by Wallace Alfred Wyss





Crashes and smashes in movie are funny and not fatal. In sequence, far left, Corvette gets launched over a ramp disguised as roadside construction and breaks in two. The hot Camaro above has enough power to wheelie, gets up on two right-side wheels using ramp hidden from camera, and ultimately turns turtle. The motorcyclist at left has most crashes in movie: through billboards, shop windows and finally into the Pacific Ocean.

Tricks and tactics



Anything goes in the race to win the Gumball: Linda Vaughn, known to race fans as Miss Hurst Golden Shifter, is hired by one driver to drive other competitors to distraction. Here, director Chuck Bail poses her. At top right and center, Ferrari enters moving truck for service before taking to road again. Cobra at right races through riverbed.

The real Gumball Rally

The controversial Cannonball Baker Sea-to-Shining-Sea Memorial Trophy dash was dreamed up by Brock Yates, senior editor of *Car and Driver*. It's the real-life, coast-to-coast race that's the basis of the soon-to-be-released movie *Gumball Rally*.

The name Cannonball Baker was to honor the real "Cannonball," a legend in his own time, who used to make coast-to-coast runs to publicize various makes of cars and motorcycles in the teens and 20s. Back in the '20s, seven days was a good time coast to coast. Now it's 35 hours.

The first Cannonball was run in May 1971 and the next two in November '71 and '72. Yates himself won the second '71 event, sharing co-driving tasks with Dan Gurney, former race driver and one-time PM columnist. Their time was just under 37 hours from the Red Ball garage in Manhattan to the Portofino Inn in Redondo Beach, Calif.—traditional beginning and end points.

The last event, run in the spring of '75, drew over 60 entrants. Yates, who runs the thing as a lark and as a protest against the 55-mph speed limit, decides who can enter based upon their driving experience. It helps if you've been involved in preparing race or rally cars and have some hard driving under your belt.

Equipment is up to the driver. Some ran modified vehicles, like the Ford van with the huge gas tank; others ran cars that looked box-stock except for the CB radio and radar detector.

'75 winners averaged 81 mph

A Ferrari Dino Spyder was one of the most expensive cars entered in the 1975 Cannonball and it won in 35 hours and 53 minutes, averaging 81 mph. Peak speed was in Texas, where the drivers claimed 145 mph.

The drivers would have taken even less time if they hadn't lost a half hour in Ohio being fined \$250 by a magistrate and another half hour in the Midwest changing sparkplugs.

But not all the "fast guns" have a pedigree like a Ferrari. Almost unnoticed, the second-place vehicle was a gold '73 Chevrolet pickup truck with a camper shell on back.

Third was Yates himself, driving his Dodge Challenger, an old '72 model which, despite such mods as a wall-to-wall auxiliary gas tank in the trunk, a special suspension, and a transmission-oil cooler, didn't do as well as it did in '72 when it finished second. Yates lost half an hour hiding from a cop on the Pennsylvania Turnpike and admits that this event was roughest because his co-driver "forgot the sandwiches." They finally gave in around Oklahoma and bought a hot dog apiece, losing precious minutes.

The Cannonball Baker is an outlaw event, but has been a safe race from the beginning—unlike the movie which is loaded with crashes. I think Yates has become wary of encouraging the monster he has created, and discourages entrants. But I'm sure he continues to pore over U.S. maps with the same intensity as Old World explorers hoping to find a passage to India. He's looking for a 500-mile shortcut that will win him back his Cannonball crown.

—W.A.W.

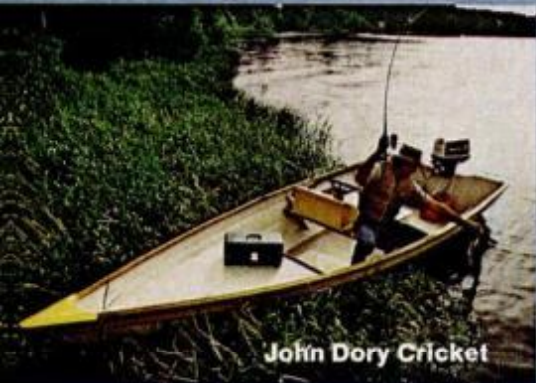


Gadfly Sailer 14
Bonair III

Bombardier 3.8



Guppy 13



John Dory Cricket

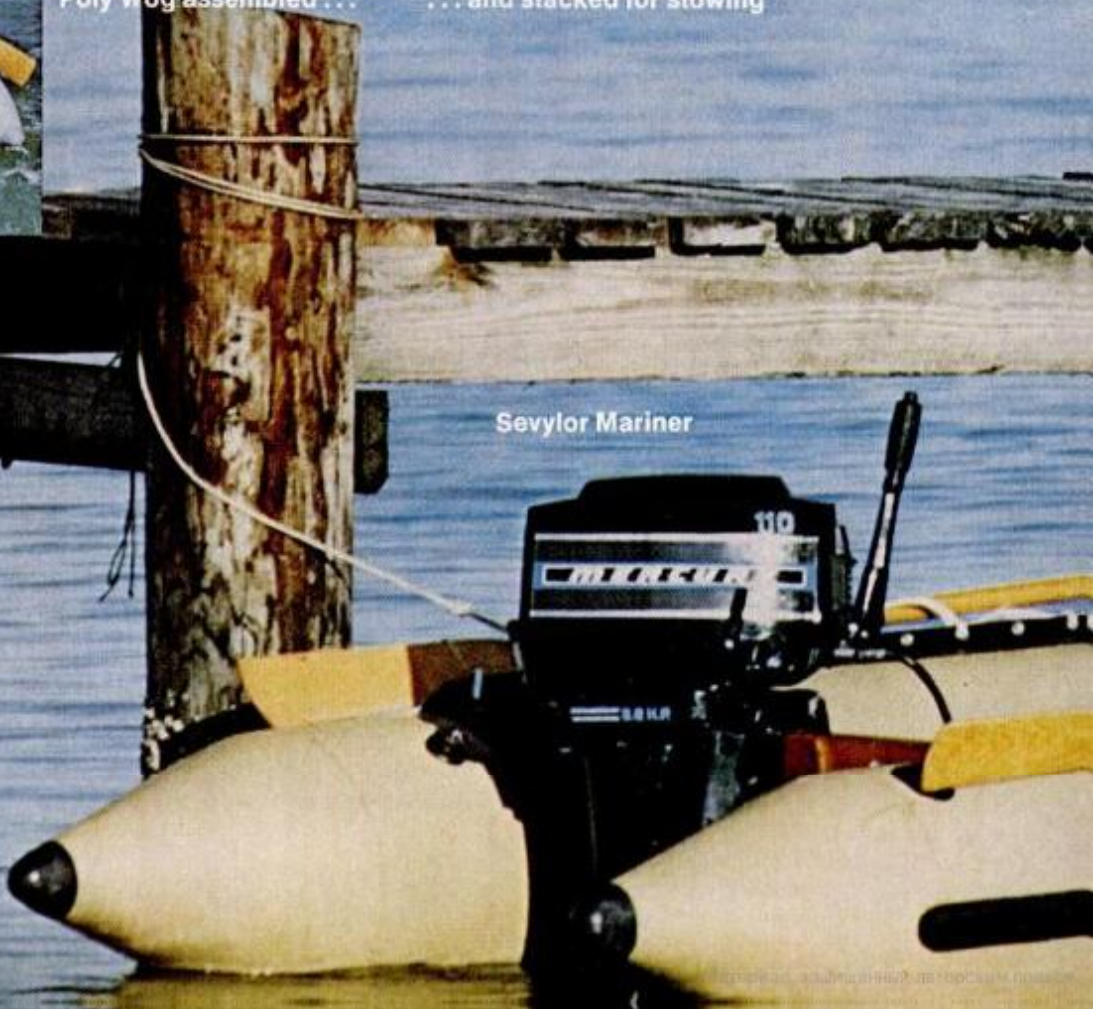


Poly Wog assembled ...

... and stacked for stowing



Zodiac Runabout



Sevylor Mariner



Your best bets in bargain boats

Lower-cost smaller craft are easiest to trailer, launch, sail, power and pay for.

by Bill McKeown BOATING EDITOR

Little boats don't cost less this year, but the right ones pack more action for the money. Selected here are samples of some versatile models that are simple to get to the water and large enough to provide safe boating under suitable conditions—bonus babies that can go cruising, fishing and frequently sailing without a budget-breaking investment. Good quality keeps down maintenance costs, and the small size simplifies storage and launching, thin-water exploring and tagging along behind a bigger boat. Big savings come from small fuel consumption, easy maintenance, and no boatyard bills at all if you pick one of our fold-up choices that can fit home in the

Gadfly 14 from Cat Marine opens stow-box into runabout or adds sail.

Bónair III, largest of Bonair Boats' Inflatables, can handle up to 40 hp.

Bombardier 3.8, an unsinkable 12½-foot self-bailer has 66 feet of sail.

John Dory Cricket is a 16-footer with steering console, casting deck.

Zodiac Runabout is one of 17 models that inflate to take 4 to 115 hp.

Poly Weg, from Todd Enterprises, can come apart to stow in car or on deck.

Guppy 13, Melen Marine's mini, can sleep two in cabin, take 2-hp kicker.

Sevylor Mariner K-88 inflatable is 90-lb. 11-footer taking up to 10 hp.

closet, attic or garage during off-season. A model that can ride in the car trunk, atop a car or on a trailer can head south with you during a winter vacation and make boating an every-month sport.

Inflatables

Pick your best buy in blow-ups by specifications instead of price. Inexpensive models may stiffen and rot quickly after exposure to sunlight, gasoline, salt and even storage. Thin vinyl toys are fun for a pool, but they puncture, abrade and tear easily if beached over sand, rocks and barnacles or if bumped into snags and floating branches. So a good inflatable is not cheaper than a conventional hull of fiberglass; just more versatile. In addition to compact storage, your pump-up runabout doesn't dent the sides of a bigger boat when used as a dinghy, has low freeboard so it's easier for swimmers and skin divers to board and can run white water where it must bounce off the rocks. Models like Gladding's little 12-pound Float Pac dinghy are small enough to backpack; Leisure Import's Pyrawa canoe sells for under \$150.

Big rugged runabouts from Bonair Boats are made of nylon coated with PVC, and all six models can handle outboard power. They sell from under \$700 to \$1200 plus, and the big

14-foot Bonair III can carry up to 1130 pounds and mount 40 hp. Imported Zodiacs run from less than \$500 for a dinghy to nearly \$5000 for a 19-footer. Several 7 to 12-foot models from Sevylor U.S.A. can also be rigged for sail.

Sailboats

When the twin hulls of a catamaran are big, inflatable, parallel tubes, you have an incredibly stable sailboat. As a little runabout that can take 15 hp, the Water-Bug from Recreational Boat Co., Box 522, Franklin, Mich., is \$387 and has an optional sailing conversion. It can be ordered as a \$150 kit with plywood for deck and superstructure bought locally.

The Gad-Fly 14 unfolds from an ABS box that turns into a cockpit deck mounted on two 14-foot tubes. Easy to cartop with pontoons deflated and packed, the 110-pound boat assembles to take up to a 7½-hp outboard and 750 pounds of passengers. The basic runabout is \$750 from Cat Marine, \$1050 with single sail and rig.

Want really compact cruising under sail? The Guppy 13, at \$2210 from Melen Marine, Ltd., Canoga Park, Calif., uses a 2-hp outboard when the wind goes down, has 6-foot, 8-inch bunks for two and can roll to the launching ramp on

a matching trailer. And for lots of sail action on a limited budget, the sailing surfboard, like AMF Alcort's Sailfish and Sunfish, is well under \$1000. The \$795 fiberglass Bombardier 3.8, a newcomer, offers a small cockpit and weighs 110 pounds.

A dinghy that comes apart for storage in a 2x4-foot space, yet fits together for easy rowing, the \$165 Poly Wog made by Todd Enterprises, Cranston, R.I., is one of the new minis that make for easy handling. The 16-foot Cricket, designed for fishing or skiing, is an \$850 example of a good multi-use model.

And for an I/O day cruiser that can convert for overnighting, Glas-tron's T-215 Vagabond Camper at about \$11,000 with full canvas enclosure can't be beat. Offshore sport fishing? Pick one of the new Makos, Seabirds, Aquasports or Black Fins that can rig a tuna tower with remote controls and for \$25,000 or less you're in the big leagues. ★★

Water-Bug inflatable . . .



Versatile fit-together inflatable, the Water-Bug (far right) is available as complete boat at \$387 or as kit, with plywood superstructure added locally, at \$149. Rated for power to 15 hp and load to 700 pounds, the little rig can mount electric trolling motor, sail conversion kit, lights, remote controls and Bimini top. Tuna tower and flying bridge, as on Formula below, can convert offshore cruiser into sport fisherman of compact size, lower price.

Formula 233 Coastal



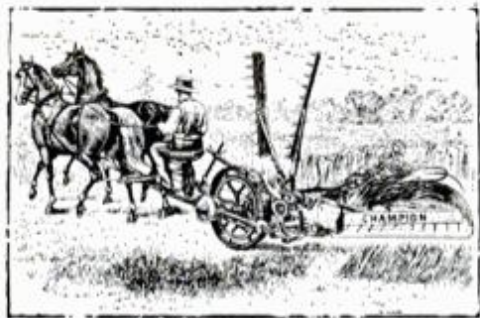
. . . runabout or fish troller



If some of the Bicentennial ballyhoo seems overdone, at least it has not been as boisterous as the buildup for the big bash in Fairmount Park, Philadelphia, 100 years ago. The 1876 promoters were whooping it up with noisemakers well before the event. On the New Year's of '76, notes Frank Leslie's *Historical Register of the Centennial Exposition, 1876*, "... church bells were rung all day, and cannon were fired at five-minute intervals." (The *Register* has been reissued by Paddington Press, New York.)

Thousands milled around Independence Hall, while bands competed for ear space. State House bells rang sequences of 1-7-7-6 then 1-8-7-6, followed by 100 single "bongs" over and over. Fireworks framed "portraits" of our founding fathers, and emotion ran at such a pitch that "dozens of individuals fainted and required medical attention."

A Philadelphia municipal historian, John Maass, who has written



The "Mohawk Dutchman" (top), in a costume of inlaid wood on cloth and a hat of the same with a propeller on top, ground out furniture for the onlookers on an "improved" saw. The Corliss Engine (right) symbolized the "age of steam" and complex machinery that did more and more things—like labor-saving reapers (above). At far right is Machinery Hall.

a book on the subject, *The Glorious Enterprise*, and knows as much about it as anyone, has great admiration for the Centennial entrepreneurs. "It was just as commercial as the Bicentennial," he says, "because that's what centennials are all about. And refined taste at such events is seldom paramount."

Hair portrait and tobacco bell

There were, indeed, the usual Centennial beer mugs, plates, flatware and cheap souvenir models of Independence Hall, he points out. Venezuela displayed George Washington's portrait made from Simon Bolivar's hair, a chewing tobacco company made a Liberty Bell out of tobacco plugs (this time it's liquor bottles) and the apple growers produced the capitol dome in fake apples. An animated wax Cleopatra raised an arm and turned her head to gaze at spectators—in a state, observed William Dean Howells primly, "of extreme dishabille."

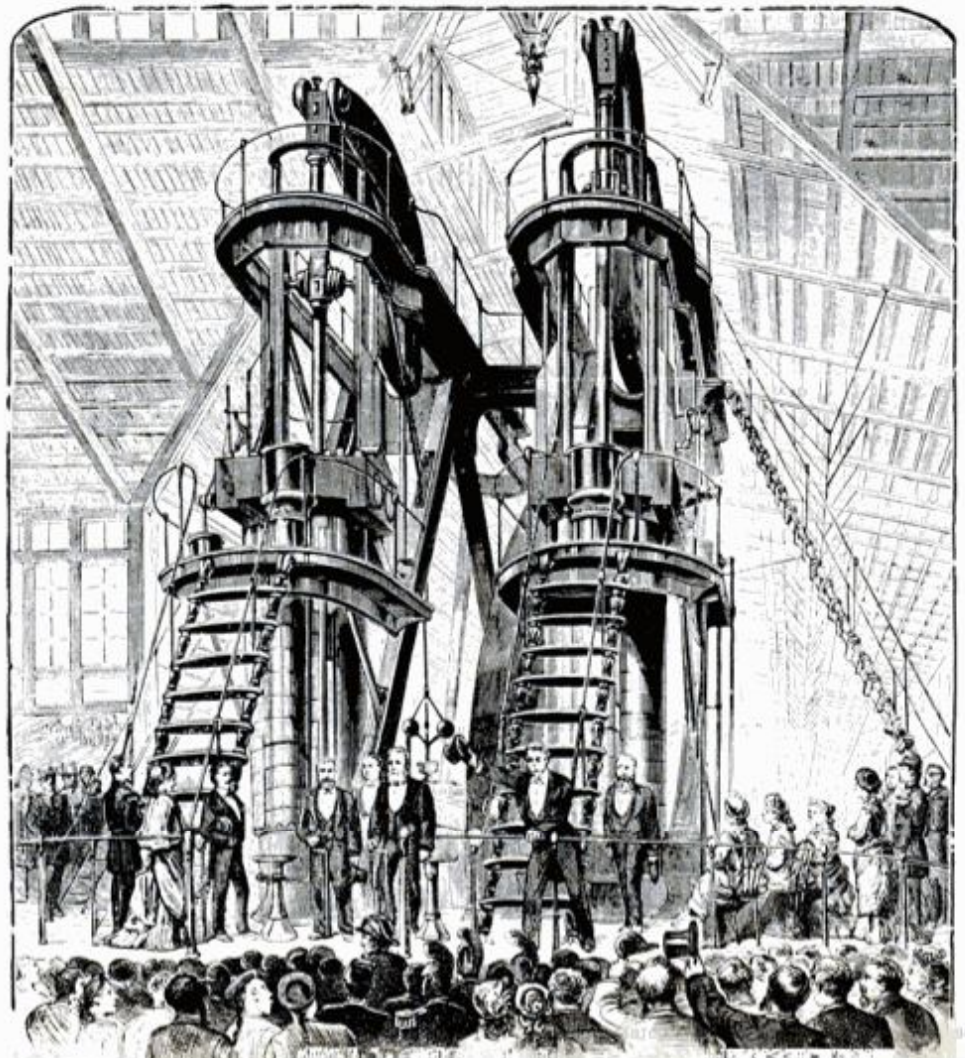
"But," says Maass, "there was a difference. The level of taste steered clear of bathroom and boudoir. For instance, there's an outfit today making a red, white and blue toilet seat that plays *The Star Spangled Banner* when you sit on it."

For the most part the nearly 10 million visitors who swarmed over

the 450-acre grounds and elbowed their way through the 249 buildings, between July 4 and Nov. 10, 1876, were immensely proud of their country and the strides it had made in commerce and technology. They stared with unabashed awe at the marvels of the age: Ethelbert Watts' new portable bathtub of rubberized cloth, which could be toted on a trip like a carpet bag, the Goodyear Co.'s new rubber tubing and cuspidors, steam-driven washing machines and ice-cream freezers, mechanical mangles, icebox refrigerators and a small domestic steam engine from France that could be hitched to sewing machines and other home appliances.

The colorfully garbed Japanese amazed everyone by still using "primitive" methods—including a man-hoisted ram to drive pilings—and no nails to erect their pavilion. "Their plane is flat, and drawn toward them . . . the saw is like a cleaver . . . the chisel a short piece of semicircular steel," said one observer. "But they show great facility . . . and are not such clumsy workmen as the tools might lead one to suppose."

The fact is that the Centennial Fair was acrawl with tidings of the future in exhibits from more than two dozen countries. But far and away the most significant develop-



ments of the age were in the displays of a budding U.S.A., and everyone seemed to sense it:

■ One Alexander G. Bell of Salem, Mass., for instance, visited the Fair to demonstrate his "multiple electro-phonetic telegraph." The device, capable of transmitting several different signals over the same wire simultaneously, was considered a tremendous advance in communications, and people queued up to listen to its musical tones at work. The judges—among them Sir William Thomson who later became Lord Kelvin—were even more impressed by an odd-looking device Bell had brought with him from experiments at Harvard, and which he called a "telephone." He demonstrated it on a Sunday, because the crowds were too noisy on weekdays, and the sounds from his prototype too faint. But Sir William's comments to the Awards Committee raved: "We may confidently expect," he wrote, "that Mr. Bell will give us the means of making voice and spoken words audible through the electric wire to an ear hundreds of miles distant." Something like that appears to have happened.

■ Young (29) Thomas Alva Edison of Newark, N.J., was also there and got an award for his "Quadruplex Telegraph" that could send four telegrams at the same time over a single wire. An outfit called Western Union Telegraph Co. grabbed it. A year later, Edison's "phonograph" was born, and two years after that he lit the world with his incandescent lamp.

■ Then there was George B. Grant, an unknown genius from Penn-

sylvania. He was on hand with a "mathematical device" that he called a *Tabulating Calculating Machine, or Difference Engine*. For years this forerunner of the modern-day computer was put to work computing tables of logarithms and performing other work at the University of Pennsylvania, until the physics department moved in 1946 and built a new calculator based on electronic principles.

■ One of the concessionaires on the Exposition grounds was a chemist chap who recently had opened a pharmacy in Philadelphia. A few years earlier, while he had been

honeymooning in New Jersey with his bride, the hostess of the farm boarding house where they were staying served an "herb tea" that the young couple thought was great. She gave them her recipe and took them out in the woods to identify the roots, plants and berries that she used in the beverage. There were some 16 ingredients.

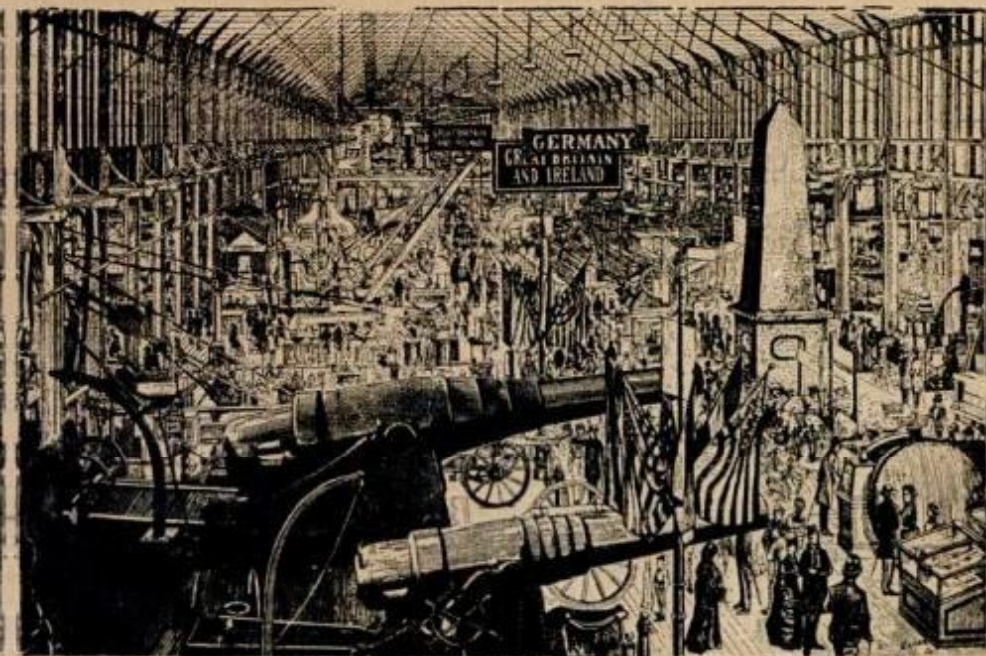
The chemist returned to his pharmacy, experimented with the "herbs" and concocted a tasty fizz beverage that soon became the rage of his own soda fountain. So he invested in a "pop" stand on the Centennial grounds and gave away free samples of his new soft drink to all the thirsty people who soon thronged around his booth. Next thing you know, he was in business. The man was Charles E. Hires, and the beverage was "Root Beer."

■ The Centennial's real symbol of the steam age, however, was the great Corliss Engine in Machinery Hall. It had been designed and built for the Exposition by George H. Corliss, a Rhode Island manufacturer and self-taught mechanical wizard. The huge steam-driven monster towered 40 feet high and powered all the machinery displayed in the 13-acre building. The thing weighed 700 tons. Its potential 2520 hp was delivered from 20 steam boilers in another building to the giant twin pistons. These drove a spectacular steel flywheel 30 feet in diameter that rotated silently between the sliding pistons at 36 rpm. Eight driveshafts,

How far have we come since the Centennial Exposition?

At the 1876 bash, Mr. A. Bell demonstrated something called a "telephone." Charles E. Hires promoted a new pop named Root Beer. Folks rode in demonstration elevators, and the popcorn concession went for \$7000. Fact is that a good many exhibits were the forerunners of today's "wonders."

by Richard F. Dempewolff



totaling two miles in length, transmitted power to individual machines on the floor via belts and pulleys, in one of the most fantastic Rube Goldberg's the world has ever seen.

■ In 1876 railroads were booming. The B&O's proud new No. 600 passenger engine was displayed beside the road's 1835 No. 6 "Grasshopper" that could tug 115 tons on level bed at 15 mph. The exhibit symbolized 40 years of rail progress. No. 600 weighed in at 90,400 pounds with double-riveted boiler and 19-inch cylinders. It could haul a six-car train up the steepest grades at nearly 20 mph "without a helper."



Japanese hadn't even seen machines yet.

■ The "Prismoidal Monorail"—a new concept in railroads—carried Exposition visitors across a ravine to Lauber's Restaurant. Cars and engine (steam, of course), each with one wheel fore and one aft, rode atop a single rail. Besides a row of benches on each side, the cars had a second deck in the center, halfway between roof and floor—hence, "prismoidal" (see sketch at bottom of facing page.) Conceived by its inventor, Roy Stone, as a "solution to rapid transit in cities, or a cheap country railroad," it was later installed on some four miles of track in Sonoma, Calif. For all anyone knows, it's still there—the first of many monorails that never "made it" in California.

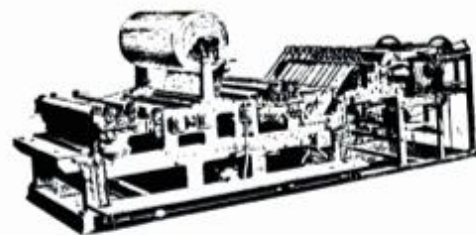
■ Pennsylvania Railroad had models of new double-walled "refrigerator cars" with an ice chest at each end for hauling perishable foods, and a layout of its latest methods of handling a fast-growing demand for liquid fuel—petroleum. It was carried in cars made of "wrought-iron boilers on trucks," each with a manhole, expansion dome and a 3600-gallon capacity. Oil was thus transported to



Brazil's Emperor tried Bell's "telephone."

"bulk boats which carry 50,000 gallons."

■ Luxury travel was approaching the height of opulence, accompanied by a splash of Yankee ingenuity. Visitors gawked through two of Pullman's "Palace Cars," featuring polished paneling with "bouquets of flowers made of inlaid pieces of wood in different colors." Canvas ceilings were frescoes of leaves and flowers. Berths could be "closed up and put out of sight . . . or let down for the night to form two-tiered beds with rich hangings of crimson, blue and gold." When transformed into a dining room, each "apartment" was broken into sections with a table and seats for four. "The brakes," observed one impressed reporter, "are the Westinghouse patent. On each side of the wheels is a large flange which, should the car run off the track, will catch on the rail and prevent it from going further." A new automatic car coupler allowed trains to be made up ". . . without the



Hoe's press printed both sides at once.

necessity of the brakeman to get between the cars."

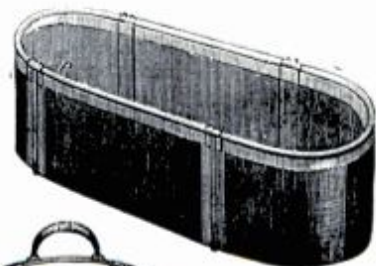
■ New and improved automated farm machinery was everywhere. Reaping machines now left the grain in windrows; automated corn shellers, harvesters, threshers—all did something new or "better." One cultivator had an attachment for eradicating potato bugs—"Rather a curious exhibit," observed one visitor.

■ More "remarkable" were the brand-new "over-the-road" and farm

"steamers," which the maker claimed could haul "six or seven heavily-loaded wagons over rough roads, or drag six plows at 4 mph or 600 pounds of coal a day and one man or boy to run them."

■ Oddly, except for these and steam-operated fire engines, which had been around for some time, there were no power-driven "carriages." France however, had an astounding display of sketches of a steam-carriage built and road-tested by Cuquot about 1770—more than 100 years earlier! It carried four passengers at 3 mph for 12 minutes before having to stop to build steam. After a "top speed" accident in the streets of Paris, it was locked up in the city arsenal as "dangerous."

■ On the seas Britain still was queen, and steam was her crown prince. A big model of her new City of Berlin drew huge crowds. The great ship, 523 feet long, 44 abeam, with an indicated 5000 hp and 15-knot speed, had just made the fastest



A portable tub for bathless hotel rooms.

run ever from New York to Queens-town—7 days, 18 hours, 48 minutes.

■ There was great excitement over the exhibit of a lateen-rigged "iron" lifeboat that was noncapsizable. It boasted luxuries no one ever had seen before in a lifeboat—"covered accommodation for females and children, arrangements for water-saving, mail box (!), and required no lowering device." It was designed to be dropped overboard by hawsers.

■ William Hewitt of Bristol, England, displayed a working model of a unique feathering propeller that worked on a mechanical gearing system that could be controlled from below, on orders from the pilothouse.

■ Some developments in Britain's

marine department were pretty far out. Mrs. Henrietta Vansittart of Twickenham exhibited her "screw propeller system" called the "Lowe-Vansittart Curved Line or Three Pitched Wave Line, Non-vibrating, Full-backing, Economical Screw Propeller." There is no explanation of what it did, or how.

■ Closer to the hearts of most country and suburban folk were elaborate tool chests, new steel planes, augers, drills and other hardware. Prefab materials were beginning to show up in items like wire work, cornices and architectural ornaments—not to mention "casket trim."

An interesting innovation was "wood carpeting." It was made from "... woods one-quarter of an inch thick, backed with canvas, and produced in ornamental designs of every description." It could be rolled out like carpet and laid on a floor to simulate parquet inlays that were the rage but beyond the means of most people.

■ But machinery was the order of the day. The bigger and more complicated it was, the more the crowds liked it. Mobs gathered to watch Messrs. R. Hoe & Co. demonstrate their new "web" press that took a roll of paper 4½ miles long through the machinery at 750 feet a minute, printed both sides as it went, then cut and delivered six papers at one time.

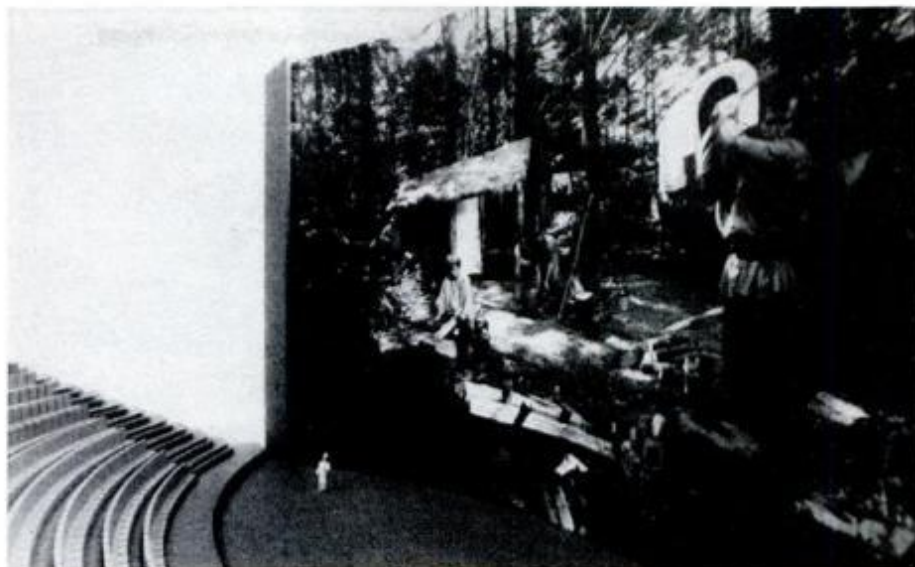
■ Intrigued groups gathered to see "The Stone Monarch"—a new 64-inch circular saw studded with diamonds—slice through solid blocks of

[\(Please turn to page 139\)](#)



Prismoidal Railroad that carried Centennial visitors to a nearby restaurant was one of America's first monorail experiments.

SEEING THE CENTENNIAL ON THE WORLD'S LARGEST SCREEN



just the beginning. From that point on the viewer is swept through 200 years of vignettes on outstanding events in American history—among them the big Centennial.

If you weren't around for the Centennial in 1876, don't fret. You still can experience a visit to Machinery Hall—as it was then, people and all—at the Living History Center (bottom left, above) of Philadelphia's Bicentennial Exposition. It's a replay of the big show a century ago in Francis Thompson's superspectacular film, *American Years*, displayed on the 70-by-93-foot screen of a "you-are-there" IMAX production. (Top photo shows the size of the screen compared to the figure in the foreground.)

The movie starts with a clatter of horse's hoofs from the rear of the Center's theater. The view on the giant screen, which enfolds the audience, is quiet countryside. There's a sudden silence, and an instant later horse and rider—seven stories high—land on the screen as though they had just hurdled the spectators and gallop away over the meadows. The colonial rider, spreading news of the revolution, is

The incredible size of screen and image in the IMAX system, developed under the direction of Graeme Ferguson, president of IMAX Entertainment, Ltd. of Toronto, is aimed at audience involvement. What makes it all possible is the huge ton-and-a-half projector (center left, above) that measures 6 feet high, 7 feet wide and 8 feet long. Its 12-element optical system has an f/2.4 aperture and 61-mm focal length. The film that runs through this monster is 70 mm—twice the width of standard 35 mm. It travels at the fantastic rate of 335 feet a minute. To handle all the bulk smoothly, the colossal 4-foot-diameter film reels (above, right) work from a horizontal position, and the film is fed past the lens one frame at a time by means of "gathers." A loop is formed as the film approaches the lens and is flattened out against the glass gate by air pressure, insuring a pinpoint-sharp image on the screen.



Oldsmobile Ninety-Eight hardtop sedan has a touch of nostalgia: fender skirts. Standard engine is the 455-cu.-in. V8 with 4-barrel carburetor and Turbo Hydra-Matic with column shift. Wheelbase is 127 inches and weight is close to 5000 pounds.

PM OWNERS REPORT: OLDSMOBILE NINETY-EIGHT

Who needs Cadillac? The Olds 98 offers just as much with a lower sticker price

A nationwide survey based on
923,000 owner-driven miles.

by Michael Lamm
WEST COAST EDITOR

Photos by the author

The Olds 98 shares the Cadillac Calais and deVille body shell. From some angles, the Cads and 98s are hard to tell apart. The big Oldsmobile uses a different engine, but delivers the same net horsepower as the Cadillac V8.

So how close to a Cadillac does the Olds 98 come? Since Oldsmobile dealers often also sell Cads, and since Olds customers often can't help seeing the two cars together in dealership showrooms, it's not surprising that owners compared the two cars on our questionnaires.

"One reason I bought the 98," says a Fort Worth, Tex., executive, "is because it cost \$1900 less than a Caddie."

Echoes a Florida dentist, "For the quality of ride, we tested Buick, Cadillac and Continental. The only superior car was the Fleetwood, and for \$11,000, it wasn't that good!"

An Iowa businessman: "Had been driving Caddies for years. Liked the 98 just as well and figured I might get better gas mileage."

The Olds 98 rates extremely high in two unusual areas. First, when we asked owners to list their specific complaints, an unprecedented 44.2 percent had no complaints at all. That's practically unheard of in this day and age.

Second, when we asked owners to suggest changes in the 98, 33.1 percent said they didn't want the car changed. "Leave it just as it is," scribbled an Illinois restaurateur, and he had a lot of company who felt the same way.

Those who did suggest changes—and less than 10 percent put down anything at all—recommended: 1. Revamping the ashtray, because its present location in the center of the dash is too hard to reach. Changing the seats so the belt/harness catches don't stick up through them, and also dividing the seatbacks to make them reclinable. 3. Design less tuck-under in the bottom of the body so spray and pebbles don't mar the finish.

← The Cadillac Calais spans three inches more wheelbase.

▶ Lots of people with families say they simply need a roomy car.

▶ Praises for economy balanced out disappointments in gas mileage.

▶ Back seats have become almost afterthoughts of late.

In the area of specific complaints (and again, we must stress that only a tiny percentage of owners complained at all), the biggest grumble was lower-than-expected gas mileage. Several people mentioned that the EPA mileage claims make them feel they're being cheated. As usual, our owner survey confirms that the EPA figures tend to be optimistic.

When we asked for specific praises, here are some of the replies we received: "Excellent, excellent, excellent!" wrote a North Carolina housewife. "Performance, spaciousness, comfort, style," said a Houston dental supplier.

"Looks like a Cadillac, rides like a Cadillac, has better acceleration than any car I've owned since 1970."—Michigan heat treater.

A Wisconsin police lieutenant: "I drive over 100 city miles a day and hate driving, but find the 98 at home a pleasure to crawl into."

"Everyone likes the styling; we consider it prettier than a Cadillac."—Dallas evangelist.

"The smoothest-riding car we've ever had—it's just a pleasure to drive. We love it."—Nacogdoches Tex., contractor.

Comfort, in fact, pleased a whopping 93.8 percent of our respondents. The front seat scored 96.5 percent in the very-good-to-excellent range, and more surprising than that, the rear seat came in for 91.1 percent. That's the first time in recent memory that a car's back seat got more than raspberries, and in most cars, even the front seat doesn't please that many owners. Yet here we have a car getting raves for its riding qualities, its seating comfort and its legroom front and rear.

The trunk also took its share of accolades. "I'm glad to be rid of my no-trunk Mark IV and into this 98," mentions a Louisiana rancher. A traveling salesman from Dallas: "I need a car with big luggage space, and this coule

has it. I hear they're going to cut the Olds down 12 inches and 1000 pounds next year, and I say don't do it."

Of Olds 98 owners, 73.7 percent reported no mechanical troubles at all since purchase. Once again, that's high praise. Dealer service rated good-to-excellent with 75.9 percent of those surveyed, and sales policies ranked even higher: 84.2 percent scored it good to excellent. That's why so many customers keep going back. Indeed, the leading reason for buying Oldsmobile was past experience.

"This is my fifth Olds 98," asserts an Alabama retiree. "I've owned Cadillac and Continental, but they in no way compare with this automobile."

"I've driven Olds 98s since 1955."—Midland oil dealer.

"Had 111,000 miles on my 1972 Olds 98, with almost no problems at all, so decided to try another one."—Los Angeles motel owner.

Owners hold workmanship in high esteem

Super service and courteous salesmen make for a lot of repeat buyers.

They're probably right, but interior roominess probably won't suffer at that.

generally. Here are representative comments: "Fit of hood, trunk and doors is good; the plush velour interior is excellent; workmanship on the dashboard is fair."—California manager.

"Good workmanship, car is tight and quiet, very few mechanical problems, appointments excellent."—California salesman.

"Delivered to me very dirty inside, one headlamp out, doors not lined up properly, never should have left the factory in this condition."—Illinois manufacturer's rep.

Several owners mentioned that they felt this would be the last big car they'd ever own. "After they chop down the big cars over the next few years, large luxury American automobiles like this will be just faded memories," declared a Southern California management consultant.

Fully 88.6 percent say they'll buy another Olds 98 next time. Many who said no added "Not if I can upgrade to a Cadillac." ★★

Comfort and roominess were high on owners' list of praise, and they appreciate convenience touches like seat pockets.

The trunk came in for high ratings, and owners also like the engineering features which include the use of soft panels



Summary of 1976 Oldsmobile 98 Owners Reports*

Total miles driven 923,571	Performance 18.5	Poor 4.8	Had any mechanical trouble?
Average miles per gallon	Economy 15.2	Comfort opinion (front seats):	No 73.7
In town (EPA, 13 automatic) 12.1	Specific dislikes:	Excellent/very good 96.5%	Yes 26.3
Long trips (EPA, 17 automatic) 15.7	Gas mileage 8.8%	Good 2.3	What type of trouble?
Series:	Ashtray location 5.4	Fair 0.6	Electrical 22.2
Luxury 98 24.2%	Paint and finish 4.8	Poor 0.6	Carburetor 13.3
Regency 98 75.8	Quality of workmanship 4.8	Comfort opinion (rear seats):	Valves 11.1
Body styles:	What changes would you like?	Excellent/very good 91.1%	Wheel alignment 8.9
Four-door hardtop sedan 67.2%	Handier ashtray 8.8%	Good 4.4	Did you repair it yourself?
Two-door hardtop coupe 32.8	Revamp seat shape 6.6	Fair 2.5	No 100.0
Why did you choose the Olds 98?	Different styling 5.9	Poor 1.9	Yes 0.0
Past experience 41.5%	Dealer service opinion:	Number of vehicles owned:	Dealer repairs satisfactory?
Styling 28.7	Excellent 39.2%	Olds 98 only 35.1%	Yes 68.4
Comfort 11.0	Good 36.7	Two cars 48.0	No 31.6
Ride 9.8	Average 11.4	Three cars 12.3	Age distribution of owners:
Size and roominess 8.5	Fair 5.4	Four cars 4.7	15-29 years 3.6
Specific likes:	Poor 7.2	Five or more cars —	30-49 years 47.5
Comfort 51.7%	Workmanship opinion:	Makes of other cars owned:	50-plus 48.1
Styling 48.3	Excellent 42.9%	Oldsmobile 39.1%	Would you buy another Olds 98?
Riding qualities 38.4	Good 37.5	Chevrolet 33.6	Yes 88.4
Handling 25.8	Average 10.1	Ford 12.7	No 11.4
	Fair 4.8	Pontiac 5.5	

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

Материал защищен авторским правом

New RVs—more inside less

Small motor homes packed with added accommodations are the first choice nowadays for on-the-go camping families.

by Bill McKeown OUTDOORS EDITOR

Call them mini-motor homes, van conversions, chopped vans, camper vans—they're the fastest-selling rigs (up 147 percent over last year) in a rejuvenated recreational-vehicle market. Buyers call them cute, convenient and classy, easy to handle, economical on gas and often small enough to be a family car that can do double duty for weekend travel. These were the first RVs to rebound with volume sales after the gas shortages of the energy crisis. Ask an owner what he'd do if fuel rationing came and he's likely to insist he wouldn't give up his rig but simply schedule shorter trips.

Luxurious but not swinging

Different from the swinging van conversions with their psychedelic paint jobs and deep plush interiors, these RVs often try for full standing headroom and a kitchen, bathroom, convertible bunks that can become a dinette, a holding tank and, for real luxury in larger models, a tiny bathtub with shower. Rather than copy the "passion pads" of the surfing set, these vehicles are influenced by the luxuries of big motor homes.

A price of \$12,000 or less might be one boundary line for these units. About 22 feet overall could be another, though sometimes a conven-

tional chassis is cut in half and widened or is stretched and dual or tandem wheels added at the rear. Raised roofs are not universal since the extra height can keep the rig out of an average family garage, and parking-garage attendants are prone to smashing roofs. Expansion "pop" tops are one alternative.

Note in the newest models three and four-burner stoves, bigger holding tanks, better water heaters and plumbing, added bunk options for larger families, increased heating and airconditioning, additional LP-gas tanks, increased options in interior layouts and decor, bigger storage and better suspension. Prices have gone up, but so have the number of installed appliances. ★★★

Compact caravanning is the promise of the new mini motor homes and van conversions. The VW Minibus, upper right, has become a Folks Wagon, built in Elkhart, Ind. A new Coachman Travel Van below it mounts swivel chairs for a view out the large observation window; uses Ford, Chevrolet, GMC, Dodge standard or "stretched" chassis. The Santana van camper from Fleetwood can carry a motorcycle and sleep four. Even trailer builders now make motor homes like the 22-foot Mini, below, from Avion.



How to zip-kit your carburetor

Just install all the new pieces.

With an ordinary amount of mechanical ability, you can take your carburetor apart and recondition it. After open-carb surgery, you'll get smoother performance and more reliability, and save a double-barreled amount of money.

Two or three times in its life a carburetor needs more than adjustment—it needs to be torn down and rehabilitated with a tune-up kit, a so-called zip kit that includes gaskets, valve balls and other parts that wear or deteriorate.

Instructions that come with tune-up kits give complete step-by-step details with diagrams. If you don't have some grasp of how a carburetor works, you should consult one of the general car repair manuals.

The kits cost \$8 or \$9. An experienced mechanic can do the job in 1½ hours, so allow yourself two or even three.

You can save \$150 a year

What will this be worth to you? The cost of the mechanic's time is the least of it. When a carburetor needs reconditioning, there can be a saving of two or more miles per gallon of gas. It is more when the car is otherwise well-tuned. Let's say you have a gas-eater that gets only 10 mpg. Spread a saving of two mpg over an annual 15,000 miles and, with gas at 60 cents a gallon, you've cut your cost by \$150 a year.

To give you some initial confidence, remember that there is just one adjustment to be made inside the carburetor: setting the float height. There are only six or seven more adjustments after the carburetor is reassembled.

Only a half-dozen common tools are needed: an assortment of wrenches, a standard screwdriver (occasionally a Phillips), needle-nosed pliers and common drill bits of several sizes to use as gauges. A hand vacuum pump is useful but not necessary.

Tune-up kits contain replacement



Typical tune-up kit includes gaskets, accelerator-pump plunger, needle-seat assembly, check balls for intake and discharge valves, diagrams and installation instructions.

parts for those most subject to wear or deterioration: the needle-seat assembly, the accelerator-pump plunger, check balls for the intake and discharge valves, all needed gaskets and new retainer clips.

Ground rules

There are two general rules: The first is that cleanliness inside a carburetor is crucial to its operation. This depends on how thoroughly you clean it and how you handle it while its innards are exposed.

The second rule is to follow precisely the instructions that come with each tune-up kit. It is not unusual to see a carburetor man of long experience with the instruction sheets propped up before him as he works.

A customer in a repair shop once was heard to say, "I'm never coming here again. Your man had to fix my carburetor with the instructions in front of him." To that the boss replied, "If he didn't do that, I'd fire him."

The exact sequence for reassembly and external adjustment is important. Carburetors are made in such a way that you can't skip one step

and then come back to it later on.

The first thing you should do, because there is a chance of gas spillage in the engine area, is to ground the distributor-to-coil wire to prevent sparks.

After you do this, purge the disconnected fuel line by flushing the gas into a suitable container; just turn the engine over a few times with the starter. This removes dirt that is loosened when the fuel line is disconnected. After the carburetor is removed, cover the manifold inlet to keep dirt out of the engine.

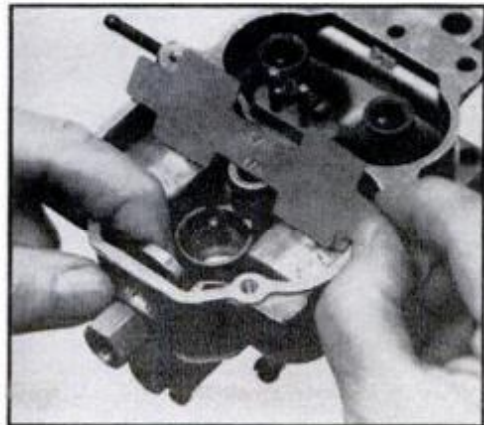
Throttle plates at the bottom of the carburetor are seated with precision. Therefore, the carburetor must be raised above the workbench so that if the throttle mechanism is moved, the throttle valve will not be pushed against the bench and become damaged. If you don't have a carburetor stand, one can be improvised with bolts and nuts as legs.

You should be prepared with a cleaning solvent. For heavily used carburetors with burned-on carbon, a strong automotive parts cleaner and a firm brush are necessary. Rubber, leather or plastic parts should not be put in solvents or cleaners.

The stripdown

Before removing the carburetor, be sure you can identify all hoses connected to it. If necessary, label them or draw a quick picture of where they go so you can hook them up again properly. Some late-model cars have more complex systems, but there is often a color code or diagram under the hood.

Remove all external linkages. Next, remove the choke pull-off and its bracket. This device works with the automatic choke to pull it open by vacuum. Its diaphragm can deteriorate, causing poor performance. A simple test is to press the diaphragm in and hold your finger over the vacuum hole. The diaphragm should stay depressed until you remove your finger (see photo). Its



Float must be set to specification using the gauge included in the kit. The float operates the needle valve that controls fuel flow to the carburetor. Bad adjustment can cause flooding or fuel starvation.

full operation can be tested if you have a vacuum pump.

The choke pull-off and the automatic choke are among the first items to check when there is a starting problem. Similarly, when the complaint is, "She doesn't run right until warm," you check the entire choke circuit. The bimetal control in some automatic chokes can fatigue with excess engine heat, the presence of dirt and exposure to the weather. Replacement may be necessary.

While taking apart the carburetor, watch for dirt and wear. Under the dust cover you'll find the accelerator pump, metering rods and the countershaft that operates them. These parts eventually wear, but do so more slowly than the items in the kit.

Next, you remove the fuel-bowl cover, actually the entire top casting. In the fuel bowl are the floats, pump plunger and, among other things, two small valve-check balls that can be replaced from the kit. Note where both large and small check balls are located so that you won't mix them

up during the reassembly procedure.

Test the floats to make sure no fuel has leaked into them. Float leaks cannot be repaired; new floats are necessary if there is a leak.

Clean Venturi clusters

Opposite the fuel bowl are the venturi clusters. These won't need replacement, but cleaning is important. The two screws that hold the venturi have fuel passages through them that are precision-calibrated. These should be blown clean. Use a compressed air source (one designed for the do-it-yourselfer is Falcon's Jet Gun).

When you get to the bottom or throttle-valve casting, you will find the two idle-adjusting screws. Pry off the plastic limiter caps. If new ones are needed, replace them from the kit. As the instructions will emphasize, it is important to establish the setting of these screws before removing them. You do this simply by screwing them in until they just seat, counting the turns on each. When you replace them, screw them all the way in and then back out the same number of turns at which they were set before.

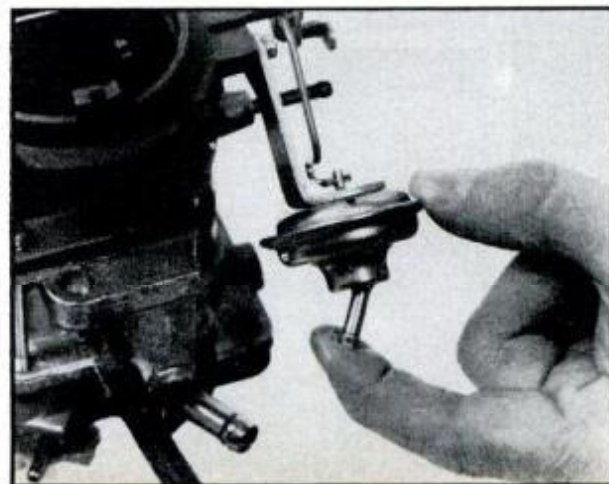
The caps are a legal and protective feature that prevent adjustment to too-rich or too-lean a mixture. Follow directions to install new ones.

After soaking parts, dry and blow them clean. Each jet, tube and passageway should be blown out.

All gaskets should be replaced with those from the tune-up kit. Fresh, soft gaskets are a must to insure a perfect seal. Be sure the mating surfaces of the castings are clean and undamaged.

The reassembly

In the reassembly phase, the first adjustment is float level. A gauge and chart for proper float level are in the kit (see photo). Put in the floats and hold them in place with the U-shaped retainer. Be sure you hold this retainer against the bottom of



Choke pull-off can be tested by depressing the diaphragm and placing your finger over the vacuum hole. A good diaphragm will remain depressed for as long as your finger is kept on the vacuum hole.



Reassembling the carburetor, you carefully insert the pump plunger into the pump cylinder as the bowl cover is replaced.

its slot while gauging. Hold the floats in place by lightly pressing the float tang against the seated needle at the fuel entry hole. To adjust, bend the tang on the float arm.

When you come to replace the bowl cover, care must be taken with the assemblies on the pump countershaft. Before putting the cover on the bowl, insert the spring on the stem of the new pump plunger. Then insert the plunger stem through the hole in the bowl cover on the fuel bowl. The pump plunger must be guided carefully into its cylinder so that the leather is not damaged (see photo).

Guide the vacuum piston with its attached metering rod arm and then the pump arm.

With dust cover screwed on, bolt carb to manifold, replace linkages and hoses, and tune idle and mixture per kit instructions. ★★★

For '77 outboarding - new compact performers

by Bill McKeown BOATING EDITOR

Never mind your astrologer. In a couple months, it may be your boat and motor dealer who can predict what 1977 is going to be like.

For an exclusive Popular Mechanics test preview of things to come, we took the reins of next year's newest Johnson Sea Horse outboard with 140 hp hidden under a compact cowl. Our forecast: On the water at least, '77 is likely to be a superyear.

Next month, Johnson, Evinrude and Chrysler will be announcing their new models for the coming spring, and in September we'll get the word from Mercury and makers of the muscle mills of lower horsepower.

This year we've seen the introduction of the biggest kickers ever, with herds of 175 to 200 horses harnessed to hang from your transom. Right now a lot of hulls can't safely take that much power and so our guess is that motor makers may offer more intermediate choices for boatmen who need more power, but not the most.

New trends

Our test prototype seems to point to a number of coming trends. It was mounted on a 19-foot Steury S1900 outboard cruiser, a neat family model with twin bunks forward in the cabin, good-sized cockpit, and rating for a 165-hp engine and 1940 pounds of passengers and power. Testing it



New 140-hp equals the output of many inboards, but the tilt-up maintenance convenience of the outboard remains. Cockpit check of powerhead proves easy.



Sleek lower-unit configuration, plus extensive prop options, also help V4 powerhead put out potent push. Power Tilt-N-Trim almost surfaces prop for thin-water maneuvering and trolling along the shore. CD ignition prevents fouling at idling speeds.

In an exclusive preview, our prototype tests of Johnson's newest 140-hp Sea Horse outboard show big-muscle performance from a smaller package.

on the lakes and waterways around Cypress Gardens at Winter Haven, Fla., I found the boat performed very well and my experienced companions—Sally Winters, who was more used to handling the rougher waters of Chesapeake Bay, plus photographer Jerry Imber, who has driven most of the small boats produced the last few years—agreed.

The engine producing the push was so new and tight it couldn't wind up to full rpm. Don't use your special Aqua Meter speedometer, the engineers advised. Until the motor is fully broken in and correctly propped for the boat, your top speed won't be that significant. They were right, but overly cautious. At full throttle, the engine, though rated for full horsepower at 5000 rpm, showed only a modest 4000. But at those conservative revolutions, the cruise-

Test runs with the cowl removed revealed that the quiet running is a result of shroud insulation, vibration dampened mounting, effective air intake silencing, muffled (though tuned) exhaust.

Full-throttle operation gave an impressive indication of engine's potential power—even from this preview prototype. Steury cruiser speedometer indicated speeds to 40 mph at engine rpm of only 4000.

er's stock speedometer flickered at a very impressive 40 mph. Allow for plus-or-minus error and that is still a handsome figure for a 19-foot cabin boat. A number of the Cypress Gardens water skiers could have easily been hooked up and towed. No doubt about it, this impressive mill is going to make a lot of friends.

Prop and pitch options

A good number of different hulls are going to be accommodated. While a 13x19 prop is standard, a variety of other pitches are available and 16 props (see specifications below) are options. Shaft lengths of long (20 inches) and extra-long (25 inches) are offered, with standard shock mounting or with T-N-T (trim-and-tilt). Manual tilt will be provided for the long shaft, and power trim comes with long or extra-long shafts for three models in all.



Slow down from that fast full throttle and idle along the shallow backwaters where the big fish are. This is where the luxury of power tilt is most rewarding, and why I feel it is a coming trend for all bigger motors. Powering out with a heavy load aboard, the trim can tuck the lower unit under and boost the hull up over the hump, quickly onto plane. Slight adjustments get the boat skimming on an even keel for best performance and speed, yet less fuel consumption, and the top speed can sometimes be boosted several miles an hour with the trim alone. Tilted so the prop was almost surfacing, the cruiser edged easily through thin water where the hull nearly touched bottom.

Test maneuvers

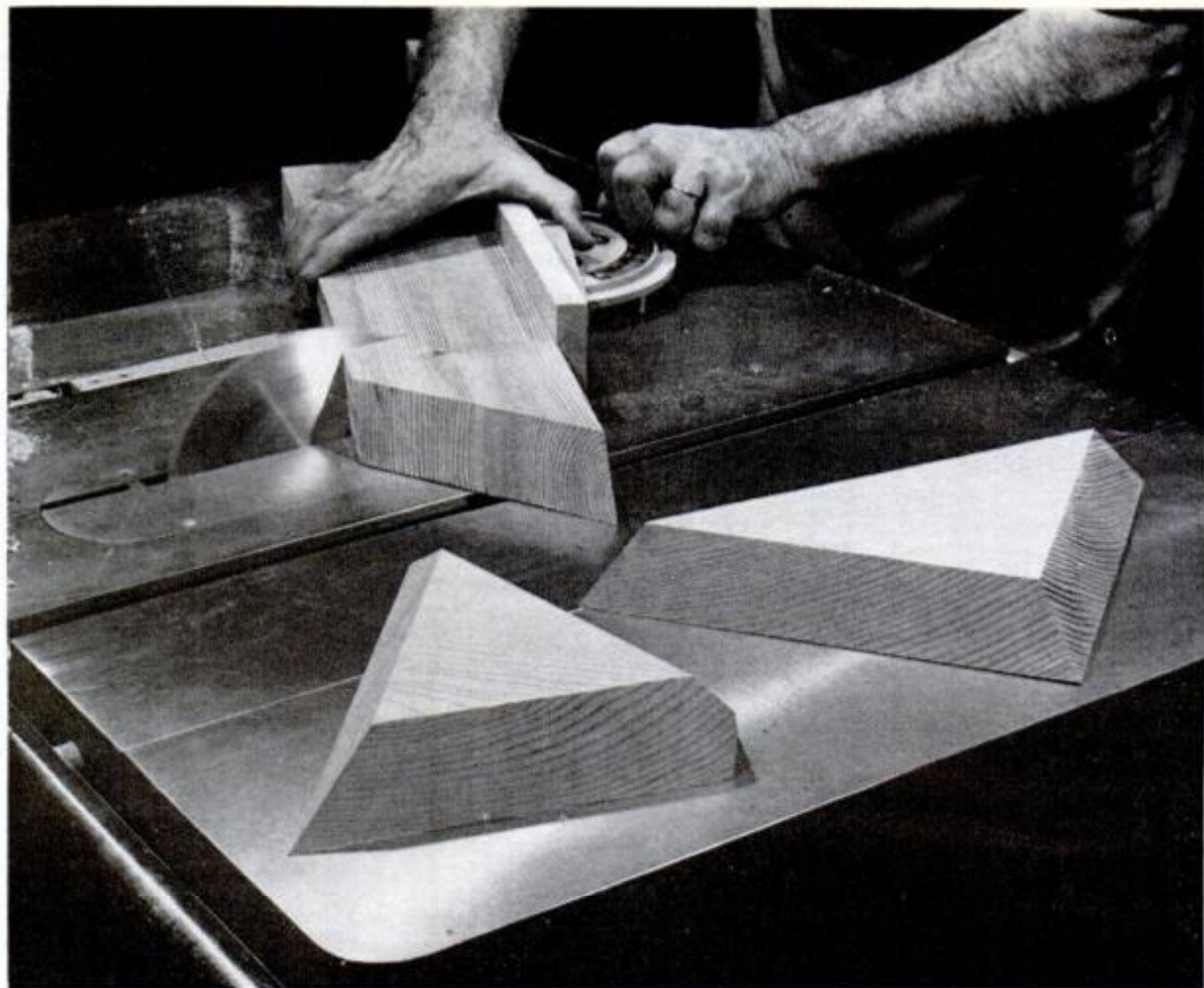
Our maneuvers were those that any boatman should use when checking outboard performance. Does the motor run smoothly at idling speeds with minimum vibration and no tendency to load up? Easy acceleration onto plane and clean response to the single-lever remote forward and reverse control? Fast turns without excessive loss of speed or cavitation? Quick stops without engine kill? Clean turns at varying speeds in both directions without undue torque resistance? This new 140, matched to a responsive hull, passed all checks admirably. Unfortunately it won't impress your friends with gutty sound effects—superior silencing of cowl resonance, air intakes and exhaust make it as quiet as a rig of less than half the power.

Even with the cowl removed to reveal the neat 90° V4 configuration, 12-amp. alternator, MagFlash CD ignition and two dual carburetors in operation, the 99.6 cubic inches turning out all that power do not generate excessive resonant vibration or racket. The engineers, apparently, have incorporated a lot they've learned from the bigger rigs into this low-profile package. For high mid-range horsepower, this new Johnson sets a standard. ★★★

JOHNSON SEA HORSE 140 SPECIFICATIONS

Power: 140 hp at 5000 rpm
Displacement: 99.6 cubic inches
Carburetion: Two duals
Bore and stroke: 3.500x2.588
Ignition: MagFlash CD
Lower unit: 20 or 25-inch
Alternator: 6 or 12-amp.
Tilt: Manual or Trim-N-Tilt
Powerhead: 4-cyl., 90° V
Choke: Electric
Props: Aluminum (8), bronze (3), stainless steel Teflon (5)
Controls: Single-lever remote





Compound cuts are made with both blade and miter gauge tilted the required degrees. Note that the blade guard has been removed for photographic purposes so operation can be shown clearly. Guard would be in place during normal use.

How to cut compound angles

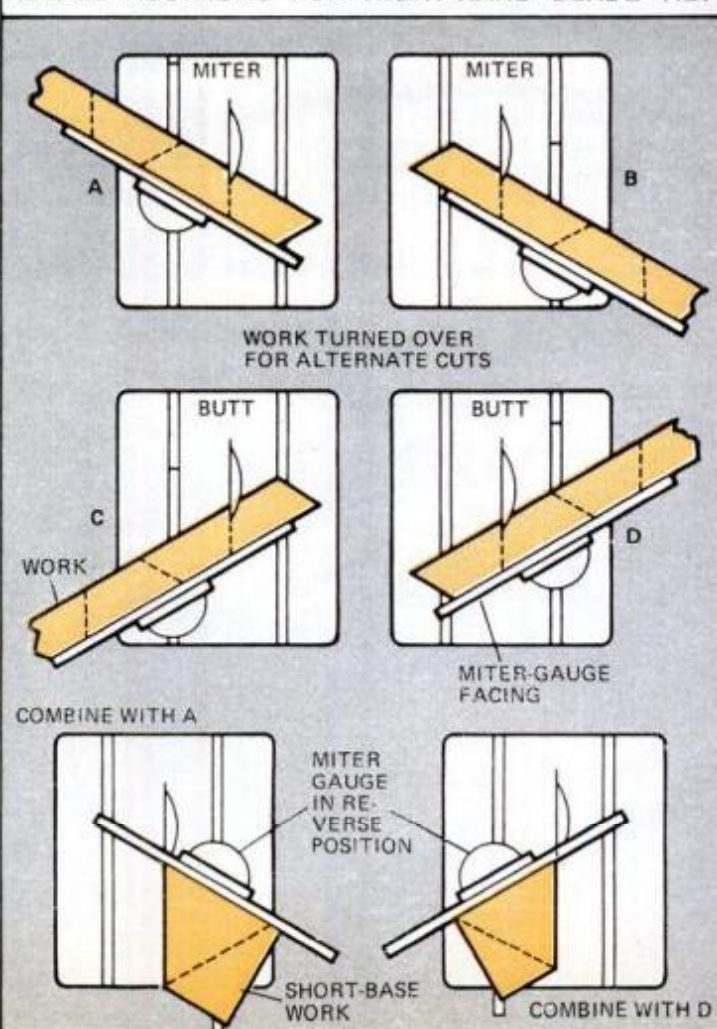
by Wayne C. Leckey
HOME AND SHOP EDITOR

Getting the four corners of a "hopper"-style picture frame to fit is fairly easy, but determining the degree of bevel for a simple four-piece box with sides that slope, say 35° , can be puzzling. For example, the butt joints of the box appear to be 90° , when viewed from the top, but when they're viewed in a true plane, you'll find the "square" edges are less than 90° —actually $70\frac{1}{2}^\circ$. That's the tricky part of compound angles: The bevel does not show in a plan drawing, and even when you study the completed job, the angles are not what they seem.

Compound angles are required when sawing the parts of any pyramidal shape of four, six or eight sides, and are made with the blade (or table, as the case

Reversed miter-gauge positions shown in two lower drawings at right are used when cutting peak and short-base work from pre-beveled board so wide side will be against wood facing of miter gauge. Bevel will be face up for one cut, face down for other.

GAUGE POSITIONS FOR RIGHT-HAND BLADE TILT



may be) tilted to cut a bevel and the miter gauge swung to cut a miter. Thus both the miter and the bevel are cut in one operation.

The chart below takes all the guesswork out of setting your saw to cut a number of common compound angles. It gives the required tilt for the saw blade and the swing (tilt) of the miter gauge in degrees.

The fastest and most economical way to saw parts for a sloping box or flared frame is from a long board which has been prebeveled along both edges. This is called strip cutting. The miter gauge is left at the same setting and the board is flopped after each cut. When the parts are individually cut from scrap, the miter gauge is turned around and used backward for the second cut so wide side of work is always against the miter-gauge facing.

Strip-cutting positions

The upper drawings on the facing page show four standard miter-gauge positions for strip cutting—A and B for cutting miter joints, C and D for butt joints. Here the blade tilts to the right. The two sets of positions are pairs worked by shifting the miter gauge from one table groove to the other. Prebeveling the

edges is done so the top and bottom edges of the pieces will be on a flat plane when assembled. If the box sides slope 35°, for example, the top and bottom edges are beveled 35°.

You can use any of the four miter-gauge positions shown when the work is not prebeveled. However, only two of these positions can be used when the work is prebeveled and the job calls for mitered joints at all four corners, as the bevel must bear against the miter gauge with the sharp corner facing up. When a peak is to be formed like the roof of a birdhouse, and cut from individual prebeveled pieces, the long side of the work must be held against the miter-gauge facing for both cuts; the bevel must face up for both cuts.

In the case of rough work, compound joints are simply butted and nailed or, for greater strength, glued and nailed. However, in finer work, splines are used. These are thin strips of wood cut to fit saw kerfs made in mating members. Beveled blocks clamped to the saw table on each side of the member will guide it at the proper angle over the blade. Here it is important that the kerfs be at right angles to the face of the bevels and be alike. If not, the joint won't line up. ★★★



When parts are cut individually from separate pieces, the first cut is made with the work held in position shown above.



To make second cut, miter gauge is turned around and used backward in the table. Same miter-gauge setting is used.

SAW-TILT AND MITER-GAUGE SETTINGS FOR COMPOUND ANGLES

FRONT VIEW ANGLE	4 SIDES, BUTT JOINTS		4 SIDES, MITER JOINTS		6 SIDES, MITER JOINTS		8 SIDES, MITER JOINTS	
	SAW TILT	MITER GAUGE	SAW TILT	MITER GAUGE	SAW TILT	MITER GAUGE	SAW TILT	MITER GAUGE
5°	1/2	85	44-3/4	85	29-3/4	87-1/2	22-1/4	88
10°	1-1/2	80-1/4	44-1/4	80-1/2	29-1/2	84-1/2	22	86
15°	3-3/4	75-1/2	43-1/4	75-1/2	29	81-3/4	21-1/2	84
20°	6-1/4	71	42	71	28-1/4	79	21	82
25°	10	67	40	67	27-1/4	76-1/2	20-1/4	80
30°	14-1/2	63-1/2	37-3/4	61-1/2	26	74	19-1/4	78-1/4
35°	19-1/2	60-1/4	35-1/4	60-1/4	24-1/2	71-3/4	18-1/4	76-3/4
40°	24-1/2	57-1/4	32-3/4	57-1/4	22-3/4	69-3/4	17	75
45°	30	54-3/4	30	54-3/4	21	67-3/4	15-3/4	73-3/4
50°	36	52-1/2	27	52-1/2	19	66-1/4	14-1/4	72-1/2
55°	42	50-3/4	24	50-3/4	16-3/4	64-3/4	12-3/4	71-1/4
60°	48	49	21	49	14-1/2	63-1/2	11	70-1/4

Figures are in degrees and are for direct setting to tilt scale and miter-gauge scale provided tilt starts at 0° and miter gauge at 90° in the normal position.

How to patch cracks and potholes in your asphalt driveway



Open cracks invite trouble if you don't keep them filled. Winter's freezing cold will break up asphalt fast when snow and water get under it.

by Ken Kaiser

The warm months are the best time to repair and rejuvenate your asphalt driveway. As a do-it-yourself project, it is entirely practical—one that will save you money and prepare the drive for the ravages of the coming winter as well as add many useful years to its life.

The basic problems

Before getting into the actual repair of the surface, it would be well to understand the causes of the problems in the first place and what may be done to improve the situation in the future.

Basically, there are three broad categories of problems that lead to cracks, ruts or deep depressions, heaving and broken pavement or edge cracking. Obviously, there is ordinary wear and tear. Asphalt tends over a period of time to dry out and lose resiliency. Refurbishing will help correct this problem to a large extent.

If the drive was improperly laid originally—for example, not a thick-enough layer of asphalt or improper crowning to provide for water runoff—the drive will develop cracks, the first step in a moisture/seepage/freezing/upheaval sequence. Also, if

Apply top coating to surface as thin as possible consistent with good coverage, using a squeegee, stiff floor brush or industrial roller. One gallon of Gilsonite top coating will cover 100 sq. ft. and fill and seal hairline cracks.

proper forms were not used at the edge of the drive, it is only a matter of time before edge cracking occurs. Though a little larger in scope, this can also be handled as a part of the refurbishing job.

The ground-water problem that eventually leads to asphalt driveway defects has two-aspects of its own: One is rainwater that sinks into the ground along the drive and then flows under it; the other—more serious and consequently more difficult to combat—is a high water table.

In the first instance, a partial solution is to provide a shallow channel on each side to direct the runoff water down the sides of the drive. These channels need to be slightly pitched to give the water a downhill run.

The water-table problem

Since water will follow a path of least resistance if it is not given direction, it will sink into the ground and spread under the drive.

A construction note: Since asphalt is flexible, any trough or channel that is constructed (particularly along the sides of the drive) must be held in position at the edges by a permanent form such as metal or wood impregnated with a preservative.

The water-table problem is more serious because if the ground on which the driveway was installed has an abnormally high water content, there is virtually little that can be done to eliminate or remove the water.

Since the problem here arises when the everpresent water freezes and forces the drive to heave and crack, the solution is to give the freezing and expanding water an outlet—room to expand in a harmless manner, thereby relieving the pressure on the drive itself.

Installing a 'relief valve'

To create this "relief valve," cut a hole in the middle of the drive, using a post-hole digger. Dig down two to three feet deep, fill the bottom with coarse gravel or stone and place an ordinary bell drain pipe and cover in the hole, level with the drive surface.

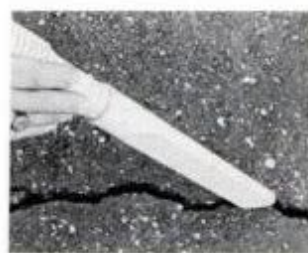
It is important to remember that water from below the drive is generally not the major problem. Rather it is water that has penetrated the surface of the driveway itself. The result is the same action that breaks rocks into pebbles—small amounts of water start a fine crack in the surface, then continually enlarge it until it eventually succumbs to pressure from underneath.

For this reason, you should establish a continuing maintenance program for the drive and pay particular attention to the last part of the



HOW TO FILL SMALL HOLES

1. Clean out the hole, removing any grass or weeds. Dig down with trowel until you hit solid base. 2. Blow clean with your vacuum cleaner, 3. Wire-brush hole to dislodge any loose particles. 4. Fill hole with cold patch, mound slightly and tamp to compact solidly. Fill and tamp deep holes in one-inch layers, not all at one time.



HOW TO FILL LARGE CRACKS

Rake out cracks with a screwdriver (reading clockwise from top left) to remove the old asphalt and gravel. Wire-brush along top edges to remove loose particles. Blow out cracks with your shop or canister vacuum. Overfill about 1/8 inch with asphalt crack filler, using ordinary caulking gun. Smooth filler with trowel dipped in mineral spirits. Avoid use of crack filler when temperature is 40° F. or below as it may not set properly.

job when a top coating is applied as the final sealer for the surface.

The importance of cleaning

Any patch, sealer or coating seals or attaches only to what it touches.

If the area is dirty or if there is loose gravel or bits of loose asphalt, you will get a less-than-strong bond. For this reason, surface preparation is most important. Make sure the area

(Please turn to page 140)

What's new

Maybe a plywood basement

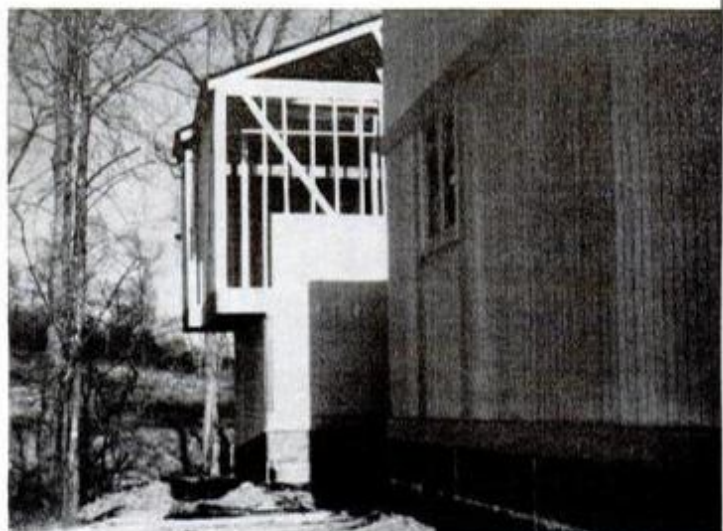
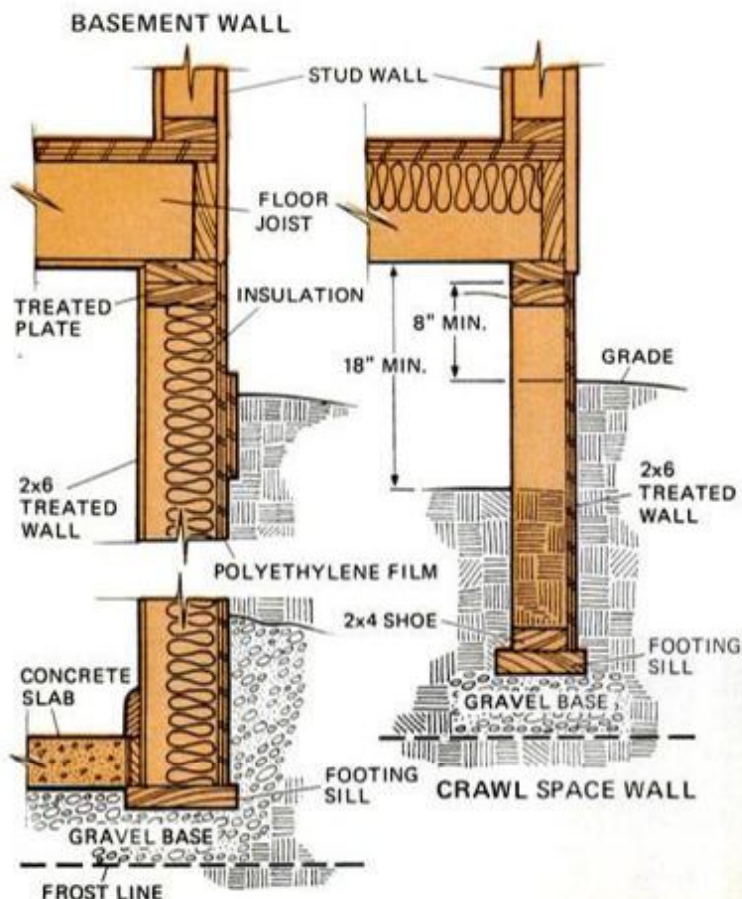
by Mike McClintock
ASSOCIATE HOME AND SHOP EDITOR

You've heard that necessity is the mother of invention, but you may not have realized that hard times have given a shot in the arm to building technology. When the boom in the residential construction market bottomed out a few years ago, companies began searching for new ideas to stimulate the industry by providing a quality house at a reasonable price. It wasn't easy to turn the limping industry around, and some ideas still need time to catch on. Most are being used by big

Wood foundations

A wood foundation consists of a pressure-treated, plywood-sheathed stud-wall below grade. Here's why the method works so well. Foundation work can be done in any season and any kind of weather and it needs no time to cure or dry. The AWWF (all-weather wood foundation) has been successfully installed on below-zero winter days and in wet, muddy ground. Installation is faster than masonry. A company in Milan, Ohio, documented the time it took for a full-basement AWWF job including a panelized first floor and basement stairway—just over

two hours. Costs are low, too. The system runs about \$450 less than masonry on an average 1500-square-foot house. It has also met standards for federal mortgage insurance programs. A builder in Virginia who has constructed over 800 AWWF homes guarantees \$1000 to the first homeowner whose foundation leaks—and he hasn't had to pay off yet. Here are some sources for detailed information: National Forest Products Assn., 161 Massachusetts Ave., Washington, D.C. 20036; American Wood Preservers Institute, 1651 Old Meadow Rd., McLean, Va.



A wood foundation may not seem permanent, but the long-lasting panels are supporting many elegant custom homes like this



in your next house

builders. Some ideas are great for your home addition or renovation.

One of the most stunning improvements is the development of a practical wood foundation. It's an honest-to-goodness, simple replacement for concrete and block installations that carry high labor costs. Plywood sheets and 2x6s are injected under pressure with a preservative. The sheets are then shop-assembled in four-foot-wide panels with the 2x6s in between. This work can be done in any weather indoors.

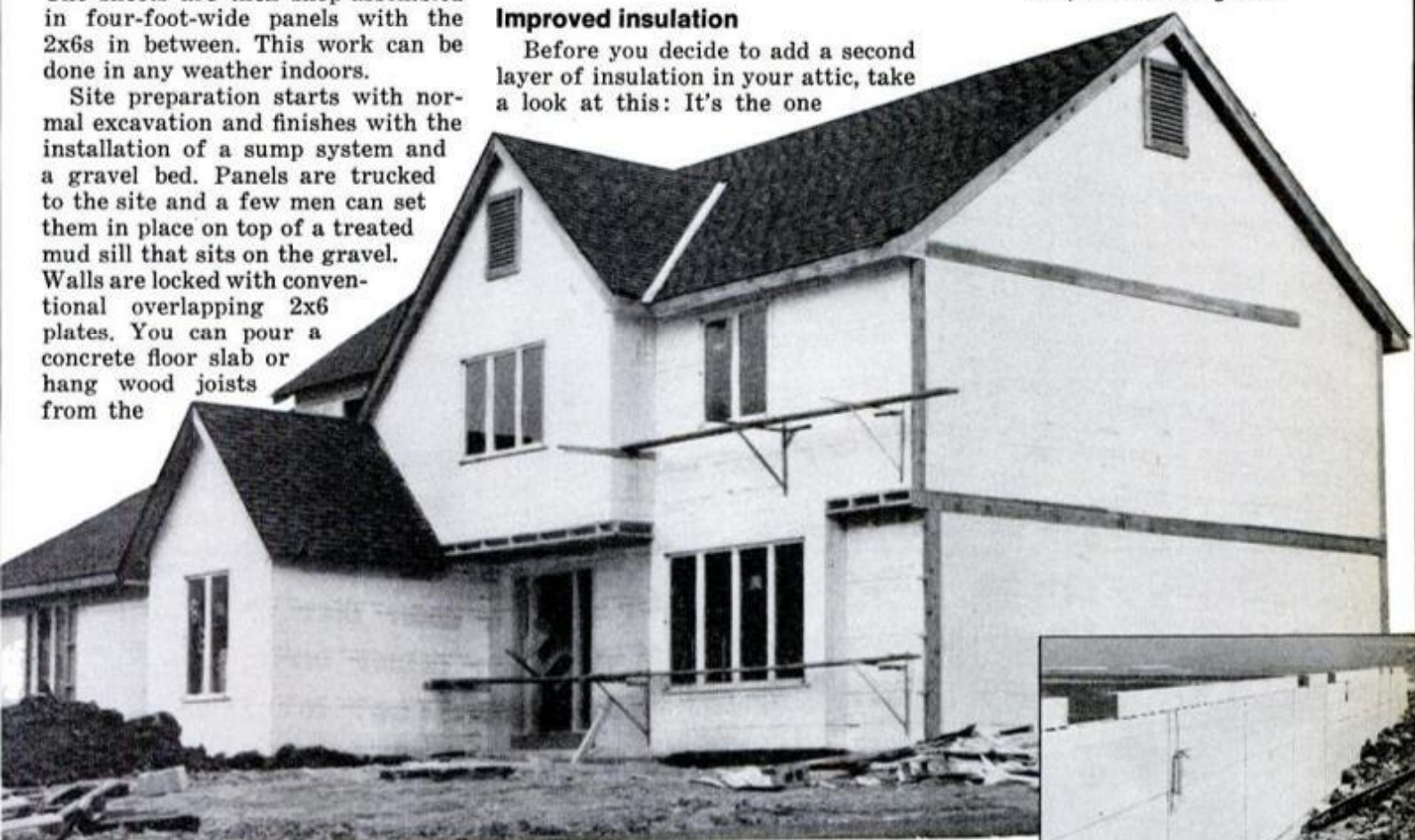
Site preparation starts with normal excavation and finishes with the installation of a sump system and a gravel bed. Panels are trucked to the site and a few men can set them in place on top of a treated mud sill that sits on the gravel. Walls are locked with conventional overlapping 2x6 plates. You can pour a concrete floor slab or hang wood joists from the

side wall panels. Exterior plywood seams are caulked and 6-mil polyethylene sheeting is cemented to the plywood at grade level, sealed at the edge with a treated nailer. Installation time on a full cellar can run as little as two hours. Sample foundations have survived 30-year burial tests with preservatives inferior to those used today. See page 94.

Improved insulation

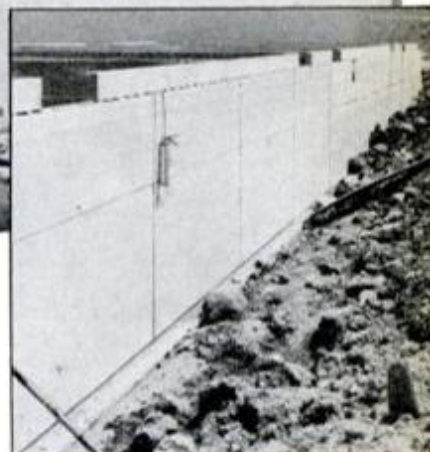
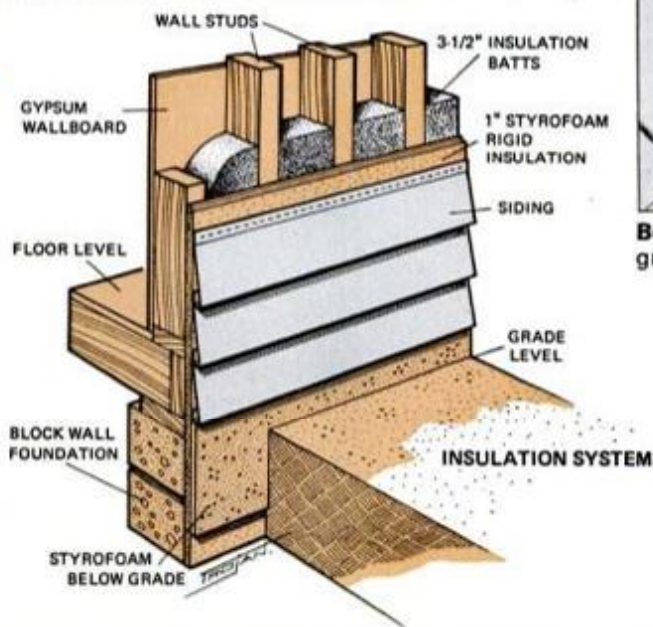
Before you decide to add a second layer of insulation in your attic, take a look at this: It's the one

Every exterior surface of the house is covered with the rigid Styrofoam board. Cutouts for doors and windows are easily made with a fiber knife. Corners are lapped to make a tight and complete insulating seal.

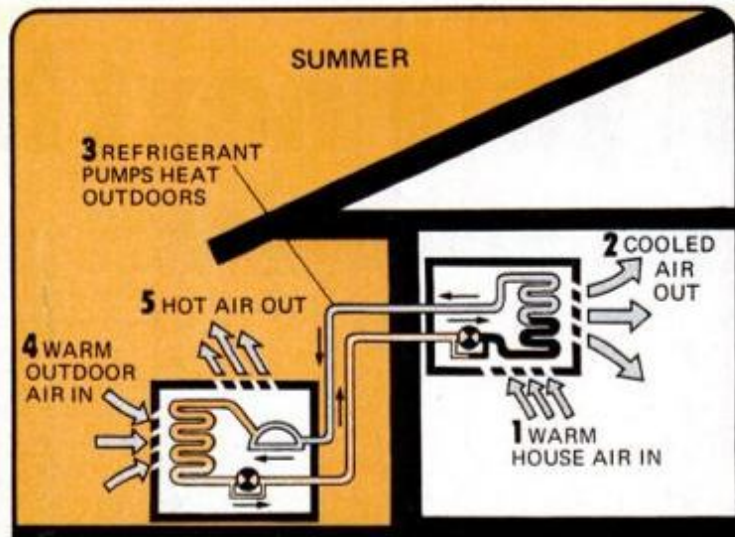
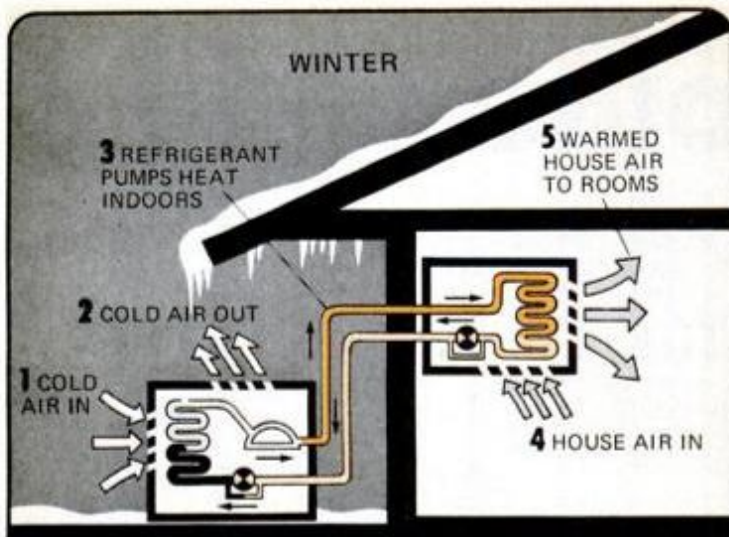


Total wall insulation

This unique system takes an old material and uses it in a new way. One-inch Styrofoam rigid sheets with tongue-and-grooved edges are used in conjunction with standard fiberglass insulation batts to make the batts much more efficient. Controlled tests on unoccupied houses using electric heat gave approximate savings of \$85 a year in Atlanta and \$235 in Minneapolis. Its R factor (thermal resistance) is 5.41 at one-inch thick, and it meets recognized national codes when it is applied over studs with let-in corner bracing. For specifications, write Dow Chemical Construction Materials, 2020 Dow Center, Midland, Mich.



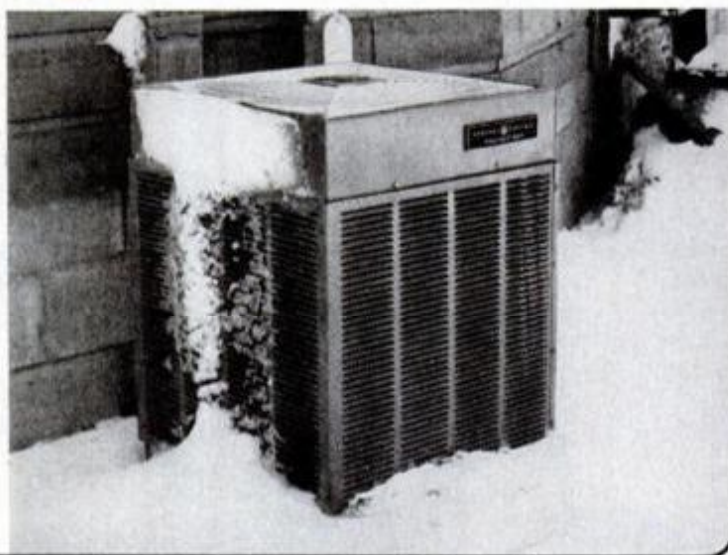
Below grade, the sheets resist ground water and soil acids.



HIGH-PRESSURE HOT GAS
 HIGH-PRESSURE WARM LIQUID
 LOW-PRESSURE COLD GAS
 LOW-PRESSURE COOL GAS

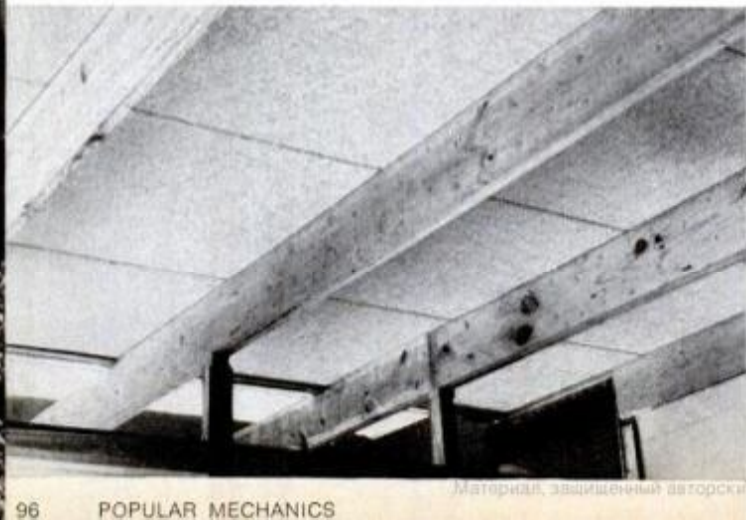
Heat pumps

Heat pumps were first used in the mid-1950s when companies realized that if an air conditioner blows hot air out of a house in the summer, the system could be reversed in the winter. There was only one catch—they constantly broke down. The ingenious idea faded, almost, into oblivion, but has made a comeback as a result of the energy crisis. Here's how a modern version works: A refrigerant inside the pump absorbs heat from interior air and from the compressor that circulates the coolant and blows it outside for summer cooling. In winter the refrigerant takes heat from the outside air (even at 0° F.) and from the compressor and blows it through a heat exchanger into the house. For more information: General Electric, Louisville, Ky. 40255, and the Air Conditioning and Refrigeration Institute, 1815 North Fort Meyer Drive, Arlington, Va. 22209.



Tectum 2 board

The ultimate building material is one that accomplishes a lot in one simple installation. The trend toward affordable "no-frills" housing has put a damper on expensive, specialized materials and encouraged multiple-use products. Tectum 2 is a step in that direction. It is made, under continuous heat and pressure, of long wood fibers and inorganic binders. Each sheet is tongue-and-grooved and a layer of urethane foam is bonded to the surface which can take all standard roofing. Over 4-foot centers it can support 200 p.s.f. Write Gold Bond, 325 Delaware Ave., Buffalo, N.Y. 14202.





Flashband

Here's another product that's flexible enough to do a lot of jobs. It combines a layer of heavy-duty aluminum foil with an asphalt-based adhesive that is unaffected by extreme temperatures and will stick to any surface. It's ideal for irregular-shaped flashing. From Evode, 401 Kennedy Blvd., Somerdale, N.J.

new energy improvement that cuts through the confusion of fuel efficiency and heat loss claims. The material is nothing new—it's Styrofoam. But the application is unique. The dense, one-inch-thick, tongue-and-grooved sheets are rigid enough to serve as sheathing over studs with let-in corner bracing. That's the first advantage. Conventional 3½-inch insulation batts are then stapled between the studs.

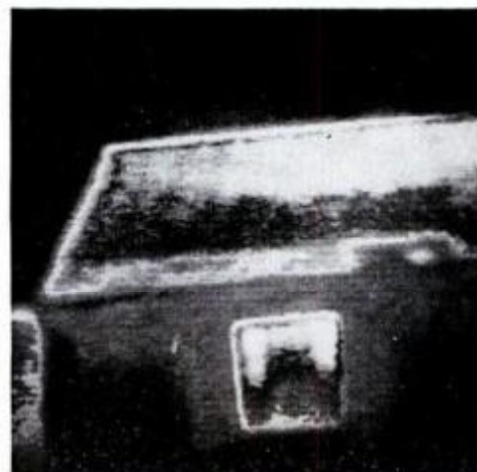
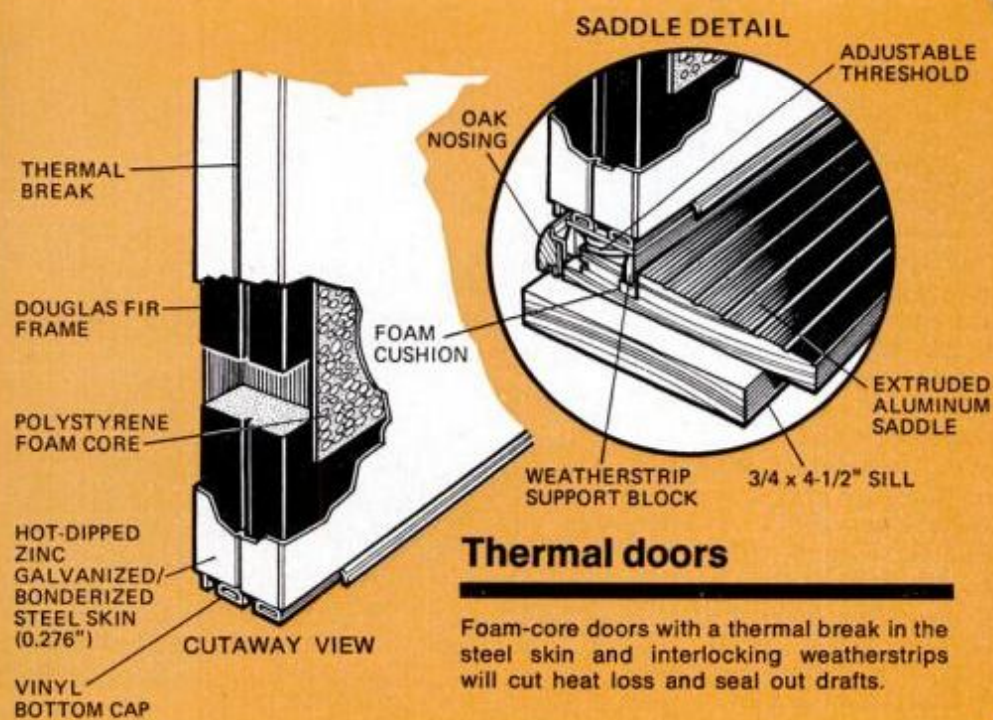
But the Styrofoam sheets can be applied below the stud wall (over masonry or wood) straight down the foundation. They resist moisture and soil acids below grade and provide an unbroken insulating seal from the eaves to the footings. They are also wrapped around overhangs and soffits to cut down on convection currents in the wall. Check page 95 to see how much mileage you'll get from your insulation batts with this system backing them up.

The one drawback is that the Styrofoam is flame-retardant and not flameproof. In a fire it would release dense, acrid smoke. So it must be protected on the interior by half-inch gypsum board or a fire-code board for a little more money.

Hot and cold magic

Every new building system will have a company extolling its virtues. You should look long and hard to make sure that the claims are backed up. Heat pumps, another wave-of-the-future product, are a case in point. They are not the ultimate energy system. The market has been blitzed with alternate energy devices, especially solar machinery, but there is no one system that is obviously the best—at least not yet.

But in moderate climates (10° F. winters to 85° F. summers) a heat pump makes a great single unit for combined heating and cooling. We've analyzed this complicated system for you on page 96 and included a few new techniques that might be standard on your next house. ★★★



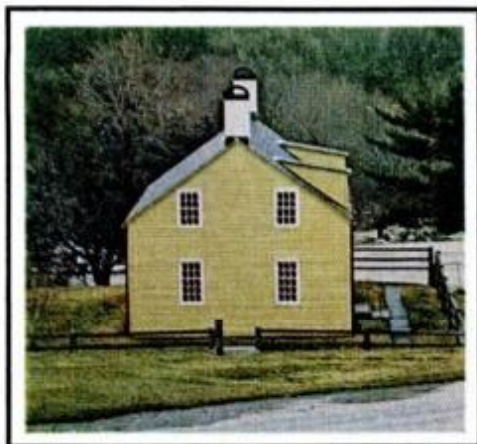
Thermography

Although thermography service is expensive now, use by utility companies for examination of homes is under consideration. In the pictures (left), with the heat loss from the window as a gauge, the difference between an insulated and uninsulated attic is obvious. Infrared radiation emitted from the house is focused and transmitted to a semiconductor component that converts the IR scan into a video signal. The detector is cooled by liquid nitrogen to minus 196° C. for optimum sensitivity. From AGA Corp., 550 County Ave., Secaucus, N.J.

Shaker Furniture

150 years of simple and functional knockdown designs.

by Mike McClintock
ASSOCIATE HOME AND SHOP EDITOR



The simplicity and strength of Shaker furniture have made the style a unique part of our woodworking heritage. The pieces are extremely durable, functional and easy to assemble.

Simple assembly was, in fact, a prerequisite of the original designs. The Shakers were the first to mass-produce furniture and ship it, in kit form, to their settlements throughout the East. The pieces were built by their best craftsmen and designed so that unskilled hands could put them together. The leading companies in the field today follow that same principle so you can assemble your own furniture just the way it was done 150 years ago.

The Shakers started building kits because they believed that all members of the sect, no matter where they lived, could achieve a degree of unity and a communal daily routine by having the same furnishings. So the central production shops were built at the settlement in New Lebanon, N.Y., and the design and construction controlled and supervised by a handful of elders. As early as 1829 there is a record of the mass-production in a letter to the deacon of the New Lebanon Church noting the shipment of "two bunches of table legs 68 in number."

The first Shaker craftsmen fol-





Photo: George Ancona

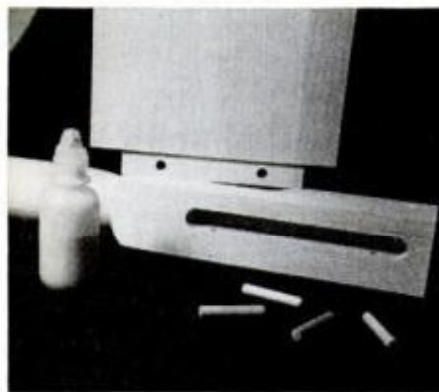


The beautiful rocker among the Shaker antiques above is a kit I assembled in four hours. It takes a trained eye to separate the copy from the originals. Left are scenes from a Shaker restoration: narrow stairs under a skylight, trestle table in the main room, a sausage maker in the kitchen, a spinning wheel and forms for making bonnets in an upstairs workroom.

Photos by the author

Shaker furniture you can build from kits

Drop leaf table



Solid maple is used on the 38x72-inch tabletop. This kit from Shaker Workshops, also comes in 4, 5 and 7-foot lengths, all priced around \$200. Authentic construction features include mortise and tenon joints between stretchers and legs that you glue and then pin with small dowels. Glue and stain are included.



Tray table

Shakers often designed their furniture to serve more than one purpose and this tray table does just that. The tray rests on the folding stand for use as a sideboard and can also be removed for serving at the table. The complete kit costs \$45 from Cohasset Colonials, Cohasset, Mass.

Tulip table



Perfect balance and simple assembly make this pedestal table a great choice for your first project. You'll be able to complete the kit and the finishing in an afternoon. Cost is \$35 (with glue, screws and stain) from Shaker Workshops, Concord, Mass.

lowed traditional solid wood designs of the 17th and 18th centuries. But as colonial furniture became more decorative with ornamental turnings and fretwork, the Shakers concentrated on improving the usefulness and simplicity of their designs. The deep religious commitment they brought to their work is illustrated in this passage from the writings of Father Joseph Meacham:

"All work done, or things made in the Church for their own use ought to be faithfully and well done, but plain and without superfluity. All things ought to be made according to their order and use."

In the early 1800s, amid the popularity of the intricate carvings and inlays of Chippendale and Hepplewhite, the Shakers at New Lebanon added production of their clean and consistent chair designs to their already thriving herb and seed business. The great popularity of the chairs, and the financial self-sufficiency they brought, stimulated other settlements to follow their example.

The Shakers did not intermarry or produce offspring, so as the population of the sect declined so did the production of furniture. In the 1930s

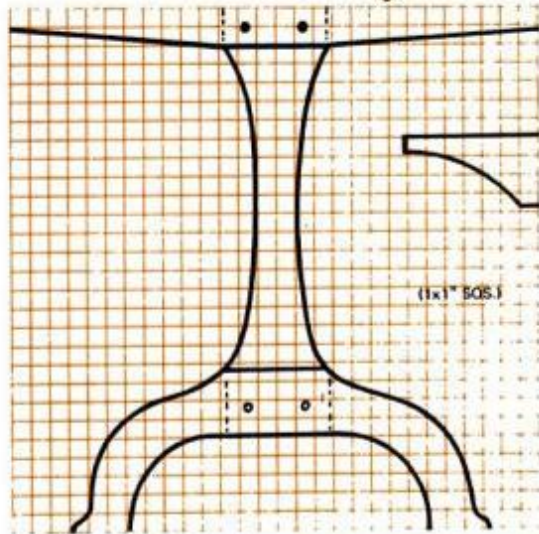
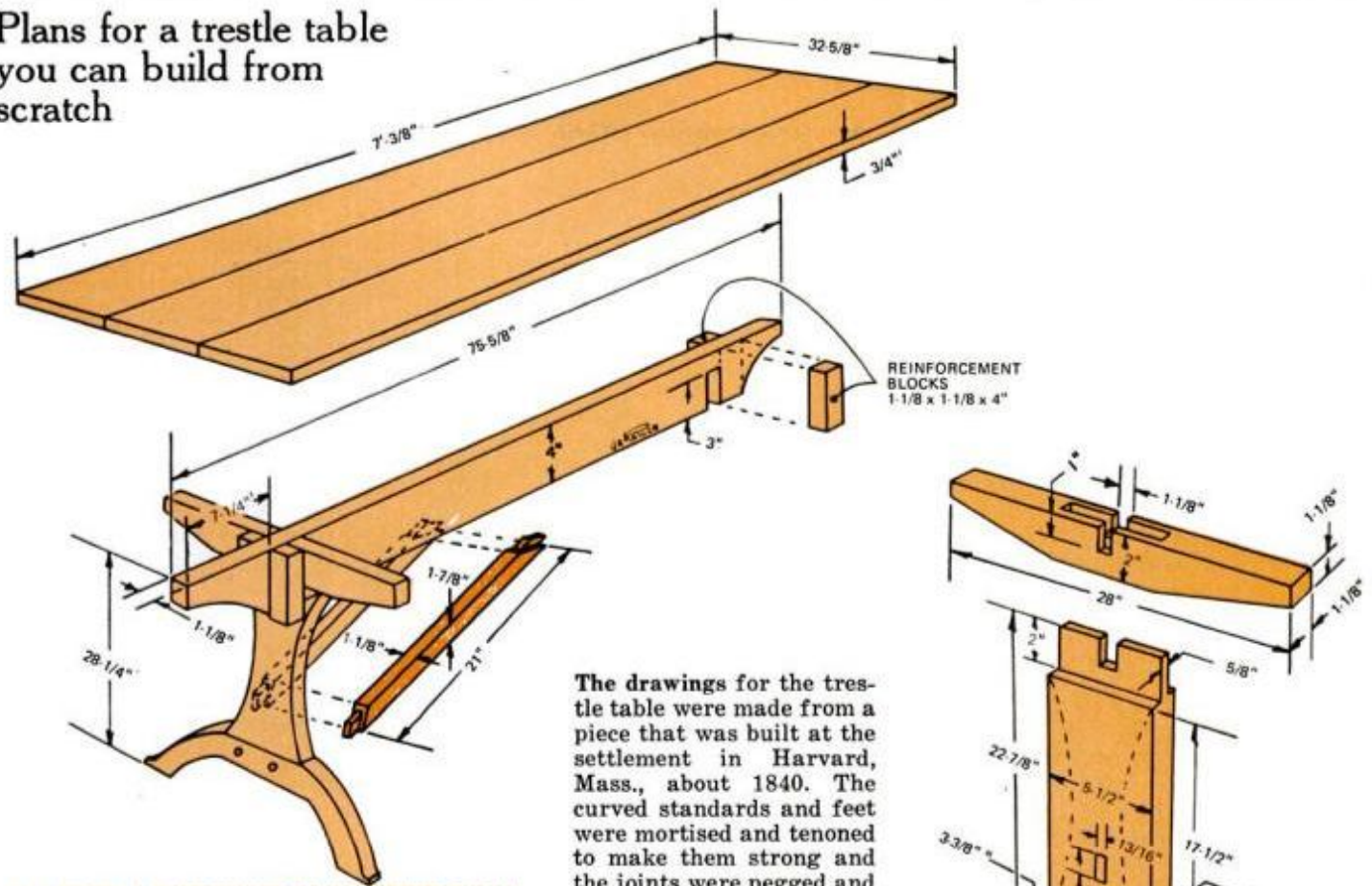
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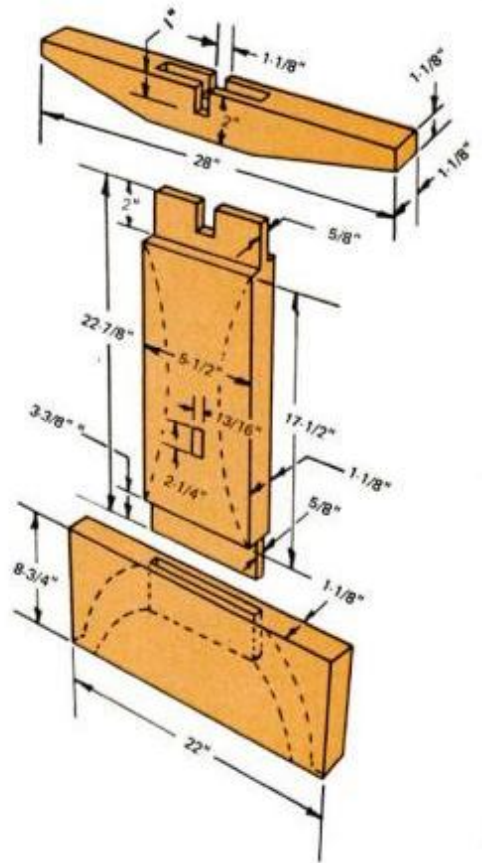
Armchair

A clean design of generous proportions makes this chair a natural for any room in the house. Putting together the pieces of the kit is a simple job but one you must do carefully. Glue should be spread around the inside of the holes in the legs. As you push in the rungs the compressed ends will expand and lock up the joint. Remove any extra glue immediately with a wet rag. Stain is also provided in three different tones. From Shaker Workshops for \$85.

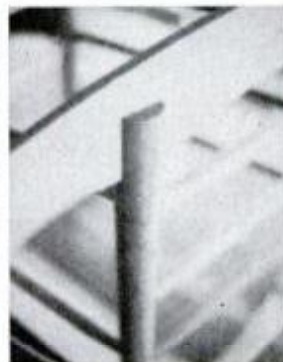
Plans for a trestle table you can build from scratch



The drawings for the trestle table were made from a piece that was built at the settlement in Harvard, Mass., about 1840. The curved standards and feet were mortised and tenoned to make them strong and the joints were pegged and braced for stability. Shaker Workshops, Inc., in Concord, Mass., offers kits in lengths from 5 to 8 feet. Its tabletop is 33 inches wide and made of 1 1/4-inch clear pine with a base of solid maple. Prices run from \$180 for a 5-foot table up to \$215 for an 8-foot unit. The kits also feature "breadboard" ends. They are strips of pine that are joined and pegged along the ends of the laminated boards to prevent warping.



From *The American Shakers and Their Furniture*, John G. Shea, copyright 1971. Permission of VanNostrand Reinhold Co.



Rocking chair

This rocking chair kit is a reproduction from Cohasset Colonials in Cohasset, Mass. The result of the assembly is shown on page 99. For \$54 and the pleasure of putting it together (an afternoon will do it), you'll have a rocker

that's identical to those the Shakers made 150 years ago. The kits come with instructions, glue, sandpaper and all the materials you need to weave the seat. Quality is so good that the Boston Museum of Fine Arts endorses the kits.

Novel lighthouse night light

by R. S. Hedin

When making that dangerous voyage through the house in the dark of night, you can rely on this friendly little lighthouse to warn you off those toe-crushing, shin-scraping reefs that abound in the uncharted regions around chair legs and coffee tables. In the light of day, the lighthouse, with its contrasting hardwoods, becomes an attractive display of your woodworking skill. The body of the lighthouse is made of alternate light and dark layers of $\frac{3}{4}$ -in.-thick wood such as walnut and birch. The base is made of two pieces of $\frac{3}{4}$ -in.-thick oak which helps give the rough-hewn texture of rock.

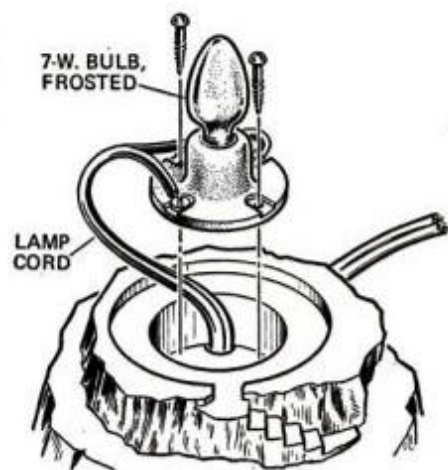
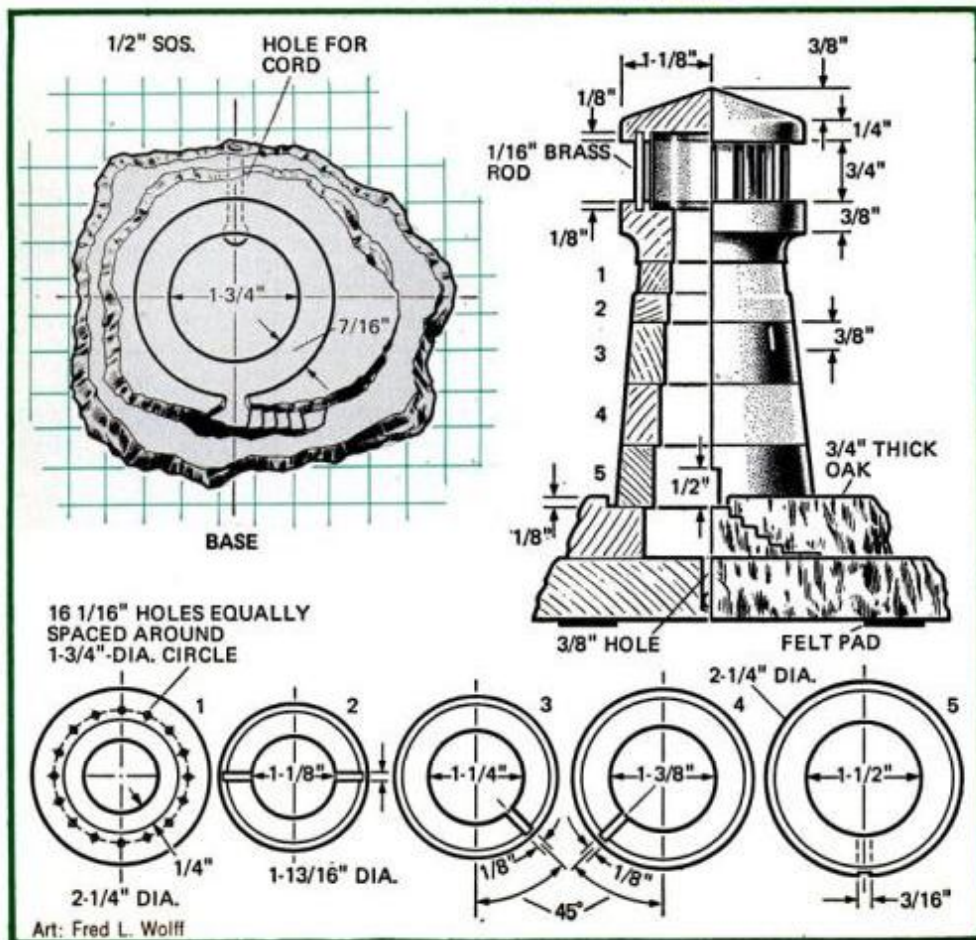
The outside diameters of the five "doughnut" rings are about $\frac{1}{8}$ in. oversize to allow for misalignment and edge splintering during mounting and turning. Cut the $\frac{3}{16}$ x $\frac{1}{2}$ -in. door and the four $\frac{1}{8}$ x $\frac{3}{8}$ -in. window openings before gluing the five sections together. Make the cutouts at right angles to the wood grain so that after making two saw cuts to the required depth, you can remove the waste with a sharp utility knife.

Use plastic-resin or hide glue to cement the five rings together, alternate the grain direction and clamp. Before turning the work, fill the door and window cutouts with wood putty or force-fit wood plugs, so the openings won't chip during turning. Mount the bottom end to the lathe's faceplate with a $\frac{1}{8}$ x $2\frac{1}{4}$ -in. hardwood spacer placed between so you'll have turning clearance at the faceplate. If you have a Unimat lathe, a length of $\frac{3}{8}$ -in.-square steel bar mounted in the toolholder will provide a suitable tool-

(Please turn to page 115)



Socket well and the top recess both are turned after base is glued and fastened to faceplate of the lathe. The lamp cord is passed through hole drilled in side of the base.



Exposed socket terminals and wires are coated with a layer of silicone rubber.

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13 mg. tar, 0.8 mg. nicotine av. per cigarette, FTC Report Nov:75

HOW THEY'RE WATCHING US

(Continued from page 49)

newspaper *Izvestia* also expressed the view that the array of antennas atop the American embassy "may be the source of the microwaves."

Diplomats of all countries are averse to discussing spy activities, a situation that has tended to keep a lid on the extent of Soviet spying on Americans in Moscow and elsewhere in the world. Of course, that same lid also serves to hide the tremendous American intelligence effort directed at the Soviets and other Communist nations.

But from time to time, spy capers do become public knowledge. In 1973, a miniature electronic bug dropped from a slit in the lining of a chair in a committee room in the House of Representatives. This was the room used for closed meetings of the House International Relations Committee. Though the bug's battery was dead, the unit—traced by the FBI to the KBG—reportedly had been operational during discussions of disarmament talks, military aid and the Vietnam withdrawal.

The trade fair ploy

Ironically, the listening device was of American manufacture and could have been bought almost anywhere in the United States. The Soviets have never been averse to buying Ameri-

can-made electronic surveillance equipment. In August 1974, the Russians put on an international trade fair for law-enforcement technology—*Krimtekhnik* '74—and invited American manufacturers to display their goods. When the news got around, various Congressmen blasted American companies planning to participate, and the Administration was forced to institute new export restrictions to prevent the Soviets from buying our latest surveillance gear.

The "Cold War" that followed World War II triggered increased intelligence operations between the United States and the Soviet Union. It was inevitable that the emphasis would be on science and technology. During the Cuban missile crisis in 1962, for example, the Soviet navy dispatched "fishing trawlers" laden with electronic gear to monitor U.S. Navy communications. In 1963, a big Soviet naval force sailed into the Mediterranean, which the United States had dominated for so long. The Soviet ships were immediately shadowed by elements of the U.S. Sixth Fleet.

In retaliation, the Kremlin complained that the Russian navy had recovered a piece of American undersea electronic warfare equipment—a U.S. Navy sonobuoy—in Russian coastal waters. On July 15, 1963, Defense Secretary Robert Mc-

Namara, at a press conference in the Pentagon, dramatically pointed to an elongated, torpedolike device and announced that it was "a Soviet sonobuoy, of which we have recovered about 200."

Found by Canadian divers

This marked the first time that a senior American official had publicly acknowledged information kept secret since 1959 when Canadian divers, helping to map the Atlantic continental shelf, came across electronic homing devices planted by the Russians. It was also in 1959 that a lone freighter appeared in the area of Kwajalein atoll in the Marshall Islands, far from the regular shipping lanes. It so happened that the ship was just in time to observe a hush-hush test of the American Nike Zeus antimissile missile. The ship's presence became known too late—a long-range Atlas ICBM had already been launched from Vandenberg Air Force Base in California as a target to test the effectiveness of the Nike Zeus.

Radars aboard ships and aircraft picked up the first blips of the oncoming Atlas. Suddenly a voice broke from the master control loudspeaker in a blockhouse on Kwajalein.

"Cancel test! We're under observation!"

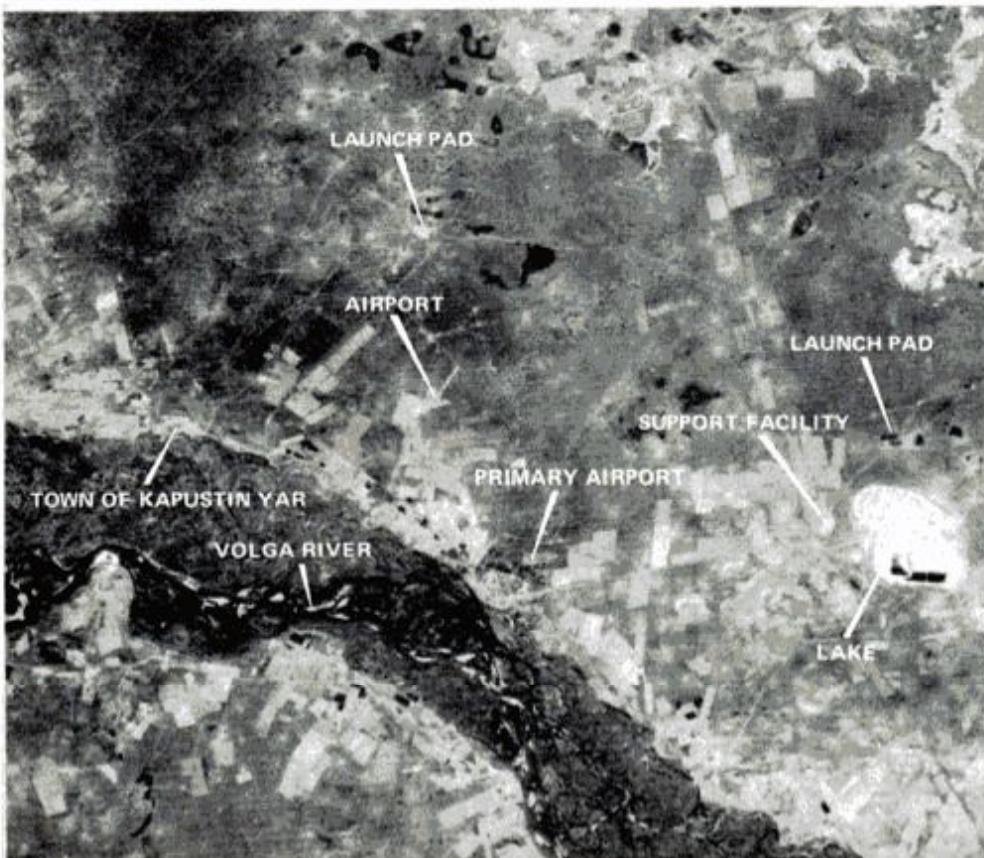
But it was too late. The Nike Zeus had to be launched—the countdown had progressed beyond the point of no-return. Flame billowed from the rear of the Nike Z and it roared into the sky. High over the Pacific and 100 miles from the tiny atoll, a flash of brilliant light marked where the two warheads met and detonated, providing the Pentagon with proof that the Nike Zeus ABM would work.

Spy ship identified

The demonstration also impressed the crew of the freighter, later identified as the *Kharkov*. Sophisticated electronic gear aboard the ship had recorded every detail of the antimissile test, including voice communications of American technicians. A U.S. Navy Neptune patrol plane circled the ship and made a series of still and motion pictures. And that was the only action taken. After all, the *Kharkov* was on the high seas, as she had every right to be, and could not be intercepted.

This was electronic spying of the highest order and the Soviets had every reason to be proud of their coup. They had accomplished it in the open, thanks to what was then the Kremlin's new naval policy: the use of a massive fishing and merchant fleet as a tool of Soviet intelli-

Soviet rocket launch facility at Kapustin Yar, 600 miles southeast of Moscow, was photographed by ERTS-2 satellite from altitude of 570 miles. Only part of ERTS photo is shown.



(Please turn to page 106)

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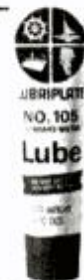
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HOW THEY'RE WATCHING US

(Continued from page 104)

gence. At the same time, Russian nuclear and conventionally powered submarines have for years been mapping undersea routes from bases in the Baltic Sea, Caspian Sea and the Pacific—routes that lead to missile targets in the United States.

High-flying spies

All this technology-based snooping is as productive, if not more so, as spying in the classic manner. Manned spacecraft, as well as unmanned spy-in-the-sky satellites, have become for the Soviets and the United States the ultimate intelligence-collecting agents. From the time of Sputnik I (October 1957) through the end of 1975, the Soviets launched 586 spy-in-the-sky spacecraft representing the major part of the 878 successful launches monitored by the United States. In 1975 alone, of 89 Soviet launches, 62 were for military and intelligence purposes while 9 of 19 American launches were related to intelligence gathering.

Much of the Soviet space effort parallels American programs. The Russians have orbited *Meteora* weather satellites and *Molniya* communications satellites, and they cooperate with America in disseminating weather information. This cooperation is based on an international treaty. Ironically, during both the Korean War and Vietnam conflict, the Russians supplied the United States with daily reports of Asian weather, which was a real help to our armed forces.

On the other hand, the Soviets helped the North Vietnamese by using satellites to photograph U.S. and allied military bases and naval vessels. Soviet trawlers also monitored B-52 missions from Wake Island and bases in Thailand.

Planes play a part

American experience in air surveillance goes back many years. In the late 1940s and through the mid-1950s, RB-47 Strategic Air Command bombers, converted to electronic platforms, flew along the USSR coastline and occasionally "wandered into" Soviet air space, but well out of anti-aircraft and missile range. Several planes were lost on these missions. But the operation served a good purpose: Photos were brought back and Soviet air defenses, committed to meet each challenge, were monitored by huge radars installed by the U.S. Air Force in Turkey.

The slow and high-flying U-2 spy planes forced the Russians to develop higher-altitude anti-aircraft missiles,

one of which brought down CIA pilot Gary Powers in May 1960. The U-2 was followed by a second-generation spy plane, the SR-71 Blackbird, capable of dashes at Mach 3 some 20 miles above the ground. Then came the spy satellites.

In all phases of technologically based spying, the United States has managed to keep a step ahead of the Russians. Round-the-clock surveillance of Soviet diplomatic and intelligence personnel in this country, for example, is carried out by the FBI, equipped with the latest in wiretaps, bugs and exotic hardware like a laser device that functions in a way similar to the microwave generator and receiver described earlier. Focused on a window in a room where people are in conversation, the radar beam bounces back from the glass pane, which acts like a mirror. Speech within the room causes the window pane to vibrate, and these vibrations are picked up by the radar beam. The radar "image" of the vibrations is then converted into speech by a special receiving set.

Our supersecret agency

Overseas, CIA agents often dog the tracks of their Soviet counterparts in operations in Western and third-world countries. As opposed to eyeball surveillance, responsibility for plugging into the vast Soviet communications network belongs to the National Security Agency, which employs some 25,000 people (90 percent of whom are civilians) and has an annual budget of \$1.5 billion. In contrast, the CIA has 16,000 employees and an annual operating budget of \$750 million. Though NSA is the more costly operation, this agency is exempt from the sharp Congressional scrutiny the CIA has undergone recently.

The supersecret NSA snoops electronically from isolated bases abroad, at sea, in the sky and in space, and utilizes a space surveillance system code-named "Dark Fence." Using high-performance computers, NSA's cryptologists decode and translate intercepted messages that are later provided to the CIA and the Defense Intelligence Agency for analysis. As far back as 1961, NSA monitored—from bases in Pakistan and Turkey—a secret Soviet attempt to launch three cosmonauts, one of them a woman, from Baikonur (now called Star City).

Other tracking stations in Canada, Hawaii, West Germany, England, France, Sweden and Italy locked on the space-craft as it was plotted in a decaying orbit.

"We are studying the program,"

(Please turn to page 108)

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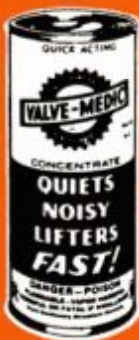


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HOW THEY'RE WATCHING US

(Continued from page 106)

the spacecraft commander transmitted to ground stations in the Soviet Union and to trawlers at sea as the cosmonauts frantically attempted to correct malfunctioning controls. "The situation becomes critical for us. Something went wrong. We are changing our course. . .

"I want to talk to the director, do you understand? If we do not get out of this, the world will never learn about it anyway. You will know what to do . . . What? . . . What?

"Here! . . . Here, this is something! . . . there is something! . . ."

Those were the last words heard from the spacecraft. Contact was lost at 20:00 hours Baikonur time, May 17, 1961. In May 1963, NASA official George L. Simpson Jr. admitted to a Congressional committee that his agency was aware of Soviet space failures but that the Pentagon and NSA had stamped the highest secrecy labels on this information.

A tearful farewell

On Apr. 25, 1967, NSA's powerful antennas in Turkey monitored a live television contact, not broadcast in Russia, between a tearful Premier Aleksei N. Kosygin and Soyuz I cosmonaut Vladimir M. Komarov. The cosmonaut had been informed by Soviet ground control that braking parachutes designed to lower his spacecraft safely to earth were malfunctioning and that there was no hope he could be saved. Soyuz I crashed in Russia.

Another U.S. program, Operation Holystone, a major effort authorized in the early 1960s, was concluded two years ago because it had become extremely dangerous. In this operation, the U.S. Navy's fastest nuclear subs infiltrated deep into what were considered "enemy" waters. One Holystone submarine, for example, slipped into Vladivostok harbor and tapped underwater telephone cables carrying traffic between that Pacific port and Moscow. Other Holystone missions have infiltrated harbors of the Peoples Republic of China, trailed Soviet submarines halfway around the world and monitored the Red navy on maneuvers, just as the Soviets have sent trawlers and submarines to observe NATO and U.S. Navy sea exercises.

The U.S. Navy has developed a vast underwater electronics system off American shores to warn against intruder submarines. This network of detection devices, also emplaced along other routes frequented by Soviet and Warsaw Pact ships and submarines, is linked to land stations

by cable and warns of traffic passing through. Virtually all Soviet ships and submarines trail a distinct sonic "signature" in their wake that has been recorded by underwater sentries and filed on computer tapes for instant recall, if necessary.

Sharp-eyed satellites

As operations on land, at sea and in the skies became increasingly risky, American scientists and engineers were forced to develop advanced satellites that could see, hear and "sense" what was happening on terra firma. Once or twice a month, a secret Discoverer or Samos spy-in-the-sky satellite is launched from Vandenberg Air Force Base into a polar orbit to circle the globe every 90 minutes at altitudes of 86 to 114 miles, carrying cameras that can spot, on the Earth's surface, an object as small as a basketball.

Some years ago, U.S. spy satellites, after a number of passes over the Soviet Union and mainland China, would eject a package at a predetermined time and position over the Pacific. Air Force cargo planes equipped with skyhooks would snare the falling package as it slowly parachuted earthward. The package would be rushed to a nearby military base and its valuable film developed for analysis by photo interpreters.

Now all that is old hat. Satellites launched in the 1970s transmit telemetry that ground stations convert to videotape images, which can be projected or printed as high-resolution photos. "Sensing" satellites like the Vela and Midas spy satellites, orbiting at an altitude of 55,000 miles from Earth, pick up various signals: infrared (heat) rays given off by a blast furnace, a launched missile, a fleet of trucks, trains, ships and even crops; also concentrations of gamma rays, X-rays, neutrons and large electromagnetic fields—indications of nuclear-bomb fallout in the atmosphere.

Satellites have replaced the Distant Early Warning (DEW) Line and Ballistic Missile Early Warning System of the 1950s and 1960s—those football-field-sized masses of steel, wire mesh, cables and plastic domes along the Arctic Circle. Today, the United States has surveillance satellites that eavesdrop on transmissions throughout the world and relay voice and code messages back to Earth where high-speed computers take over and distill and file potential intelligence information.

Even crops are important

And then there are the NASA satellites that provide additional information required by military lead-

Material, защищенный авторским правом

ers and State Department foreign policy makers. These "peaceful" satellites also provide valuable intelligence. Earth Resources Technology Satellites monitor such things as crops, forests, geological strata, ocean currents and channels.

This type of intelligence makes it impossible, for example, for the Soviets to hide a poor wheat harvest, giving the United States an advantage in bargaining with the Kremlin. New highways and railroad routes are passed on to the Pentagon; in the event of war, this is the type of information that the generals need to map their battle plans.

Improved maps

Maps are another very important factor in war as well as in peace. The Soviets continuously charge that U.S. geodetic satellites are performing a military intelligence function. As a matter of fact, they are. Intercontinental missiles are worthless if targets thousands of miles away are not pinpointed. Prior to the advent of satellite mapping, the cartographers of the previous 100 years had accurately mapped only a portion of the globe. Once the geodetic satellites were put to work, the locations of some cities in Siberia and the Peoples

Republic of China were corrected by as much as 10 miles.

Monitoring Angolan action

Here are some other accomplishments of America's high-flying spies: ■ Early this year satellites and U.S. destroyers tracked Soviet troopships and freighters that delivered Cuban soldiers and equipment to Angola.

■ India's recent nuclear weapons experiments were monitored by satellites, and the birds have provided details about the power of the blasts and the degree of dirty fallout.

■ Military flare-ups along isolated borders between the Soviet Union and China can no longer be kept under wraps and leaked by Peking or Moscow as they see fit. Satellites observe and eavesdrop, and this intelligence is received in Washington within a matter of hours. In the early 1960s, news of Sino-Soviet battles would be received weeks after the fact.

■ Late last year satellites provided intelligence about new mobile ballistic missile launchers fielded by the Soviets and the keel laying of a fourth Red navy aircraft carrier.

Whether it's a new steel plant, truckbuilding complex, chemical factory or missile launching site, its

existence can't be hidden from our orbiting snoopers. Though American surveillance is considered superior to that of the Soviets, it can be assumed Russian satellites also are effective.

Snooping in publications

Where does all this leave the traditional undercover agent? He still plays a role, but a diminished one. The Soviets, for example, maintain a large force of intelligence agents in the United States, in Washington and at the United Nations. Much of their spying consists of collecting everything published about economic, industrial, political and military developments in the United States. Occasionally, these agents attempt to ferret out more closely held information by subverting government employees.

But it's not like the good old days. "Science and technology have taken all the fun out of spying," says a former spook who worked behind enemy lines for the OSS in World War II and who recently retired from the CIA. "How do you compete with a computer or guard against esoteric equipment you can't see, much less understand? No wonder the CIA is retiring us real spies." ★★★



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UPBEAT GEAR FOR DIVING DOWN

(Continued from page 55)

ing compressed air, its moisturizer unit can be mounted between regulator and mouthpiece.

Standard instruments have been improved, and new ones added for serious divers. Console units running off the air tank now house all the instruments that used to be strapped to a diver's wrists. A typical panel has a depth gauge, tank-pressure gauge, compass, dive timer—and runs about \$200. Farallon's lighted "Navigator Console" is \$195.95.

Scubapro now has an automatic decompression computer that continuously memorizes repetitive and multiple-depth dives, noting time and depth for decompression when it is required. The size of a large wrist-watch, the \$80 instrument estimates the rate at which nitrogen goes into and out of solution in the blood stream.

Farallon's similar instrument, the \$75 Multi-tissue Decomputer, uses a color display to tell when you should surface after multiple dives to avoid decompression stops. It also has a new \$225 Digital Depth/Ascent Rate Indicator that flashes when you are surfacing too rapidly.

Controlled lifestests

The old lifestest has undergone changes to become a buoyancy compensating vest and controls a diver's float level—for about \$85 to \$150. Lung-shaped buoyancy-control system bags attached to the tank harness are \$200 to \$300.

Beginning divers in particular worry about sharks, but so do professionals. Cousteau's divers carry a "shark billy," a length of wood with a wrist strap at one end and a bottle cap nailed to the other. Poking the shark with it is claimed to be effective. The bang-stick, a long pole with a firing device on the end, pumps a shotgun shell into a shark on contact, but is a bloody business that can attract more sharks.

The Naval Undersea Center, however, has developed the Shark Dart, a hand-held device that looks like a dagger and fires a CO₂ cartridge when stabbed into a shark. The expanding gas ruptures internal organs and kills the shark without spreading blood. Farallon markets it in knife and arm-length models, plus a repeater that is attached to a compressed-air bottle. Prices range from \$39.95 to \$175. The invention is regarded as effective, but the maker warns: "Sharks should be regarded as extremely dangerous. Being armed with a Shark Dart does not make a diver the shark's equal." ★★

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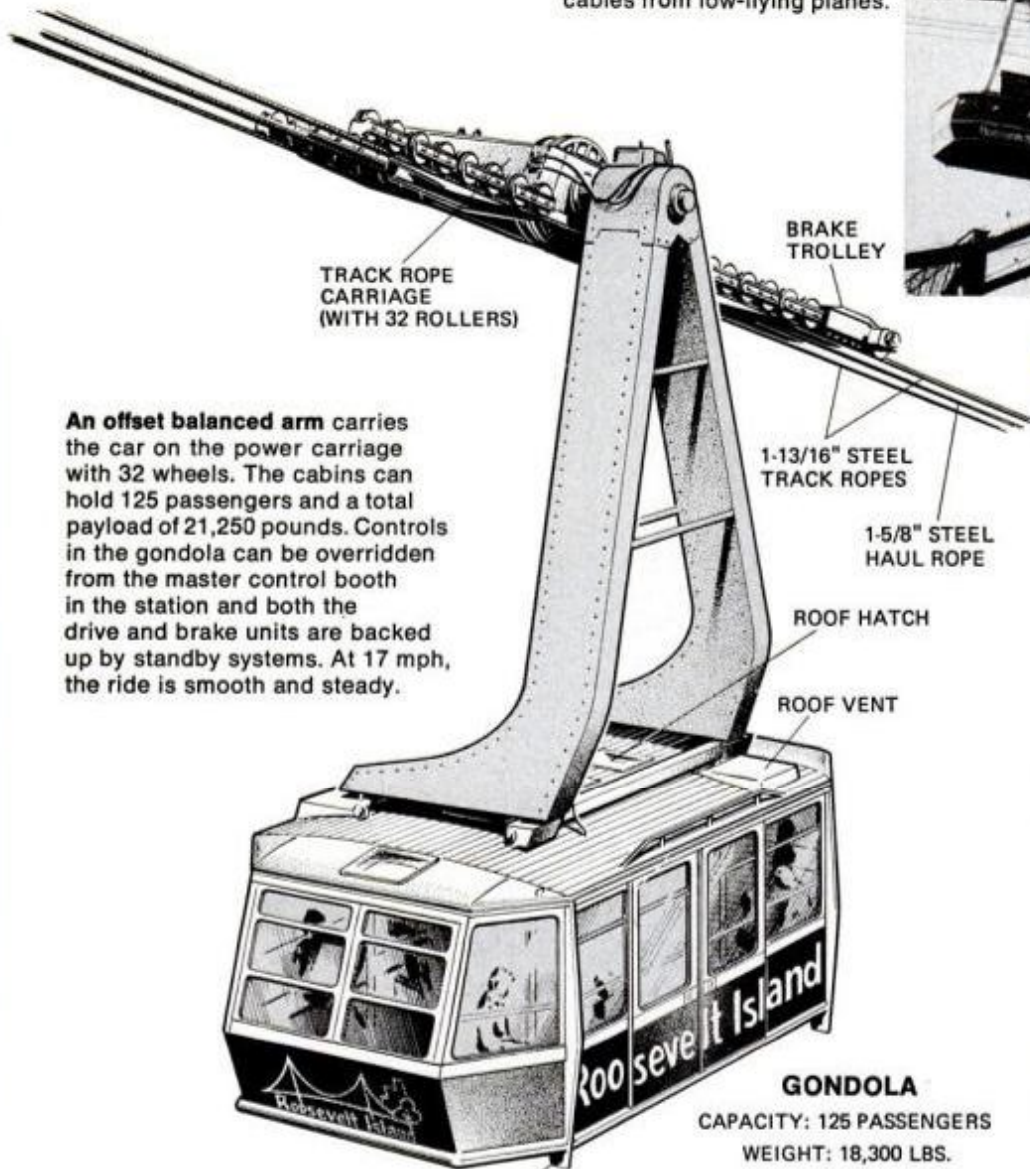
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PM 7/8

Engineers on the tower inspect cable tension as the tramway rolls by on a test run. Bridge superstructure in the background shields the cables from low-flying planes.



An offset balanced arm carries the car on the power carriage with 32 wheels. The cabins can hold 125 passengers and a total payload of 21,250 pounds. Controls in the gondola can be overridden from the master control booth in the station and both the drive and brake units are backed up by standby systems. At 17 mph, the ride is smooth and steady.

GONDOLA
CAPACITY: 125 PASSENGERS
WEIGHT: 18,300 LBS.
SIZE: 24'11" x 12'10"

AIRBORNE COMMUTERS

(Continued from page 53)

erator, although the full length of the system is managed and constantly monitored from a control booth at the station. Wrap-around windows offer riders spectacular views as the cars rise from the loading docks and quickly reach the tracking speed of 17 mph.

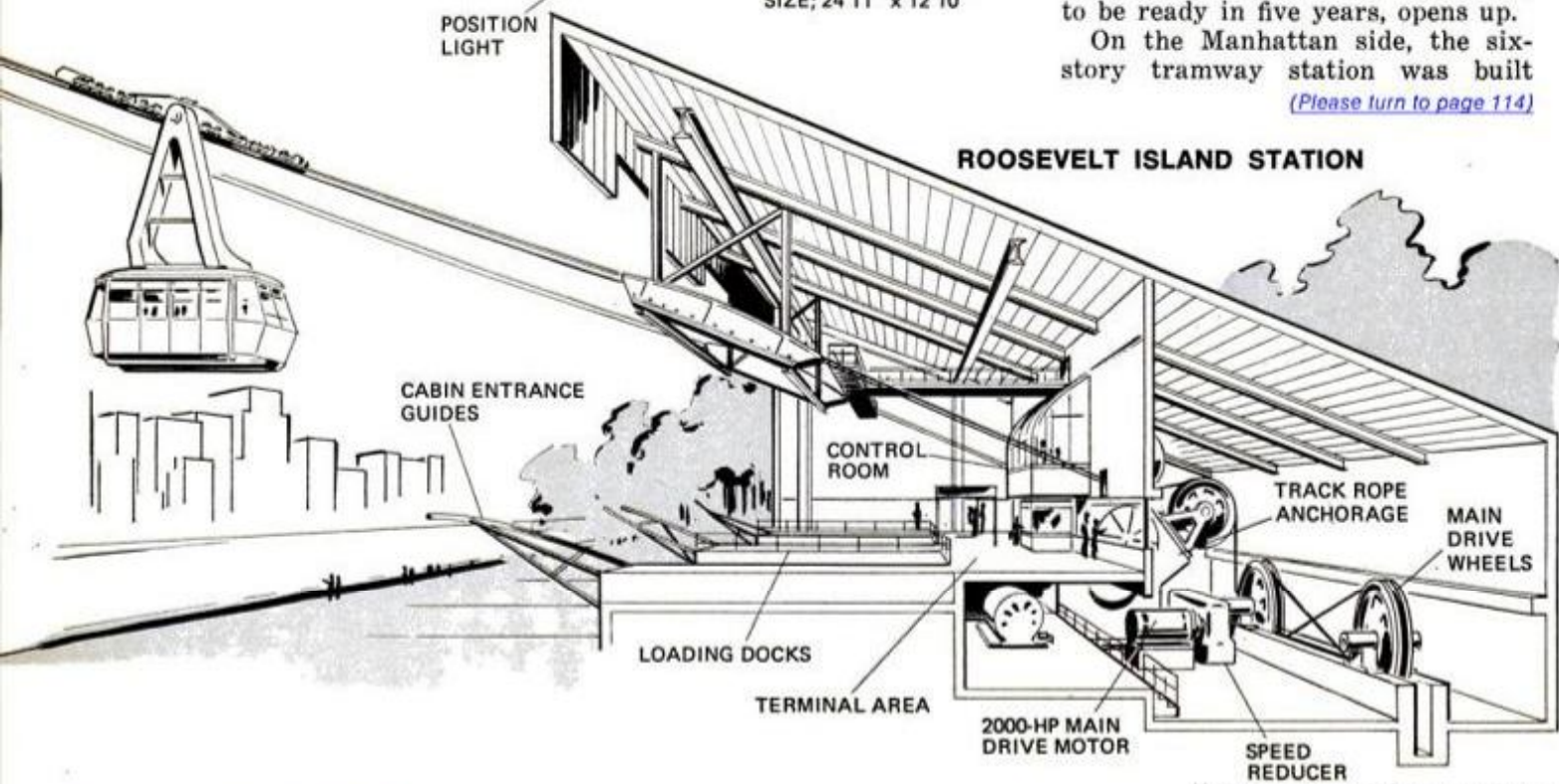
Users avoid parking problems

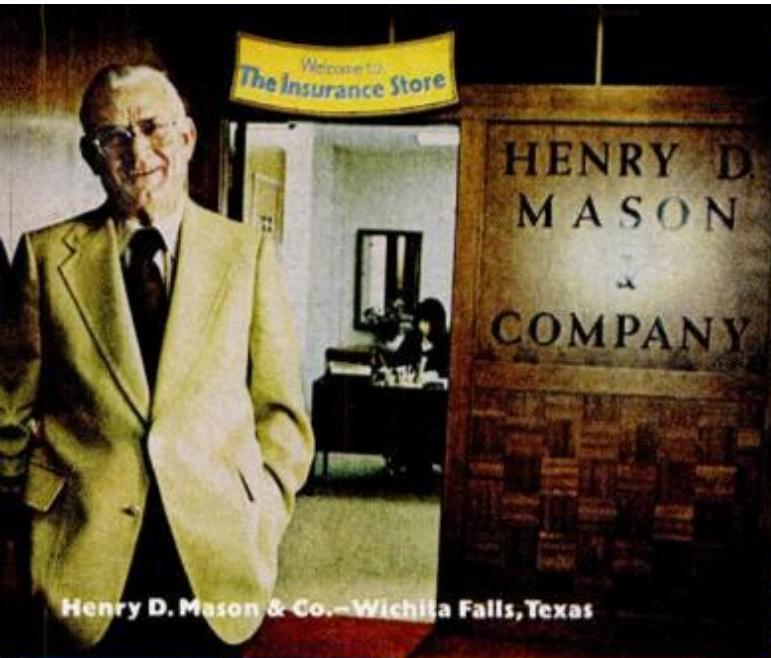
In addition to whisking past the bumper-to-bumper traffic on the adjacent Queensborough Bridge, the real bonus to commuters will be avoiding the hassle of parking in the city. Many residents don't need cars at all since transportation is provided throughout Roosevelt Island by electric buses.

This system is one addition to modern mass transit that stands a good chance of succeeding. One factor is that the only alternate commuting route is a typical New York bus and subway combination that can take 45 minutes or longer. There will be no competition until a subway stop, to be ready in five years, opens up.

On the Manhattan side, the six-story tramway station was built

(Please turn to page 114)





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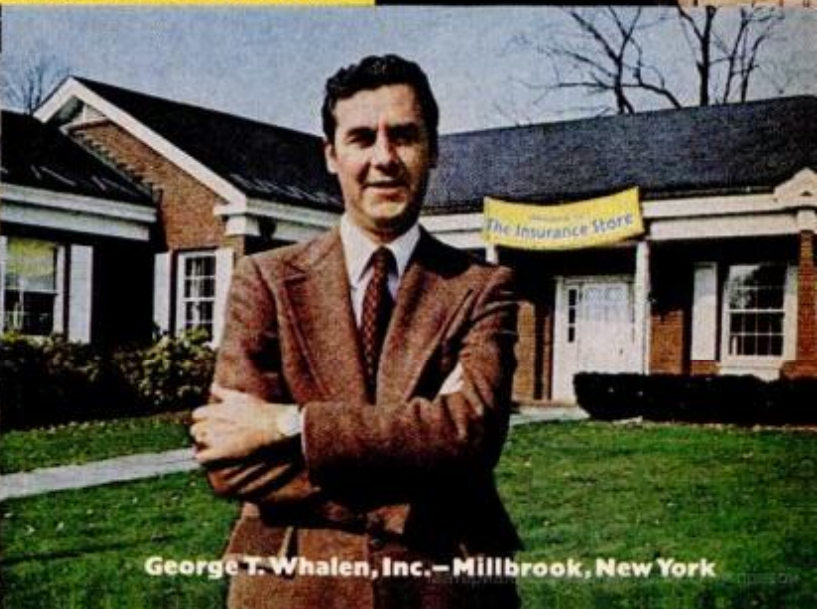
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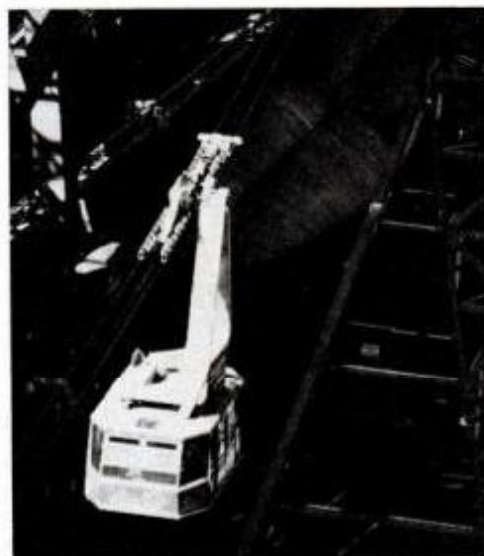
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AIRBORNE COMMUTERS

(Continued from page 112)

around 40-inch steel and concrete columns that will eventually support a 32-story building above the loading docks. So the real estate pays for itself. Manhattanites arriving at the island can get to more than 40 acres of parks on the quiet electric minibuses, stroll the promenade that circles the 147-acre island, and browse through shops along the stone-paved Main Street.

Safety for the passengers was uppermost in the minds of the designers. The site was chosen, and towers placed, so that tramway cables would be shielded from low-flying aircraft by the Queensborough Bridge superstructure. Safety features include a wind-speed warning system to stop operation if winds become excessive, an overload circuit that can cut off the drive unit and monitor circuits to check cable tension, brake fluid levels, traction rope slippage and tensioning weight overtravel.

All systems fail-safe

Every system is fail-safed with at least one backup system. There are also two 14-passenger rescue cabins

PM editors get a great ride sometimes. The author shot this (left) as his open-door helicopter circled the bridge and zoomed in on the tower. The high point of the ride (below) is over the 300-foot Manhattan tower. The extended carriage evenly distributes the weight on the cables.



with independent drive systems and an extra standby drive system with battery-operated controls. In case of a major system failure, the special carriages on the cabins are attached to the rescue rope system. This assembly moves along the independent rescue cable, attaches to the walls of the stranded cabin and can take off passengers through opposite window openings.

All cabins have telephone communication with the control station and backup walkie-talkies. Electronic circuits in the cabins have built-in programmed sequences that protect against an incorrect command from the cabin operator and, if need be, full operating control can be taken over from the master control panel in the station.

One unique part of the project was the integrated effort of the team from Berne, Switzerland, where the tramway was made, U.S. engineering firms and local union workers. The result of their efforts could become a model for a new concept in modern mass transit. ★ ★ ★

TRAMWAY'S VITAL STATISTICS

Length of one-way ride: 3094 feet
Longest span between towers: 1184 feet
Tallest cable tower: 300 feet
Trip travel time: 3½ minutes
Trips per hour: 12 on five-minute cycle
People per hour: 1500 each way
Track drive: d.c. variable speed
Controls: manual, automatic, remote
Motor: a.c., 2000 hp
Cabin capacity: 125 passengers
Cabin size: 25 by 13 feet
Total payload: 21,250 pounds

NOVEL LIGHTHOUSE NIGHT LIGHT

(Continued from page 102)



Square bar clamped in lathe's toolholder provides long toolrest for turning chisel.

rest. Turn to the dimensions given; then remove plugs from the door and window openings and sand the work with progressively finer grades of paper while it is still in the lathe.

Cut the 2 $\frac{3}{8}$ -in.-diameter roof from dark wood, attach it to the faceplate and turn to a 2 $\frac{1}{4}$ -in. diameter. Turn the $\frac{1}{8}$ -in.-deep recess for the round window, then remove the partially turned roof from the faceplate and drill 16 $\frac{1}{16}$ -in. holes in both roof and body for 1-in.-long brass posts. Make a jig to help space the holes by first drilling them in a metal disc. Tape the disc in place, drill two holes opposite each other, insert two posts to hold disc, remove tape and drill the other holes.

Remount the roof on your faceplate and turn the sloping roof line. I used three short No. 5 wood screws (with washers) to attach it, placed on a 1 $\frac{1}{4}$ -in.-diameter circle.

Making the 'rock' base

Draw the patterns for the two base pieces on grid paper, transfer them to your wood with carbon paper and saw out. Cut a 1 $\frac{3}{4}$ -in.-diameter hole in the top piece, turn a $\frac{1}{8}$ x 2 $\frac{5}{8}$ -in. recess in the top surface and drill two holes in the bottom piece for the lamp cord. Glue the base pieces together and carve the edges with a hand grinder to simulate rough jagged rock. Smooth with sandpaper.

Make the circular window from a 1-in.-wide strip of thin clear plastic, or a pill bottle, and rub it on the inside with extra-fine steel wool to make it translucent. Lap the ends about $\frac{3}{16}$ in. and cement to form a band.

Cement posts in the holes and add the roof, first placing the plastic window inside. Install socket in the base and cover exposed terminals and wires with silicone rubber. Install a 7-watt bulb.

For a finish I used several coats of sanding sealer and rubbed each one with 4/0 steel wool to give it a semiluster look. ★ ★ ★

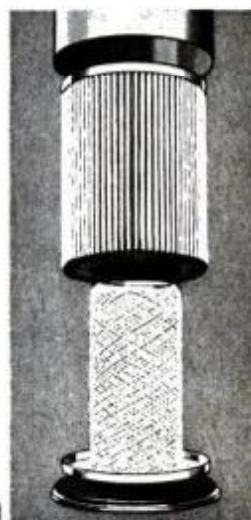
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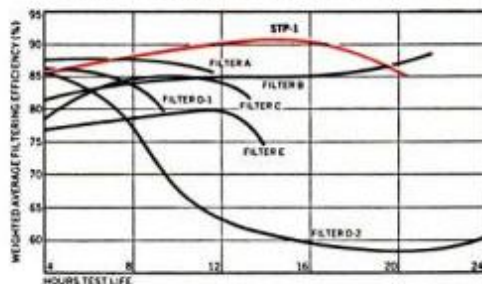
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"This machine pays for itself making money out of scrap boards. It is a very well built machine and I confess it is more than I really expected for the price. It does everything you say it will."

Stephen Schultz — Orangeville, Penna.

"I bought a batch of walnut in the rough, and after planing it on the Belsaw I figured I saved enough money to pay for two-thirds the cost of the Planer. It really does a good job."

R. S. Clark — Springfield, Ohio

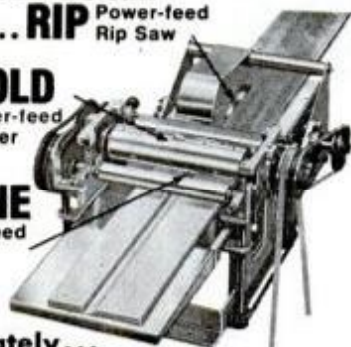
"I make furniture, grandfather clocks and many other things. My Belsaw does nice work and I couldn't do my job without it. I really like it."

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Workbench Magazine

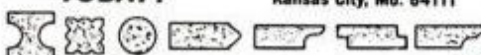


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4 KITS FOR CAR SAFETY

(Continued from page 70)

it with a Baggie or something protective when it's not in use.

Slowing down your wipers

Windshield-wiper delays save you the nuisance, on damp or drizzly days, of constantly leaning over to your dash to turn the wipers on for a few strokes, then off. We tried delay kits from Heath and Amtron that eliminated this bother by switching the wipers on for a few seconds, then off for a delay time you can adjust with a front-panel knob.

Heath's \$16 CH-1068 kit lets you set an internal control to keep the wipers on for bursts of 1/2 to 10 seconds, with delays (adjustable from the front panel) of 5 to 30 seconds between bursts. The \$27.50 Amtron UK-707 has no burst-length adjustment, but offers a delay range of 3 to 50 seconds. Both kits take about an hour to build, plus a half hour to an hour to install—once you figure out how to install them.

Since wiper-motor circuits vary quite a bit from car to car, that can be hard to figure. Heath's catalog covers in some detail car models the delay won't work with, and their instruction manual gives lots of information that will help you figure out how to install it in most U.S. cars. For my import, though, I had to write Heath for help, enclosing a copy of my car's wiring diagram.

Comparing manuals

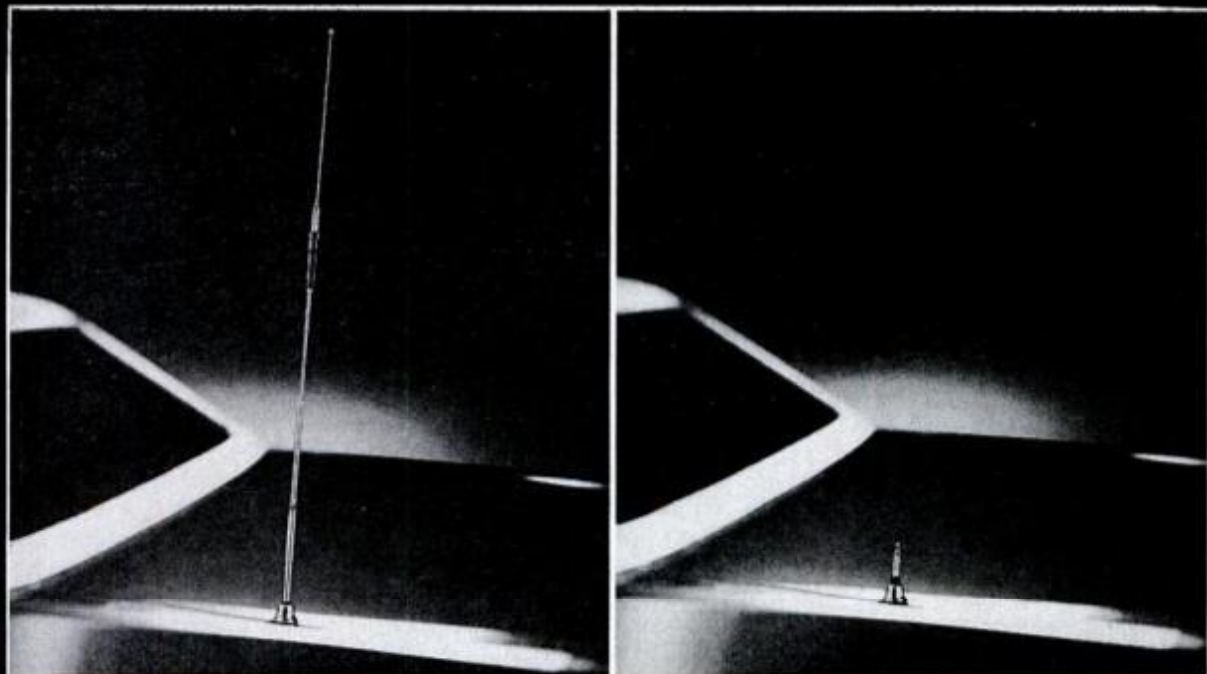
The Amtron kit's manual gives a lot less installation information. Presumably it will work fine with European cars—it's Italian—but the manual doesn't even offer a clue.

Heath's manuals suffer, if anything, from being a bit too fussy, detailed and precise. That makes them great for beginners, but can make experienced kitbuilders grow a bit impatient.

But manuals like Amtron's require even more patience from beginner or veteran alike: Illustrations are frequently printed on pages that can't be seen from the page where you'll find the instructions that the picture refers to. Wire lengths are given only metrically, without the handy rulers (English and metric) Heath prints on its manuals' pages. And resistor color codes, spelled out at each step in Heath manuals, are on a separate chart with Amtron (that's not a problem for the old kitbuilder, though, just for the beginner).

Still, the Amtron is simple enough that its manual isn't much of a problem, and it's more compact than the Heathkit delay, too. ★★

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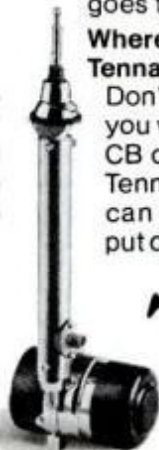
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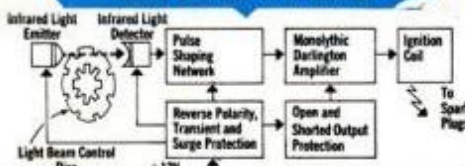
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CALL THEM MINI-VANS (Continued from page 51)

lo). For 1978, this X-shell will be all new, and it's been engineered to take fwd, probably with the Buick V6 ahead of the front-axle centerline. There might also be a crosswise in-line Six for the same package.

GM had originally slated this mini-van to accept the rotary powerplant, but when that engine got shelved, the project was shoved back some 18 months. Had the rotary worked out, this X-bodied vanette would have been out this summer.

The van on GM's 1978 X-body might be offered by all four divisions. Regular passenger cars will also be built around the X-chassis, and these will look very much like the current BMWs. The GM vanettes and the GM N-O-V-A cars, though, won't look alike—they'll just share chassis pans and some running-gear components.

What Ford, Chrysler and AMC have up their sleeves along these mini-van lines we don't know yet. You can bet, though, that if GMs sell—and likewise the imports headed this way—the other Detroiters will hop in, too.

Another American small-van design that's about ready to go is a pure custom job from Elite Industries of Cokato, Minn. Elite now markets the Laser 917 kit for VW conversions. Called the 49er Mini-Van (49 inches being its height), this new vehicle is tooled now, and the first prototypes are being tested. The 49er van may well be America's first semiproduct job in this size and price class.

Fully rigged

The 49er will use a VW Beetle floor plan as its base, but unlike kit cars generally, it takes the full Detroit approach, with inner body panels, locking gullwing doors, glass windows and good insulation. It will meet all federal requirements and use Monza square headlights, Pinto bumpers, a rear lift gate, gas-filled pistons to help counterbalance all doors and so on. Ski and luggage racks, custom seats and wild interiors are among the planned options.

Overseas contenders

Overseas, they're already building a raft of mini-vans, and some companies are considering Americanizing these for import. For example, there's the Mazda F-1000, a rear-engined mini on a 97-inch wheelbase, with 52 hp from its 987-cc ohv in-line Four; and the Nissan (Datsun) E-20, on a 107.5-inch chassis, using the 96.5-cu.-in. pushrod Four with 80 hp and a four-speed gearbox. Datsun also makes the "Homer" that uses the same power train but spans an 89-inch wheelbase.

Other Japanese contenders might be the petite (66-inch-wheelbase) Daihatsu 360 and the Suzuki L-60-V (68.7-inch-wheelbase) vanettes. These, though, might be too small to achieve broad popularity unless we run into a replay of the fuel crisis.

Toyota currently makes the "Hi-Ace" van on a 92-inch wheelbase. It's for the Japanese market so far and has a sliding side door and a full liftgate. Whether Toyota will bring its mini into the United States, however, remains to be seen, although the company is evaluating two Hi-Aces in Southern California now.

Toyota's Japanese design staff recently produced the hit of the 21st Tokyo Auto Show—a vanlike station wagon dubbed the MP-1. This clean, handsome machine looks like a cross between a conventional station wagon and a van, and the silhouette stands somewhere in the middle. It was originally slated for fwd, but time pressures dictated using the Crown in-line Six with rear drive. Yet the floor is very flat, windows are flush with the body sides, and there's a stubby hood.

The rear doors slice back parallel to the body. Inside, the passenger's bucket rotates 360°, and the center section of the rear bench flips 90° so it can face forward or rearward. The MP-1 has a sun roof, built-in refrigerator and a marvelous instrument panel design that makes the cockpit seem much larger than it is.

Honda's hopeful

Also from Japan comes the Honda "Life," another diminutive vanette that uses the Civic's fwd setup and has practically no overhang anywhere. Like other Japanese vans now in production, the Life needs some re-engineering to bring it up to U.S. standards, but Honda is giving that some serious thought.

Bertone, the Italian design firm, has worked up a handsome little six-door, rear-engined mini-van for Fiat. This one started out to be a "visitor's bus," but there's no reason why it can't be outfitted as a fun/mule sort of vehicle. Called the M-B/850T, it's chicly modern, with loads of greenhouse and a clever roll bar integrated into the B-pillar and roof.

What's happening: These manufacturers are eyeing a wide series of vehicles that make the most of interior capacity (like a box), yet have some style; that a woman doesn't feel she's borrowed from the local plumber; that are fun and versatile and don't cost an arm and a leg. So mini-vans in various sizes and shapes seem to be on the way. ★ ★ ★

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SHOOTING THE GUMBALL RALLY (Continued from page 72)

cept for an outrageous comedy." (An account of the event on which the movie is based appears on page 73.)

But Bail is a former movie stunt driver himself and somewhat of a "purist" sports car owner. So when he set out to make his driving movie, entitled *Gumball Rally*, he tripled the workload by insisting that all driving sequences be 100-percent authentic, with no "under-cranking" of the camera to make it look like cars were going faster, or "process scenery" rolling by a stationary car.

Bail chose a comedy format "since it would minimize pedestrian involvement, and make all the complications occur between the racers themselves." The name "gumball" comes from the prize in the race—an ordinary street-corner gumball machine.

Bail describes the tone: "We wanted it to be like those cartoons where the characters run over the edge of the cliff, stop in midair, then run back to safety before they start to fall."

But, again, the driving had to be authentic. Bail had John Morton, three-time national SCCA driving champ in his Datsun 240-Z, set up a one-week "driver's school" at a nearby racetrack to teach the stars, like Michael Sarrazin, the fine art of spinning a car without getting hurt.

Car casting

After casting the actors, Bail had to "cast" the cars to match the actors' personalities. "It's almost like certain kinds of people have certain kinds of dogs," confides Bail. "It's that way with cars, too. For instance, we knew our two older gentlemen—Vaughn Taylor and Pat O'Malley—would have a purist car representing the hot model of their younger days—the Mercedes 300SL. By contrast, our star, Michael Sarrazin, drives the hottest car of his youth, the 427 Cobra. We went from the characters to the cars."

Bail talked to the Detroit auto-makers about supplying their hottest models, but "they were hard-nosed about it," he recalls, "so we had to use the older models which were faster anyhow." Some cars, like the Ferrari Daytona and the Cobra had to be leased from collectors for sums exceeding \$100 a day. Cars like the Camaro, Corvette and Porsche 911 were purchased outright.

Gumball Rally employs all the paraphernalia currently in use by what Bail refers to as "the racing underground," including scanners to monitor police broadcasts and "Snooper" radar detectors which give off a

"beep" tone when you approach a radar unit.

The "van cult" also receives more than a nod of recognition of its existence in the casting of a Chevy van in *Gumball* equipped similarly to a van entered in the real coast-to-coast race Bail first read about. It has wide tires on mag wheels, a front spoiler, road lamps, CB, a Snooper, and a 200-gallon gas tank. "They figure that, by cutting out all the gas stops, the tortoise can beat the hare," explains Bail.

Expensive dupes

Once the initial cars were "cast," a duplicate of each had to be obtained in the event the original was pranged in an unplanned stunt. Out on location, with costs running up to \$16,000 a day, the cast and crew can't sit around waiting for a duplicate car to be whipped up from scratch. As it happened, the crew of mechanics went through several all-night sessions to keep the cars both unbent and running. The Camaro, which started out with a 400-hp engine, went through three engines "because we never had time to break in the new engine," laments Bail. One expensive car, the Daytona, was crunched inadvertently and a \$35,000 duplicate had to be purchased in case the backup car suffered an equal fate.

Bail insisted on *real* locations for all action shots "because I knew moviegoers have seen our back lots a million times on television." Going on location raised the cost far beyond the original \$5-million budget.

Among the real locations are New York's Wall St., Times Square, Washington Bridge, Park Ave. and the Holland Tunnel.

Although frequently in Hollywood "chase" sequences, all the cars you see around the stunt cars are also manned by stunt drivers in case the principal car goes out of control. Bail and his crew used "real traffic" wherever they could get away with it. To do this, he had a police car out front with sirens and flashers on clearing traffic, then the camera truck, and finally the rally car being filmed—all rolling at better than 100 mph—and giving commuters the shock of their lives.

Dangerous towing

Bail filmed the drivers two ways. His crew devised a special rig that could be hung onto each car to shoot the drivers through the windshield while the car was being towed. Towed at 100 mph? "We had to resort to towing because of pure driver

(Please turn to page 124)

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SHOOTING THE GUMBALL RALLY (Continued from page 122)

fatigue," reports Bail. "By the end of the day, our actors were so tired they could hardly talk, let alone drive. So we towed." But it was dangerous because no "break-away" cable was used. If the driver of the rally car tried to turn, an accident would certainly have resulted.

To film the scenes where cars had to be under their own power, Bail had the one-ton camera truck built. "We tried to use Old Yeller—an old race car converted to a camera truck—but it was too rigid, so we souped up our camera truck and made another out of an El Camino," says Bail. He also used some rally cars by merely turning the cameras to face outward.

In order to run through "real traffic," a lot of planning was necessary. First, it took three or four miles just to get the camera truck up to 100 mph. Then the cameras would roll for a minute to a minute and a half during which another five miles would be covered. "So every running shot used up another eight miles of highway," says Bail.

Although the cars in *Gumball* were doing over 100 mph during the filming, the effect won't be blurred backgrounds as in *LeMans*. "I used 'hard' lenses," says Bail, "or nontelephoto ones which had everything in focus from zero to infinity. But this way, it's even more terrifying. If you want to imagine it, just think of what it would be like on your nearest freeway doing 110 mph when everyone else is doing 55 mph—it's outrageous."

State governors consented

To obtain the clearances necessary to highball it at over 100 mph, Bail and Warner Brothers had to go through the governors of each state for permission. "They allowed it only after we proved we had enough police protection to minimize the public's chances of getting hurt," explained Bail.

Of all the cars in the film, the Cobra required the most cosmetic work because it was so low to the ground that New York potholes would rip off its sidepipes, and its aluminum body proved so eggshell-thin that it was constantly suffering dents.

Except for the Cobra and Daytona, "we had to hop up every car used in the movie," explains Bail—including the one-ton camera truck. The truck not only had to be able to cruise at 100 mph hour after hour, but it had to be able to do so with 11 people aboard: three cameramen, three assistant cameramen, a director, light-

ing man, assistant director, sound man and—oh, yes—a truck driver.

\$700,000 for cars alone

Because all cars had to be kept running until the end of the movie—in case a shot had to be done over—Warner Brothers eventually had to spend as much as \$700,000 for rental and maintenance of cars.

Sometimes necessity became the mother of invention: After blowing the engine in the Camaro the second time, the filming ground to a halt until someone thought of a "fast way" to get a Camaro engine. They rented a Camaro, "borrowed" the engine for the movie car, filmed the scene, then removed the rental-car engine and reinstalled it so the rental could be returned. Avis never knew its engine was a movie star!

The only "public" casualties were the engines of several police escort cars. "They just couldn't take running at sustained 120-mph speeds," laments Bail, "and I have the engine rebuilding bills to prove it."

Ironically, the real cops assigned to run escort for the location crew really enjoyed their assignment, recalls Bail. "They can hardly wait until the movie is released this summer," he says. "Of course, they realize it's just a fantasy film."

The script features some 34 driving stunts—each planned with the preciseness of a military campaign.

Incredible stunts

"I sat down with the special effects man and told him what I wanted," says Bail, "and together we figured out how to do it." A most difficult stunt was the destroying of a Corvette in which the script called for it to break completely in half. To do this, the Corvette was sawed in half beforehand, bolted back together, and "broken" again after running it over an off-camera ramp. Amazingly, the driver and his copilot are seated in the car during the trip up and off the ramp. "What cost the most money," says Bail, "was making the car so it could still be drivable, yet would break apart on impact."

A second spectacular stunt—a Camaro careening along miles of crowded freeway—involved Ollie Anderson, who has an "Auto Dare Devil" show. To make it look accidental, a ramp was hidden next to a center divider and rallyist Ollie puts the car up on two wheels while zooming down the freeway. Then he weaves through 100 other cars before going all the way over. Another tough, dangerous stunt was called for by the bucks-up Ferrari drivers, who, not

wanting to lose a minute to a pit stop, drove into a maintenance truck at 55 mph to have work done while constantly rolling toward their goal.

Perhaps the stunt driver enduring the most pressure on him was the one who had to take a \$35,000 Rolls-Royce Silver Shadow through a new-car dealership and wipe out 17 new cars, yet still leave the Rolls drivable.

The film was made more difficult for stunt men because several cars were convertibles and Bail wouldn't allow roll bars "because the real rallyists didn't use them." But Deist shoulder harnesses and seat belts were used. Bail, who drove stunt cars 16 years, believes "it's impossible to roll a car unless you hit a curb or ditch. Watch Indianapolis—you see them spinning out at 180 mph all the time, and unless they hit something, they stay right side up."

Because he was a stunt driver, Bail is tough on stunt men. He had Ollie put the Camaro up on two wheels 15 times before he allowed him to roll it all the way over. "Guys like Ollie don't get paid to get hurt," growls Bail, "because I'm likely to say 'let's do that stunt over'—which I did quite frequently."

Blew out engines

Because Bail is a long-time car enthusiast, he knew he couldn't fool other enthusiasts in any details. For instance, in dashboard shots—where the tachometer needle has to work with the speedometer needle—he had all cars corralled in a dyno room and run up to 140 mph so he could get dashboard shots of each car at speed. "Unfortunately," he says, "this cost us a lot of bread because three very expensive engines were lunched on the dyno."

One thing Bail hates is driving scenes where the sound is dubbed in from the wrong kind of car. So, after filming was completed, all the cars were taken to a deserted section of unopened Los Angeles freeway and run at various speeds a whole day with recorders going full blast. For car nuts, the sounds of 427 Cobras and 300SLs going through the gears to redline will be worth the price of admission alone!

One danger of teaching the actors to drive, admits Bail, "is that I worried one might become overenthusiastic." Fortunately, during the filming "none of them got in over his head." But at least one actor—Tim McIntire—confided he "can't wait to buy his own Ferrari." Says McIntire, in real life a member of a rock band, "the Ferrari was like music to me. The minute I heard those 12 cylinders start up, I dug the tune ..."

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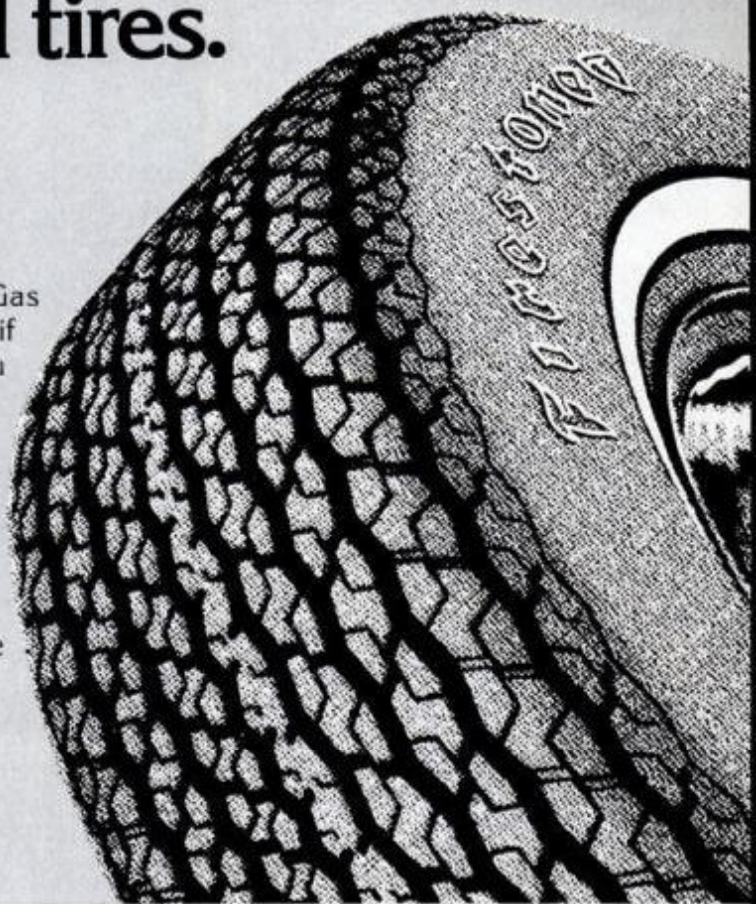
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PROTECT YOUR BOAT FROM THE FIVE BIG HAZARDS *(Continued from page 67)*

during the initial stages of a fire. Marine alarms, though sometimes more expensive, are desirable, however, since they are constructed to operate dependably in the moist and often corrosively salty atmosphere found around boats.

An intrusion alarm system warns when an unauthorized person boards your boat while it is docked. For the most part, these are pressure-sensitive devices that are activated when stepped on, setting off a loud alarm bell or horn. There are also magnetic devices screwed to the inside of cabin doors. When the magnetic field is interrupted by someone breaking into the cabin, a loud alarm sounds. These alarms can be rigged to indicate if mooring lines have been cut, untied or chafed free.

How they work

Bilge and explosive vapor detector systems are basically simple mechanisms consisting of a sensor mounted in the area being monitored. In the case of a bilge alarm, the sensor is a float device which rises as the water rises. When the float reaches a preset level, it activates the alarm, giving you time to start pumping,

head for shore, and attempt repairs.

In the case of a good-quality vapor detector, the sensor has a platinum (active) filament that's exposed to the atmosphere of the compartment in which the sensor is placed. This filament is the main part of what is called an electrical Wheatstone bridge circuit. When no explosive vapors are present, the circuit has the same current flowing in its active and reference filaments, which "equalizes" the current and keeps the alarm in a passive state.

When explosive fumes come in contact with the active filament, there is a change in resistance owing to a

rise in temperature of the platinum wire. The temperature increase is a chemical reaction of platinum when it's exposed to explosive gas fumes. The resistance produces an imbalance in the circuit which is proportional to the amount of vapor present, causing the current to flow through the alarm circuit and producing a warning.

The warning indicator is usually mounted in or near the cabin or at the helm position, and may be a horn, bell or light. Console units may have a set of lights with labels that indicate which form of trouble is occurring. Better models will also have some test arrangement so you can be sure the lights and bells will function in an emergency. Simple single systems may cost as little as \$10, while the more elaborate multiple-warning consoles run \$200 or more, plus charges for extra sensors.

Buying tips

There are several important points to keep in mind as you shop for and install the alarm systems you need.

1. Even though your boat may be equipped with an automatic bilge pump, don't discount the need for



Bilge alarm is triggered by rising water which pushes up float to activate bell.

bilge alarm. Bilge pumps can fail, or a leak can develop a larger capacity than the pump can handle.

2. An alarm system generally works off the boat's electrical system although many have batteries. In any event, a low power drain is necessary—1.0 amp. or less is ideal.

3. Alarm systems should possess stainless-steel hardware to withstand corrosion.

4. Installing an alarm system is a relatively simple task, requiring only basic tools. If you want to find out how easy this is, write the maker first for instructions.

5. Explosive fume detectors should be mounted low enough in the engine compartment or bilges to sniff gas fumes which are heavier than air, but sensors should not become submerged in bilge water.

6. Install as many vapor detectors as needed, and remember the galley as well where bottled gas may be used for cooking and refrigeration.

7. Use No. 16 or larger wire when splicing in detectors.

8. You can test sensors by placing 10 drops of gasoline or lighter fluid in a two-pound coffee can. Let vaporize by covering it for several minutes, remove lid and lower in sensor. Your alarm should sound. ★★

WHAT DETROIT HAS LEARNED FROM RECALLS (Continued from page 57)

December 1974 a recall could also cost the owner money. The law used to read that the manufacturer could require the owner to pay for the fix. That's been changed. The factory now has to pay this cost.

Recalls hit the manufacturer much harder than they hit the owner. For openers there's the cost of sending out the recall notice. The cost of preparing a recall letter, mailing it and the follow-up record-keeping can easily run \$6 to \$8 per car. Then there's the cost of supplying dealers with parts, shipping the parts, preparing instruction material on making repairs and paying mechanics for time taken to correct the problem.

The companies won't release cost information on recalls. But there are some ballpark numbers available. A minor recall can run \$5 million to \$10 million. A major recall can cost \$25 million to \$50 million. One GM recall of a few years ago is estimated to have cost the company \$40 million.

Recalls mean red faces

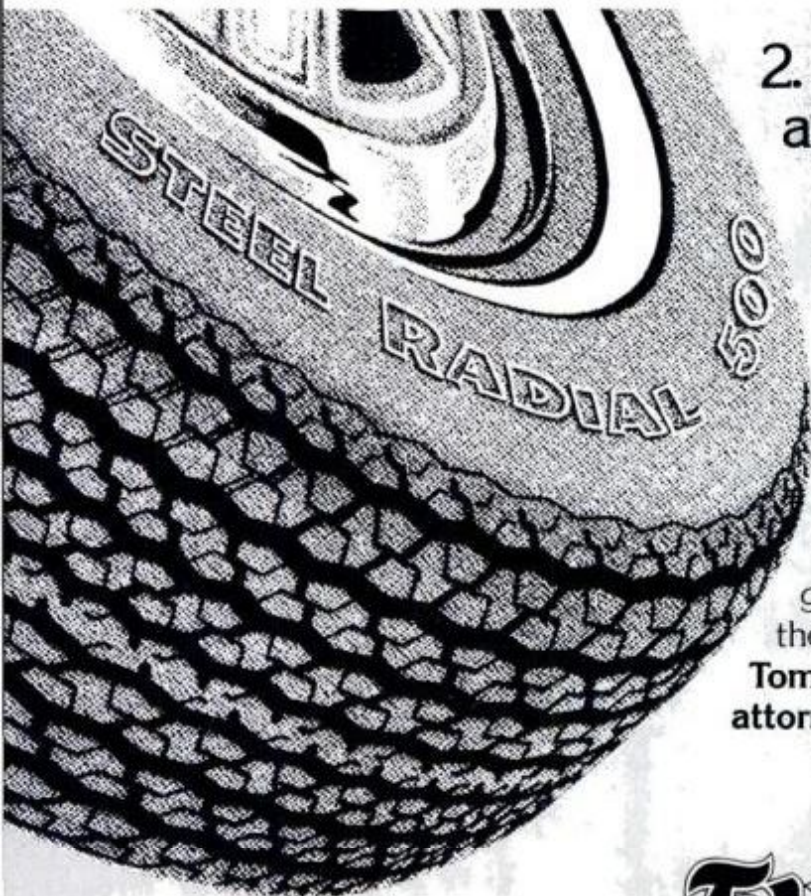
The big pay-outs aren't the only thing that distresses Detroit. Recalls are embarrassing. Although a company may recall only 50,000 cars out

of a production of 1,000,000, the 50,000 call-backs reflect unfavorably on the 950,000 good cars. Most people remember the name of the company that manufactured the lemon—Acme Motors—and not the name of the particular Acme model recalled.

Recalls contradict the image auto-makers try to create for themselves with advertising. The companies spend millions of dollars a year advertising the merits of their cars. The full page ad in the newspaper or the TV commercial, bought at enormous cost, can be undone by a four-line story on a back page or a brief mention during the network news.

Recalls plague both the factories and dealers in still another way that has nothing to do with the defect in the car. Any recall for any reason brings out thousands of disgruntled car owners who seize on the recall to try to get their cars fixed without paying for it. The problems are real enough. But they are not related to the recall. Ford once had to recall 700 cars because they carried the wrong decal on recommended tire pressure. Dealers were besieged by owners who tried to make out a case

(Please turn to page 132)



2. Ask a friend about Firestone.

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Tom Finnerty,
attorney.

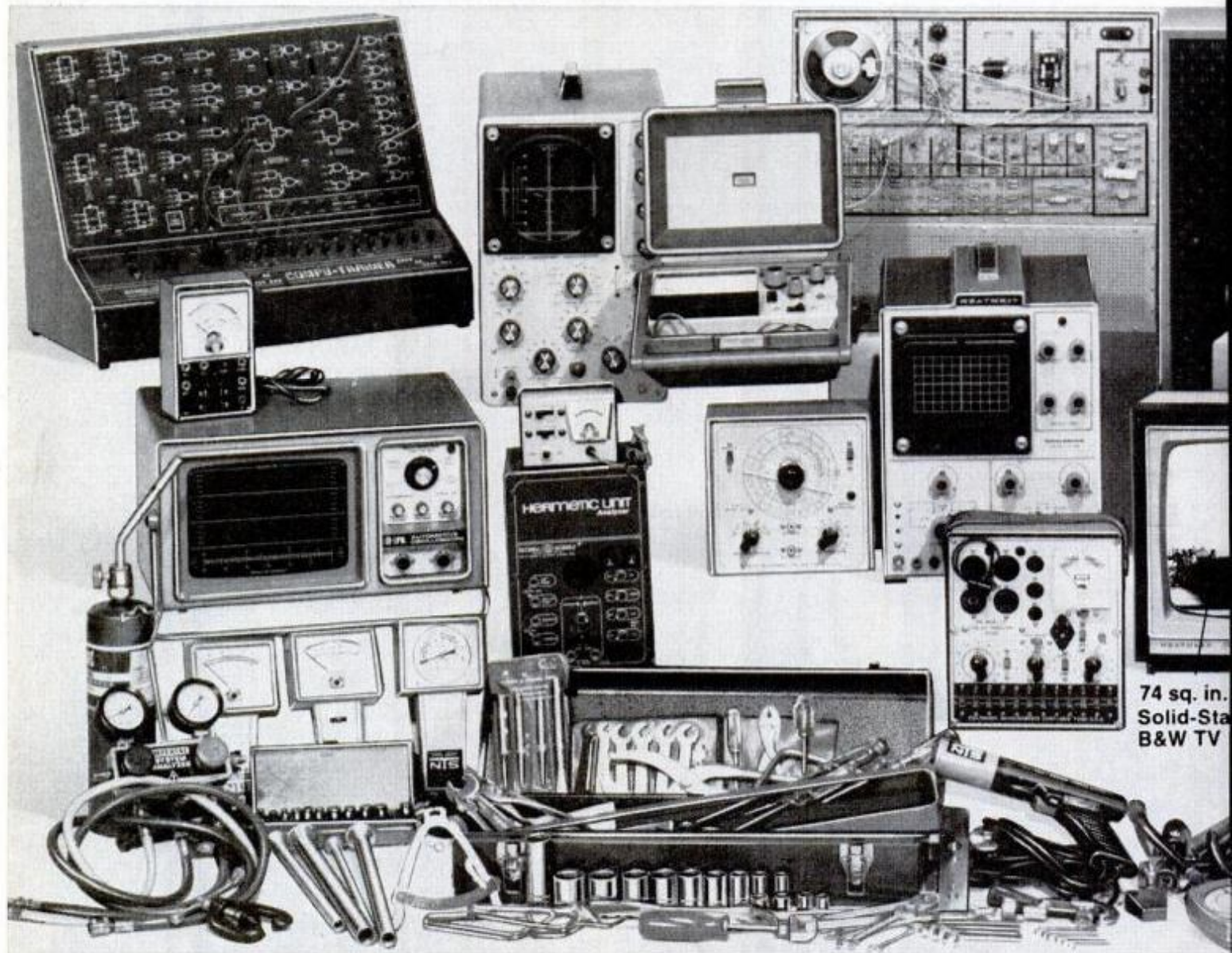


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WHAT DETROIT HAS LEARNED FROM RECALLS (Continued from page 127)

that "the funny noise in the rear" or hard starting had something to do with this use of the wrong decal.

Carmakers say they cannot foresee a time when all cars will be perfect and recalls will diminish to zero. But the companies are improving in several ways—in their attitude toward recalls, in setting up safeguards to prevent recalls and in building cars so they are less likely to be recalled. The result has been fewer recalls.

Join 'em prevails

In the early days of NHTSA, the companies frequently let out an aggrieved howl or threw a tantrum when ordered to bring a car back for repairs. There was a lot of arguing over who was responsible for the recall, whether the defect was really safety-related, how many cars to bring back, who would pay for the fix, whether it could be handled with a do-it-yourself kit or required the services of a professional mechanic. American Motors didn't like the idea of making a public announcement of recalls. AMC would fix the cars, but didn't want to broadcast its boners.

The industry's attitude has undergone a complete change—from sweep it under the rug to an attitude of if you can't lick 'em, join 'em.

Detroit now initiates more recalls than the government orders. NHTSA says about 80 to 85 percent of recalls are initiated by automakers. The car firms say the percentage is much higher than that—95 to 100 percent.

I tend to believe the Detroit figure over the government figure. But not because I credit the carmakers with noble intentions.

Before a recall is issued, the government conducts an investigation. During the investigation, the government calls in engineers from the company producing the car. So the company is tipped off in advance that a recall is being considered. Why let the government take credit for it? Why not beat NHTSA to the draw, send out a recall and make the best of a bad situation. Oneupmanship.

Admit the blunder

If a defect is serious or involves a great number of automobiles, it is impossible to keep the lid on for any length of time. Ralph Nader, the Insurance Institute for Highway Safety, a consumer protection group or someone else is going to learn about it and blow the whistle. Why let the "enemy" make points by publicizing your mistakes? Better to admit the blunder, get it out in the open and make good on it than try to conceal it.

Those are the reasons Detroit is initiating more recalls on its own hook, rather than waiting for the government to issue an order.

Are the companies building better cars because of the threat of having to recall bums?

Statistics from NHTSA indicate that's the case, although that agency cautions against drawing any trend conclusions from its figures.

NHTSA compiles two sets of numbers: one of the number of recall campaigns, another on the number of cars recalled per year. The figures for the past four years show a steady decline in both departments—fewer campaigns per year, fewer cars recalled per year. Here are the figures:

Year	Recall Campaigns	Number of Cars Recalled
1972	277 U.S.	7,800,000 U.S.
	43 foreign	4,200,000 foreign
1973	208 U.S.	6,600,000 U.S.
	43 foreign	334,000 foreign
1974	208 U.S.	2,300,000 U.S.
	39 foreign	531,000 foreign
1975	190 U.S.	1,800,000 U.S.
	27 foreign	280,000 foreign

(The reason foreign cars show up better than U.S. cars is that U.S. makes outsell imports and not because foreign cars have fewer recall problems than U.S. vehicles.)

Some auto engineers grumble that recalls do nothing to improve future cars because the system is directed at correcting yesterday's mistakes. "By the time we recall a two or three-year-old model," a Ford source explains, "we have already moved to a new design and are probably engineering the car beyond that. We monitor dealer repair orders and service complaints. So if there's a problem, we hear about it very early and make the necessary change."

Ford has a point. The companies make an honest effort to catch problems and correct them before a car becomes a candidate for a recall.

But it isn't true to say recalls don't benefit future cars. Many changes made in pre-1976 cars have been carried over to the '76s and will continue to be used on cars of the future. Some instances:

VW had a recall of its Type 2 van in 1974-75 because of condensation forming in the brake hose. The hose could freeze, causing a loss of the booster effect on brakes. VW did a redesign of the hose. The new hose is being used now and will continue to be used until something better comes along.

GM had a massive recall—3.7 million cars—in 1973 because of a problem with stones coming up under the car and lodging in the steering

mechanism. It was a freak problem. The stones had to be a certain size, the road had to have certain undulations in it, the car had to be traveling at a certain speed and the steering would jam only if the driver was making a left turn. GM recalled the cars and fitted them with a shield over the coupling of the steering shaft column. GM now equips all cars—not just those on the recall list—with the shield and will continue to use it indefinitely.

Chrysler had a series of recalls and problems with the jack for its cars. The jack had a hook on it that was supposed to fit under the bumper. But the hook configuration wasn't right for all bumper configurations. To solve the problem, the company went to a new type of jacking arrangement—a finger type that locates in a slot in the bumper. The jack hook was eliminated. Chrysler has made the new jack standard for all cars and will continue to use it on future cars.

Better testing

Recalls or the threat of a recall are also responsible for the way parts and cars are tested before they go into production and after they go into production.

W.R. Kittle, director of vehicle safety and federal standards for Chrysler, cites the example of steering knuckles and brake anchor pins. The naked eye cannot detect the difference between the best steering knuckle ever made and the worst. To the eye they look like identical twins.

Chrysler had a problem with steering knuckles and brake anchor pins. The parts are forged and underwent some change during the heat treating process. Chrysler had to call cars back.

Solution: Chrysler changed its method of inspection and testing. All steering knuckles and other suspension-system components are now ultrasonic and eddy current tested. (Eddy current means an electrical field is put through the part to detect a coarse grain structure.)

GM has taken several steps to tighten its inspection and testing of cars to guard against recalls.

"Recalls have created an awareness in our people, put us on the alert for anything that could cause a problem," says John C. Bates, director of GM's service section.

GM polices itself at two points, in its own plants and in supplier plants. The company has a committee of inspectors who visit suppliers on a regular basis to make certain parts and subassemblies meet GM standards. In its plants, GM uses a sta-

(Please turn to page 134)

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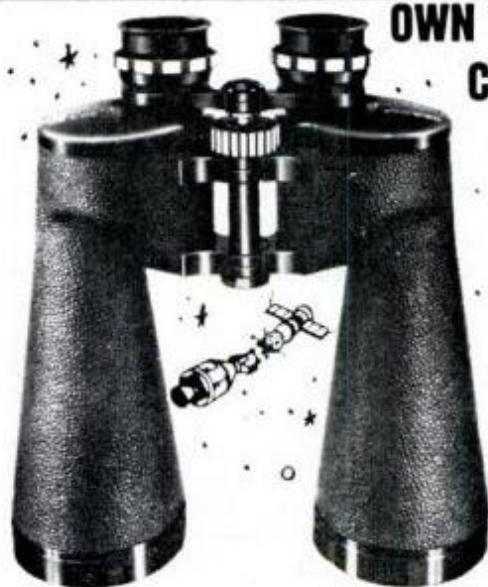
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DETROIT RECALLS

(Continued from page 133)

tion-by-station method of inspection. That old picture of the grizzled vet known as "Final Inspector" who jumped in the car at the end of the line and marked it Pass/No Pass is no more. If he ever existed.

"Inspection," says Bates, "must be made at every critical point on the line. Not at the end of the line."

GM has gone to what it calls a quality audit of its cars to cut down on call-backs. The company does a complete quality autopsy of two percent of all cars made in every plant every day.

"What we're looking for," Bates adds, "is a fail-safe way of building automobiles. So if something should go wrong, it can't go wrong to a point where it would present a problem for the car owner."

If it ever comes to that—the nearly perfect car—much of the credit will go to what automakers have learned as a result of recalls. ★★

NEW ELECTRONIC CAMERAS

(Continued from page 69)

Most of the time, though, the replacement is buried deep inside.

Modern electronic production methods are constantly lowering the costs for circuits and of their installation, too. Integrated circuits, combining the functions of perhaps thousands of transistors and other components, cost a great deal to develop, but come down rapidly in cost when you make enough of them.

Greater precision, too

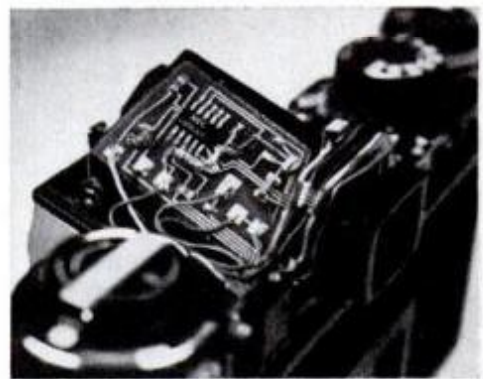
Still another advantage is greater precision: Electronically controlled shutters, for example, are usually closer to their nominal speeds than many mechanically governed shutters, and can be easily adjusted to any intermediate speed required (not just 1/250 and 1/500, but 1/373, if that's what's needed)—important when they are to be controlled directly by an auto-exposure circuit. Fast-acting electronic circuits also simplify feedback, where a process is controlled by monitoring its result. The most common example right now is automatic flash, which monitors the light bouncing back from the subject and cuts off the flash when there's been just enough.

Complex processes simplified

Electronics can handle—and simplify—some pretty complex processes. One example was the problem of combining through-the-lens light metering with automatic exposure control in single-lens reflex cameras.



Electronics are getting into accessories, too, such as the motor drive, remote and radio controls and timers available for this electronic-shutter Contax RTS.



Flexible, printed wiring (at rear of prism above) and tiny integrated circuitry (atop the prism) helped to make modern, electronic cameras possible.

Most meters read the light either at the mirror or in the viewfinder. But just before exposure, the mirror flips up to let the light reach the film—and then no light can reach the light-sensing cells.

How the 'memory' works

To get around this problem, Pentax developed a memory circuit that calculates exposure data as you start depressing the shutter-release button, just before the the mirror flips up. As the mirror begins to move, it closes a memory-circuit switch so the memory will record the exposure data. When the mirror's up, it releases the shutter, whose speed is timed by data stored in the memory.

That "memory" is actually just a capacitor, charged by the light-sensing cell. With the voltage on the capacitor as a reference, a timing capacitor begins to charge as the

shutter opens, and the shutter closes when both capacitors have equal voltages.

An improved electronic component, the silicon-blue light cell, gave Olympus another way of solving the same problem in their OM-2 (page 205, April '76). Since the silicon cell's response is far faster than that of older CdS cells, it can be placed below the mirror to read the light after the mirror rises in the brief time the shutter is open. The silicon cells are also more sensitive in low light levels and read more accurately in extreme lightness.

Scheduling SX-70's moves

Even more complex are the operations in Polaroid's SX-70. Between shots, its lens is wide open for easy viewing and focusing. When you press the shutter switch button, the shutter must close, the mirror rise, the lens open again to whatever aperture the light requires, the shutter stay open just long enough for correct exposure, then close. Then the film must be ejected, the mirror lowered and the lens opened all the way again—all in correct sequence and timing. Only electronics could do that.

When you plug in a FlashBar,

other circuits switch control of the lens aperture from the electric eye to vary with the distance you've focused on (the farther the flash and you are from your subject, the dimmer the flash's light will be and the larger the aperture you'll need). Then a selector circuit sequentially tests each lamp in the flashbar. When it finds an unfired lamp, the circuit triggers it; if all five lamps are dead, the camera won't shoot off a wasted film—and if there's no more film, the flash won't fire, either.

Special circuits for movies

Movie cameras present a unique problem to automation-minded camera designers because they usually require only aperture control, as the shutter speed is limited by the frame rate. But engineers at Siemens AG in West Germany got together with designers at the German-Belgian photographic equipment combine Agfa-Gavaert to develop a MOS circuit for cameras similar to those used in hand-held calculators and digital watches.

The Siemens-Agfa device was designed specifically for a family of recently introduced 8-mm movie cameras, the Agfa Movexoom MOS Electronics.

The MOS circuit has two primary functions in the Agfa cameras. It controls the opening and closing of the lens diaphragm, and it controls the film-drive motor in several different modes, including single-frame, single-picture-repeat, and delayed 10-second exposures. The final feature allows the camera operator to get into the act.

What's ahead?

In the future are integrated circuits that contain all of the logic and control circuitry necessary to handle virtually all camera control functions on a single chip. Also possible: a liquid-crystal dynamic scattering technique for controlling the amount of light passing through the lens. Significantly, this could eliminate mechanical shutters altogether, as well as filters.

About all that's left to automate is focusing. And they're already working on that (page 96, May '76).

So pretty soon, you'll never have to worry about whether or not your pictures will come out, but only about how to aim your camera and pose your subject to make them come out good. All the mechanics of photography will have disappeared—replaced by electronics. ★★★

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

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CB VACATION

(Continued from page 60)

TELLING WHERE THE TRAFFIC IS

That rush to work is just no fun at all. You pull out of your driveway, praying that the freeways and major roadways you travel will be clear. But you know that there's a better-than-average chance you'll find yourself stuck in a hopeless traffic tangle with dozens—often hundreds—of other drivers, as police clear away the remains of an accident or traffic hazard.

One reason for this uncertainty is that many cities lack a consistently accurate system of feeding traffic information to motorists. In southeastern Michigan, however, a group of more than 100 CB radio operators are working with major radio stations, police agencies and the American Automobile Assn. to provide area residents with this information.

In addition, the Michigan Emergency Patrol, Inc. (MEP) has been assisting law-enforcement agencies by reporting injuries, accidents, stranded motorists, street crimes and all sorts of traffic conditions, including debris on the road and bad paving. MEP also provides travelers with routing and other information.

Despite its name, MEP is not a patrol. Its members and several hundred designated spotters simply call in reports to the MEP base as they see conditions which require action. Then they're instructed to leave the scene immediately, if possible. (That's good advice for all CB Samaritans. Too much enthusiasm can get you involved in the very trouble you've reported.)

The MEP base, a completely equipped transmitting and monitoring station on the 20th floor of a central Detroit skyscraper, is in operation 20 hours a day, seven days a week. Here, an operator uses closed-circuit TV to pass traffic advisories on to the 50,000-watt clear-channel commercial radio station on the floor above. Police and several other major radio stations in the area keep abreast of developments via electrowriters. MEP also maintains direct lines to police and public-service agencies for emergencies.

Receiving close to 100,000 calls annually, the all-volunteer, nonprofit MEP is the largest operation of its kind in North America. MEP spokesmen believe their organization was first in the United States to use the official emergency and motorist-assistance channel (9) for traffic advisory reports. (Several other organizations have started since 1970, when MEP was formed.)

—Diane R. Pawlowski

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THE COAST GUARD.**

the last remaining shop, Elder Robert Wagan's chair business, closed and the long tradition came to an end.

For a long time the only way you could get a piece of Shaker furniture was to canvass auctions, junk shops and barn sales. The Shakers were very matter-of-fact about their works and had no pretensions that they were true works of art. So as settlements closed down, the furniture was simply discarded.

One museum curator I talked to said he rescued a beautiful set of straight-back chairs from the town dump. He also told me about a week's worth of frantic negotiations so that Fruitlands Museum, a Shaker restoration in Harvard, Mass., could buy a mint-condition, massive, 12-drawer workbench dating from 1840. He came up with the money shortly before it was slated to be converted into a bar.

Today you needn't go to a museum to see Shaker furniture. You can make it from scratch using the drawing on page 101 and reference books listed on this page, or you can choose from a large selection of kits. The beautiful rocker on the opening pages was photographed at the Shaker Museum in Old Chatham, N.Y. But it's not a museum piece. It's a kit I put together a few days earlier.

The maker is Cohasset Colonials in Cohasset, Mass. 02025, a company that strives to maintain the tradition of quality in Shaker kit furniture. The rock maple and pumpkin pine used is culled from small lumber-

Inventions of the Shakers

Shakers were the leading inventors of their time. But they rarely received credit for their work because they believed that all useful things should be shared and therefore rarely applied for patents. These are just a few of their inventions to make man's life more useful and productive.

■ **Circular saw:** In 1820, Sister Tabitha Babbitt got this idea, which revolutionized lumbering and construction, by observing the circular power of her spinning wheel.

■ **Sash-balance counterweights.**

■ **Adjustable ventilating door transoms.**

■ **Lumber-drying kilns.**

■ **Automatic washing machine:** In 1858, Brother David Parker of the Canterbury settlement perfected the design which was one of the few patented. The water-powered system had automatic drains and a "centrifugal wringer" (spin dryer).

■ **Common clothespin.**

■ **Metal penpoints.**

■ **Cut nails.**

■ **Static electricity machine:** In 1810, Brother Thomas Corbett, a pharmacist at the Canterbury settlement, made this machine to relieve rheumatic pain.

■ **Rotary harrow.**

■ **Water-powered cooling fan.**

■ **Fertilizer spreader.**

■ **Flat broom:** In 1798, Brother Theodore Bates of New Lebanon got this idea observing the labors of sisters sweeping with common round brooms.

■ **Apple parer and corer.**

■ **Condensed milk.**

■ **Automatic seed planter.**

A Shaker cabinetmaker's daily schedule

4:30—Morning bell (5:30 winter).

Morning chores: Bring in firewood, milk cows, feed the stock, fire up the stoves in the workshop and lay out materials for the day's work.

6:00—Breakfast.

Work in shop turning spindles, pegs, and chair legs for component stock.

12:00—Dinner bell.

Afternoon in shop cutting dovetails and assembling drawers on a chest.

6:00—Supper.

Evening at meetinghouse for a social gathering, singing and discussions.

9:00—Bedtime.

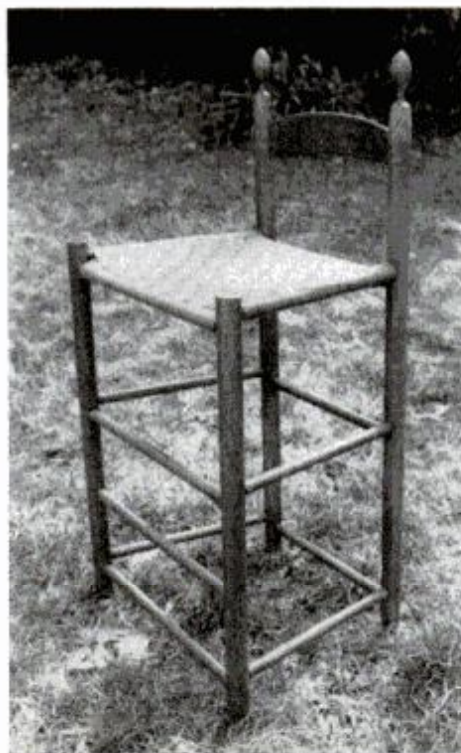
yards and forests in the Northeast.

The owner says that the business may have to close down in the next 10 years because the supply of these woods is diminishing. Eastern white pines once stood 100 feet high in dense forests along the coast. The straightest ones were cut by the British before the Revolution and shipped to England for use as ships' masts. The company now has to laminate six-inch boards to make tabletops that used to be made from a solid plank.

Shaker designs are pleasing to the eye in almost any setting, and the furniture you assemble in the Shaker tradition is built to last a lifetime. Sister Ann Lee, founder of the sect, gave life to that tradition in her words, "Do all your work as though you had a thousand years to live, and as you would if you knew you must die tomorrow." ★ ★ ★

Weaver's chair you can make from a kit

The original of this chair was made in 1830. The high seat (26 inches off the floor) was made for weavers who sat for hours at looms. The easy-to-assemble kit costs \$45, with all materials included, from Shaker Workshops, Inc. Chairs were the heart of the Shaker furniture industry. All designs from tall ladderbacks to the smallest children's chair were light, strong and comfortable. The most popular types were slatbacks. They derived their beauty from a subtle combination of different woods in different thicknesses. Slat backs were made of maple (sometimes curly or bird's eye variety) and the rungs were hickory or ash. Back slats were planed down to $\frac{3}{16}$ inches thick and made slightly wider in succession toward the top of the chair. Other unusual chair types included a variety of specialized rockers (originally built to bring comfort to the aged or infirm) and swivel chairs that were called "revolvers."



More information

Books

Make Your Own Antiques, Francis Hagerty

By Shaker Hands, June Sprigg

The American Shakers and Their Furniture, John G. Shea

Restorations

Fruitlands Museum, Harvard, Mass.

Shaker Museum, Old Chatham, N.Y.

Shaker Community, Hancock, Mass.

Kitmakers

Cohasset Colonials, Cohasset, Mass.

Shaker Workshops, Inc., Concord, Mass.

CENTENNIAL EXPOSITION

Continued from page 81

stone at up to two feet a minute, "a state of affairs incomprehensible to the ladies."

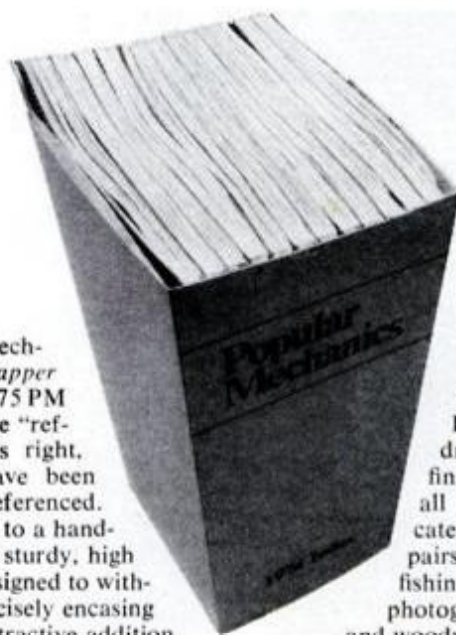
■ To demonstrate the versatility of his unique "band saw" (and himself), a patent modelmaker named McChesney devoted his entire time to making items of furniture without referring to patterns. "Rocking chairs, sofas, footstools poured from his saw in an endless stream." He called himself the Mohawk Dutchman, wore clothes covered with wood inlays and a hat of inlaid woods with a propeller on top. He later made a successful career out of his "improved" saw.

■ A mysterious form of energy called "electricity" was beginning to make itself known in products like thermoelectric batteries that "... worked by gas, charcoal, coke or mineral oils." These were fuel cells rather than batteries as we know them. Displays of the new dry-cell storage batteries were there, too, and more understandable since they powered the familiar telegraph. But even that was sprouting new developments in all directions.

■ For most people, the real "gee whiz" development in electricity was W.E. Sawyer's "fac-simile" machine. "The peculiarity of this instrument," observed Leslie's reporter, "is that by its use a person's own handwriting or drawing can be transmitted by telegraph in perfect fac-simile." By Centennial time, a group calling itself the "United States Postal Telegraph Co." had just been organized "for the purpose of constructing lines and operating them under Mr. Sawyer's patents."

■ Most dramatic exhibit in Machinery Hall, after the Corliss Engine, was the menacing 26-foot, 126,750-pound Krupp Gun. But Krupp wasn't alone. The friendly U.S.A. had its big guns out, too. There was the Gatling—newly improved by a Mr. Bailey, of Indianapolis so the output of its four barrels vastly exceeded the 200 shots a minute of the original. It could be taken apart and refitted "... by any person of common intelligence" and disassembled in 10 seconds by removal of a single lock "... so that its capture by an enemy would be of no advantage to him." Remington, Colt, Winchester and others displayed their new breech-loading firearms "... and all other arms suitable for war or sport."

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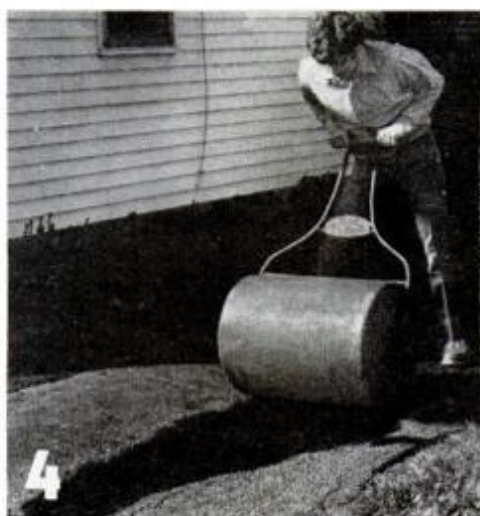
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■ When it was over, the Centennial Exposition would go down in history as a "smash hit," with something for everyone. Most folks, for the first time in their lives, rode elevators in viewing towers on the grounds. They marveled as photographers transferred pictures from film to the surface of plates in the new pyro-photographic process. As they ate popcorn balls at booths throughout the grounds (a monopoly franchised

for \$7000 by an enterprising inventor), they could watch the grains popping before their very eyes in that gentleman's ingenious "popcorn machine"—an open furnace that produced the fluffy white stuff in blizzards.

Even the exhibit of artificial teeth was, as Leslie's man pointed out, "most comprehensive." If our new Bicentennial does half as well, it should be a real blowout. ★ ★ ★



HOW TO PATCH 'CRATERS'

1. Use cold patch as it comes from the bag or can. Spoon it in holes or pour it over large depressions. 2. If area is deeper than 1 inch, apply and compact the patch in 1-inch-thick layers. 3. Place a board over the patch and use your car to compact it. 4. Use a lawn roller to compact sizable areas, rolling lengthwise at first, then crosswise.

you are working on is as clean as possible, even if it means going over it with a shop or household vacuum cleaner.

Hairline cracks

The first step in the repair of a hairline crack is to make sure it is truly a hairline and that you aren't looking at only the narrow top edge of a wider, deeper wedge-shaped fault. Take a knife or screwdriver and try to rout out the crack. If it's nothing more than a hairline, meaning $\frac{1}{16}$ inch wide or less, it will be sealed by a well-applied layer of top coat, the last step of the job. If the crack is larger than $\frac{1}{16}$ inch, proceed with the next step.

Repairing larger cracks

For this type of repair, you use a rubber-extended, asphalt crack filler. The rubber allows for flexibility and expansion after the material has cured. The crack filler is supplied in cartridges (like caulking compounds)

and is used with an ordinary caulking gun.

Before filling the crack, make sure the area is clean and dry. If the crack filler will come into contact with metal drains or metal expansion joints, those surfaces should be wire-brushed of rust before applying the filler.

Crack filler should not be applied below 40° F. The material becomes highly viscous below this temperature and, when used with a gun-type applicator, it's more difficult to work with. Because of higher viscosity, the sealer will not fill the cracks completely, and since frost begins to form below 40° F., there could be a loss of adhesion later.

Crack filler is ready to use as it comes from the tube. Never thin it, even if it is stiff from having been stored outdoors. Bring it inside for 24 hours to warm it. Never apply direct heat to the cartridge with a torch or by heating in a pan of hot water. Crack filler contains a solvent

which may, under direct heat, reach its flash point. In addition, direct heat may drive off the solvent, thereby destroying the cartridge.

Snip off the tip of the nozzle at a 45° angle and use a straightened wire coathanger to puncture the tube's inner seal.

Put the nozzle as far into the crack as possible to prevent any air entrapment and pull the gun toward you as you squeeze. Let the filler build up $\frac{1}{8}$ inch above the crack. After the crack is filled, go back with a trowel or similar tool dipped in mineral spirits (not linseed oil) and tool the surface smooth. Make sure the crack is completely filled and sealed at the edge. You want to keep moisture out now that the crack is clean and dry.

Crack filler will cure in about 24 hours depending on temperature and humidity. The lower the temperature and the higher the humidity, the longer it takes to cure.

While the filler is curing, cover it with waxed paper to keep from tracking it into the house. The paper is easily removed the next day and any remaining traces will soon disappear with usage.

Assuming there is proper drainage, crack filler will provide an excellent seal against water penetration. It will stand up well under temperature extremes from -20° F. to 150° F.

Larger holes and depressions

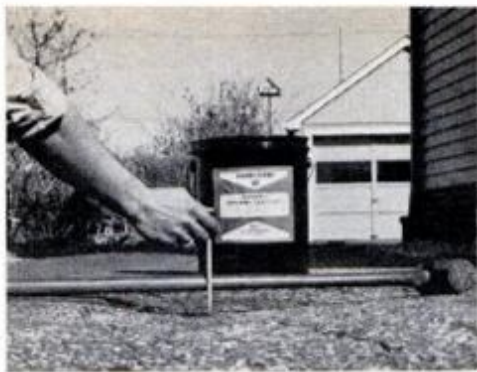
Cold-patch driveway-patching compound is used for repairing big holes, depressions or ruts. Because it is made for filling and covering comparatively large voids, cold patch is a combination of hard aggregate (gravel, pebbles) asphalt, resins and wetting agents.

In your selection of cold patch, it is important to know that compounds are generally available two ways: in large 50 to 75-pound paper sacks or in 5-gallon cans. The paper sacks are usually less expensive, but have disadvantages. Many times the filled sacks are shipped and stored in tiers on pallets. This means that the lower sacks in the stack are being progressively more compacted than the upper ones before the material is used. Also, material stored in sacks may have a tendency to begin to oxidize and lead to premature setup.

Again, surface preparation is all important. The area to be patched should be dry and free of dust. I used Gibson-Homans cold patch, which can be applied on a damp, puddle-free surface so the area can be made dust-free by hosing it down.

If the area to be patched has any grass or weed patches in it, remove them.

Cold patch is ready to use as it



To level surface depressions deeper than 1 inch, build them up by filling and tamping them in a series of 1-in. layers.



It's important that driveway be dry and clean before applying top dressing. Sweep surface well with stiff floor broom (1). Use industrial-size paint roller to apply dressing (2); throw away when finished.

comes from the can or sack. It can be "spooned" or "ladled" into a hole or poured into a larger depression. If the area to be patched is deeper than 1 inch, it should be patched in 1-inch layers.

After pouring and spreading the cold patch, you must compact it, which is an important step. The more the patching compound is compressed, the more tenacious it becomes and the better the bond you get.

There are several ways to compact

cold patch. If the area is a narrow hole, a good compacting tool is a 2x4. Place it on edge or side depending on area and then put a lot of muscle into a sledge hammer. If the area is large, such as a lengthy depression, a good compacting tool is an ordinary lawn roller. Roll it back and forth several times, then at right angles and back again.

Another good method for compacting a large patch is to lay a 3/4-in. board over it and roll your car wheel back and forth over it.

If the area to be patched is along the edge of your drive, use a No. 1 grade, creosote-treated wood form to contain the patch. If the form is then left in position, it will help resist "creeping" which is inherent in all asphalt. Be careful when working with creosote. It is a registered poison and should be handled with sensible caution.

The newly cold-patched area can be driven over in three to four hours—but don't let your car stand on the patched spot for at least a week. This will give the patch ample time to set. The same holds true for the top coat-

(Please turn to page 142)



Scrap 2x4 block and sledge are used to tamp cold patch in small holes and long, wide cracks. Place block on edge (1) or use flat (2). The more the patch is compressed, the better will be the bond and the greater will be the life of the patch.

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PATCHING CRACKS AND POTHOLES

(Continued from page 141)

ing. Usually you will patch one weekend, top coat the next.

Top coating the surface

Now that all the cracks, holes, ruts and depressions have been repaired, it is most important that you seal the entire drive surface with a good quality top coat or dressing. It not only will provide a moisture-tight seal and give the drive a finished look, but it will rejuvenate the dry, brittle or deteriorated asphalt, literally adding years to your driveway.

Basically there are two varieties of top coating available: A Gilsonite base and a tar-emulsion base. There are advantages and disadvantages of each. Of the two, tar emulsion is generally a little less expensive per gallon, but requires two coats. Gilsonite, requires only one coat. On the average, Gilsonite will cover 100 square feet per gallon, while tar emulsion covers between 60 and 75 square feet per gallon.

Tar emulsion is highly resistant to gasoline, oil and similar corrosives over long periods of exposure. Gilsonite, though less resistant, will stand up well to the occasional spill or drip.

Application

Tar emulsion cannot be applied below freezing (if it freezes before it is applied, it loses its chemical qualities) and really should be applied above 45° F. Gilsonite can be applied near or above freezing. Tar emulsion requires thorough mixing before being applied; Gilsonite does not.

Tar emulsion requires about 2½ hours to dry to the touch versus about one hour for Gilsonite. The Gilsonite coating should be ready for traffic in about 12 hours (depending on temperature and humidity), while at the same temperature and humidity tar emulsion would require about 24 hours. In addition, since tar emulsion is a water-base compound, should it get wet during the first 24 hours, it is best to wait another day for it to be completely dry.

Tracking

During warm weather, tar emulsion has a tendency to become tacky. If the drive serves as a home basketball court or other playing surface, the coating may be picked up on shoes and tracked into the house. Gilsonite, on the other hand, is unaffected by the hot sun and remains tack-free once it has set.

Again, surface preparation is ex-

tremely important. With the Gilsonite base, the drive must be clean and dry. A true hairline crack will be sealed with an application of Gilsonite base coating. Anything larger than a ¼-inch crack should be filled with crack filler followed by a five-day wait for proper curing.

Give the drive a good sweeping followed by vacuuming. If there is oil on the drive, wash the area well with detergent. Gilsonite top coating may be applied with a large squeegee, stiff brush, broom or roller. I used a long-handled industrial paint roller.

A word of caution: As with any roller, no matter how careful you are, there will be some splattering. Wear old shoes and roll the roller slowly.

The coating is ready to use right from the can. Dip the roller to saturate it, then spread over the drive surface. Apply the coating liberally to make sure the surface is well covered and sealed, but at the same time use as thin a coat as possible consistent with good coverage. Be sure there are no puddles, and don't try to cover less than the recommended 100 square feet per gallon. In this case too much is worse than too little.

When you've completed the top coating, put up a barrier of some kind at the drive entrance. ★★★

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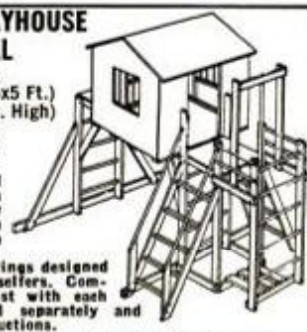


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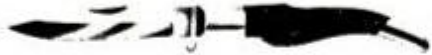


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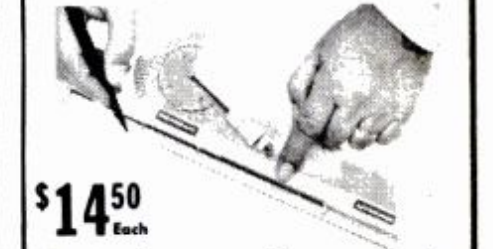
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BECOME Tax consultant. Our students earn \$1,000-\$3,000 every tax season preparing returns evenings. State approved. National Tax School, Monsey 2GG, New York 10952.

ANTIQUES. Furniture Stripping Equipment \$5000.00. Amity, 2315 Stoughton, Madison, Wisc. 53716.

\$250-\$500/THOUSAND, STUFFING ENVELOPES. COMPLETE ASSISTANCE. Send Stamped Addressed Envelope, DAHBU ENTERPRISES, Box 8486, Capital Heights, Maryland 20027.

1001 Fast, easy ways to make money! Free! Rush name, address, zip. Perry, 13263-F Ventura Blvd., Studio City, Calif. 91604.

EARN Outstanding profits as a mailorder dealer. \$10 on every \$15 sale. Holley Associates, Dept. 1PM7, P.O. Box 29, Melrose, MA. 02177.

HOW TO MAKE \$2,000 WEEKLY At home using other people's money. Guaranteed. Free details. Richlieu, Box 25277, Dept. B-7, Houston, 77005.

LET ME Show you how you can have your own Rubber Stamp Business FREE! Write: Roberts, Room RC-2-FK, 1512 Jarvis, Chicago, IL. 60626.

\$200 WEEKLY Mailing letters. Foolproof program. Start immediately. Ozark, Box 28411, St. Louis, Mo. 63141.

\$300-\$700 Monthly. Raise Rabbits, Laboratory Animals for us. We supply Equipment, Breeders, Instructions. Financing Arrangements. Details-25¢. Laboratory Animals, Inc., PM, Countyline Road, Pentwater, Michigan 49449.

UNIQUE Woodworking projects for spare time income. Details free. Bradley House, 157-A Bradley Ave., Meriden, Connecticut 06450.

CLASSIFIED ADVERTISING!! 60,000 buyers!! \$15/word. \$3.00 minimum. Details free!! Salco, 1432B Birch, Lewiston, Idaho 83501.

INSTAMAIL Means instant Cash! \$100.00 Weekly! Instamail, Box 797-H, New Castle, Pa. 16103.

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\$1,000.00 MONTHLY Mailing Collection Letters. Guaranteed!! Free Information. Master-PM, Dawsonville, Georgia 30534.

FREE Jewelry Sales Kit. Make 233% Profit. Courtesy Gems, 1634 Bogart, Bronx, N.Y. 10462.

FREE 100-Page Catalog waiting to bring you Big spare-time cash commissions. Sell Advertising Book Matches. Every business a prospect... complete selling instructions furnished. Steady, repeat business. Dept. MX-776, Superior Match Company, 7530 South Greenwood Avenue, Chicago, Illinois 60619.

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EARN Money Raising Fishworms for us. Write Oakhaven-38, Cedar Hill, Texas 75104.

PIANO Tuning quickly learned with home study course. Diploma granted. American Tuning School, 17050 Teller Dr., Morgan Hill, Calif. 95037.

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\$200.00 SPARE Time earnings with your Tablesaw. Write: Workshop Five, 3800 Harney, Vancouver, Washington 98660.

VENDING Machines. No selling. Routes earn amazing profits. Big catalogue Free. Parkway Machine Corporation, 1930PMB Greenspring Drive, Timonium, Maryland 21093.

\$1.00 LISTS You year sent to 1000 Importers, Jobbers, Mailers, our mailing year. Dixie, King, North Carolina 27021.

HOW TO RAISE \$100.00 to \$1,000,000.00! Write: Capital-PM, Dawsonville, Georgia 30534.

I MADE \$40,000.00 Year by Mailorder! Helped others make money! Free Proof! Torrey, Box 318YY, Ypsilanti, Michigan 48197.

MAIL Baby Catalogs to New Mothers for Big Profits! Details 25¢. Voiz-PM, Ypsilanti, Michigan 48197.

FREE WEALTH BOOK: "2100 Unique Ways To Make Money!" World's Biggest Collection of Home Businesses!! Success-M, 26903 West Eight Mile, Detroit, Michigan 48240.

(Continued on next page)

BUSINESS OPPORTUNITIES

(Continued from preceding page)

\$200 WEEKLY! Make, Sell Bricks! Free information! Xcto Bricks, 5715 N. Mozart, Chicago, Ill. 60659.

WORLD'S Largest Supply, 25% to 40% under wholesale. Closeouts. **HONG KONG** Clothes, Automobiles, Electronics, Free Details. International Buyers, Box 16386MM, Portland, Oregon, 97233.

REPAIR Hydraulic Jacks—Details Free. Write: Hydraulic Parts Supply, Box 4157, Brownsville, Texas 78520.

YOUR Own Mailorder Catalog Business. No Merchandise Investment, Details Free. A.M. Sales, 31-14 94 St., East Elmhurst, NY 11369.

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\$70 TO \$200 WEEKLY—Home, Spare Time Simplified Mail Bookkeeping. Immediate income. Easy. Auditax, Box 34741A, Los Angeles, Calif. 90034.

\$400.00 MONTHLY Raising giant fishworms. Soilless method. Charlie Morgan, Bushnell, Florida 33513.

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\$231.00 EXTRA Weekly Playing Mail Order "Money Game"! Details—Business, 2205-J Robinhood, Albany, Georgia 31707.

SELL SENSATIONAL LOW-COST BURGLAR ALARM. Lightning seller. Exceptional margin. Samples for trial. Northwest Electric Ave. 209, Mitchell, S.D. 57301.

WATCH REPAIRING. For cash income or hobby. Free sample home study lesson. Chicago School of Watchmaking, YGA, Fox River Grove, Illinois 60021.

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MAKE \$2,000.00 MONTHLY. Spare time. Unique proven enterprise. No selling. No capital to start. Free brochure. Kashbuilder, Box 1132-19K, Indianapolis, Indiana 46225.

\$500.00/THOUSAND—Stuffing Envelopes. Begin immediately. Beginner's kit, \$1.00. Guaranteed! Contemporary, Box 1144PM, Forest Park, GA 30050.

\$335.00 WEEKLY, Extra Income. Free Report. Wilco, Box 2148-B7, Texas City, Texas 77590.

RAISE CAPITAL—START A BUSINESS 250 Guaranteed Sources \$2.00. Mardan, Box 44, Chateau Terrace, Amherst, N.Y. 14226.

STUFF Envelopes, \$50.00 Hundred! Free Details. Send Self Addressed Envelope: Dodier, Box 730E7, Mitchell, Ontario, Canada, NOK 1N0.

BE YOUR OWN BOSS—Part of a dynamic, fast-growing national organization! Write today! New York Mortgage & Finance, Box 69, Dept. A7, Oneonta, New York 13820.

PHOTOSTAMP Agents Wanted! Make Big Money From Home Mailorder. Free Samples, Information: Postermatic-C7, East Providence, R.I. 02914.

START A Money making mail store at home. Details free. Vandex, Box 1096, Abingdon, Virginia 24210.

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MAILORDER Course 24 lessons \$2.00. Welco, 1523 Woodside Rd., Redwood City, CA. 94061.

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THRILLS—FAST RICHES. SCIENTIFIC CATFISH FARMING. U.S.-sponsored. Financing. Nationwide established markets. Details 50¢. Catfish Industries, Box 1089, St. Petersburg, Florida 33731.

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OFFERS From over 100 dealers, 3 homework plans and free gift offer. \$1.00. House, Drawer E, Millbrook, AL 36054.

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\$30.00 HUNDRED Stuffing our Circulars into stamped addressed envelopes. Beginners kit \$2.00. Colossi, 1433P-61 Street, Brooklyn, N.Y. 11219.

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YOU CAN MAKE MONEY AT HOME In mail order. "Mail Order Dealers Questions and Answers" tells how. \$4.95 Satisfaction Guaranteed. Richard Schmidt & Sons, Box 7896, Philadelphia, Penna. 19101.

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WANT Success in Mailorder?? Good Profit, Repeat Sales. Learn How; Write: Brooker, 2026PM7 Appleton, Long Beach, California 90803.

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(Continued on next page)

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(Continued from preceding page)

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