

Popular Mechanics

JAN. 1973 50 CENTS

**We show you how to build
this deluxe pool table for \$107**

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**How to fix
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**How to cut your
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**How to make
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**How to prevent
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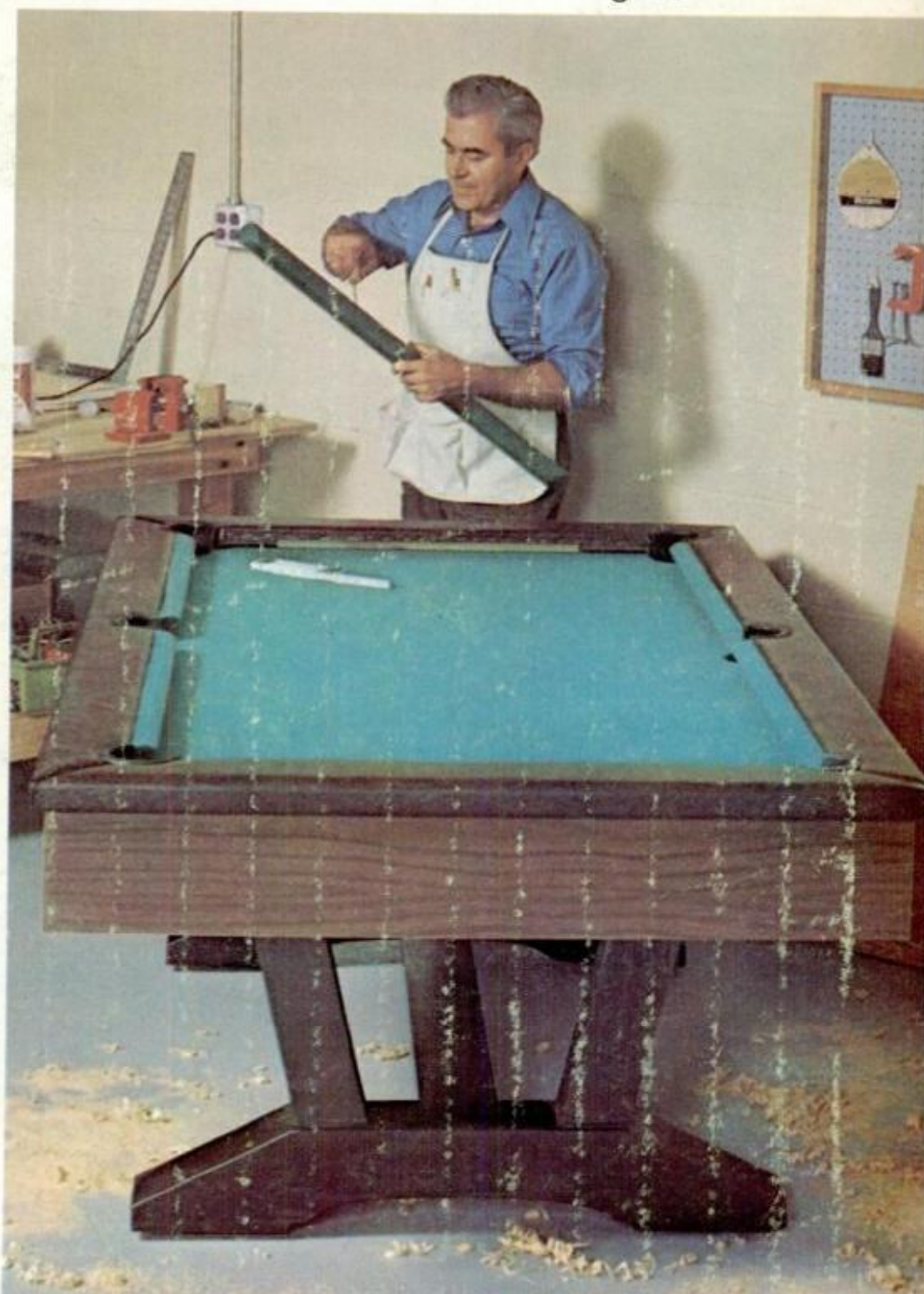
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a smokeless
fireplace**

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**How to service
a Vega**

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**Get away from the crowd.
Get the flavor you want in
Old Gold Filters.**



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 Aug. '72.

IF YOU OWN A PICKUP TRUCK, CAN YOU PASS THIS TEST?

- | | TRUE | FALSE |
|--|--------------------------|--------------------------|
| 1.) Most people who buy pickup trucks end up carrying heavier loads than they think they will. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.) Passenger car tires are designed to perform as well in truck service as they do on cars. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.) All pickup truck tires cost more than comparable size passenger tires. | <input type="checkbox"/> | <input type="checkbox"/> |

(Answers below)



- 1.) **True.** Many people who buy a pickup plan on carrying only light loads. But because it has the capacity, and is so readily available to them and their friends, its load limits, particularly its tire load limits, are often exceeded.
- 2.) **False.** Passenger car tires are designed for car use. Truck tires, like the Firestone Transport, with a combination of shock-fortified nylon cord body plies, rugged tread design and rubber compound, reinforced beads and sidewalls, are designed for the tougher requirements of pickup trucks. In addition, the Transport has a 6-ply rating instead of a 4-ply rating of passenger car tires.
- 3.) **False.** Some sizes of Firestone Transport truck tires actually cost less than passenger tires. And you can even get them with whitewalls at your Firestone Dealer or Store.



Transport[®] Truck Tire

Firestone

HOW COULD YOU FORGET

MILT MARION?

1936 was a very good year for a race fan. The very first race on the famous Daytona Beach-Road Course was held.

The purse was 5,000 bucks, and lest you think this was a minor-league affair, remember the price of groceries in '36. This kind of important money attracted a pretty hot field, including: the Indy 500 winner, Bill Cummings; the dirt track champions Bob Sall, Doc Mackenzie and Ben Shaw; Major Goldie Gardner; the Collier brothers, Miles and Sam; and an obscure service station operator named Bill France.

The winner? Good old boy Milt Marion, in a Ford V-8, the Permatex Special. (That France fellow was not only Milt's mechanic, but drove another Ford to fifth place.)

The interesting thing about Milt's car was that the engine was literally stuck together with Permatex products. To prove they worked, the engine was assembled without any gaskets, using our Form-A-Gasket products instead (Form-A-Gasket #1, hard-setting, and Form-A-Gasket #2, pliable-setting). Obviously, it held together.

It really wasn't much of a gamble for Permatex. After all, the company got its start helping Barney Oldfield, back in '09. And today, you'll find Permatex products in service stations, NASCAR garages, and wherever automotive products are sold.

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Permatex
our name is our bond

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P.O. Box 1350, West Palm Beach,
Florida 33402 305/686-0880

Courtesy of Museum of Speed, Daytona Beach, Florida



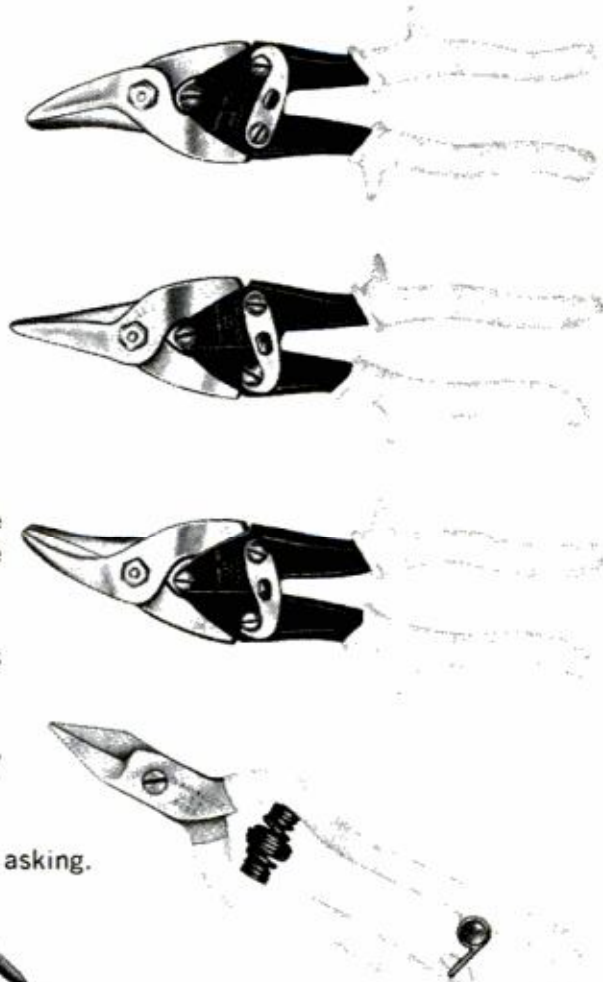
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FOURTH OF JULY

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This One



QK0Y-7DC-X01T

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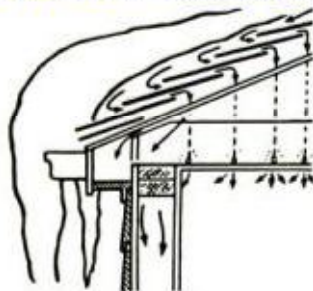
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HOW TO...

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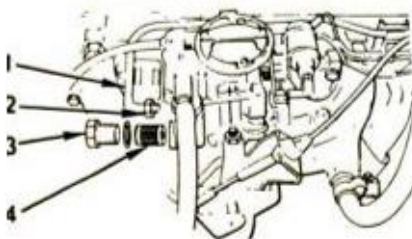
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EVERY MONTH

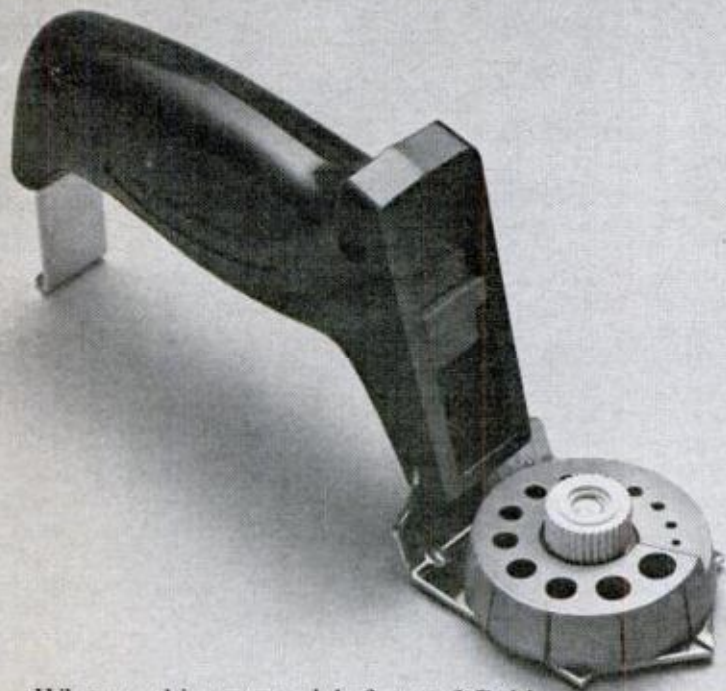
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Cover photo by John Capotosto

WORTH WRITING FOR: SEE PAGE 56C

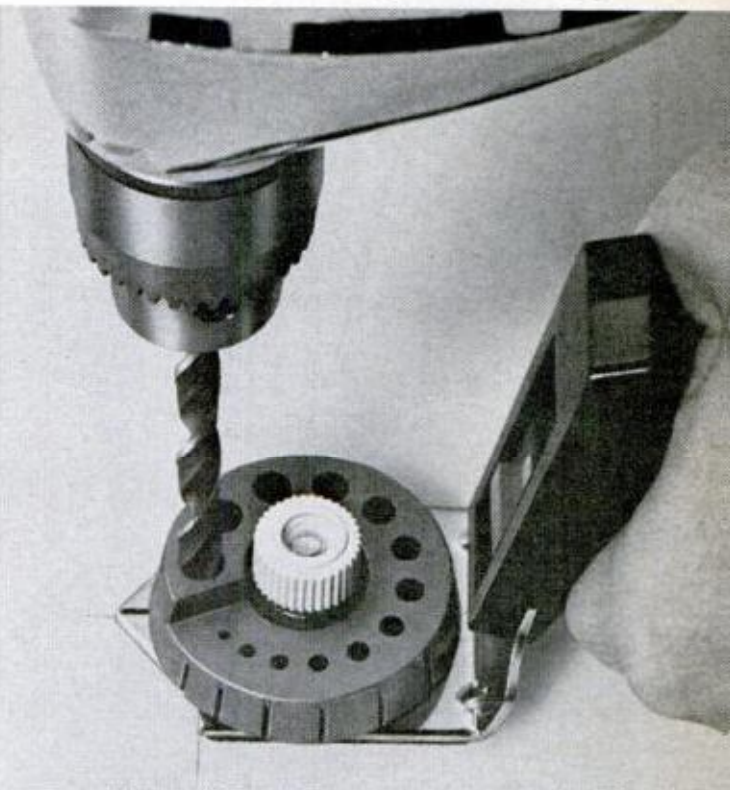
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Stanley's Drill Guide has you going straight.



What can this new tool do for you? Guide your electric drill to a perfect right angle into metal, wood or plastic.

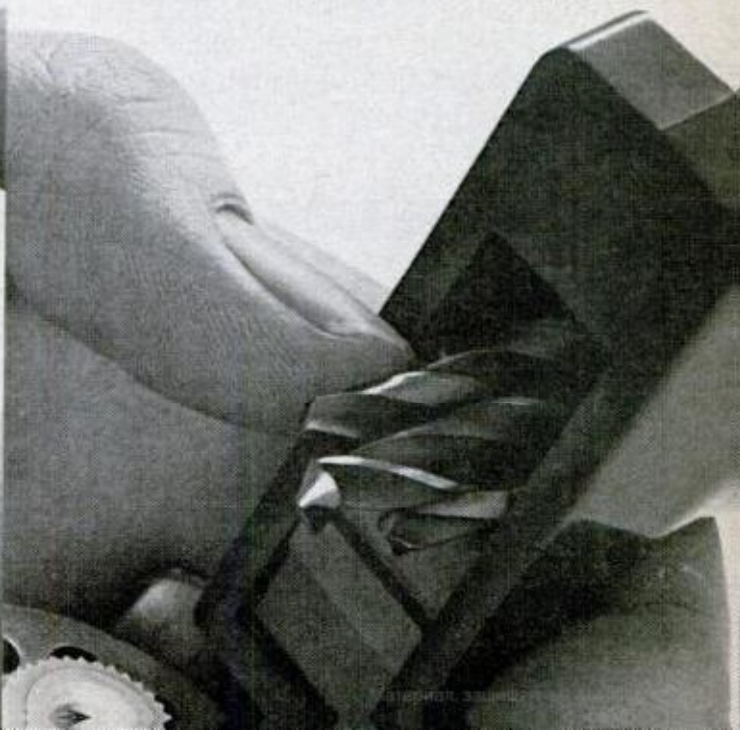
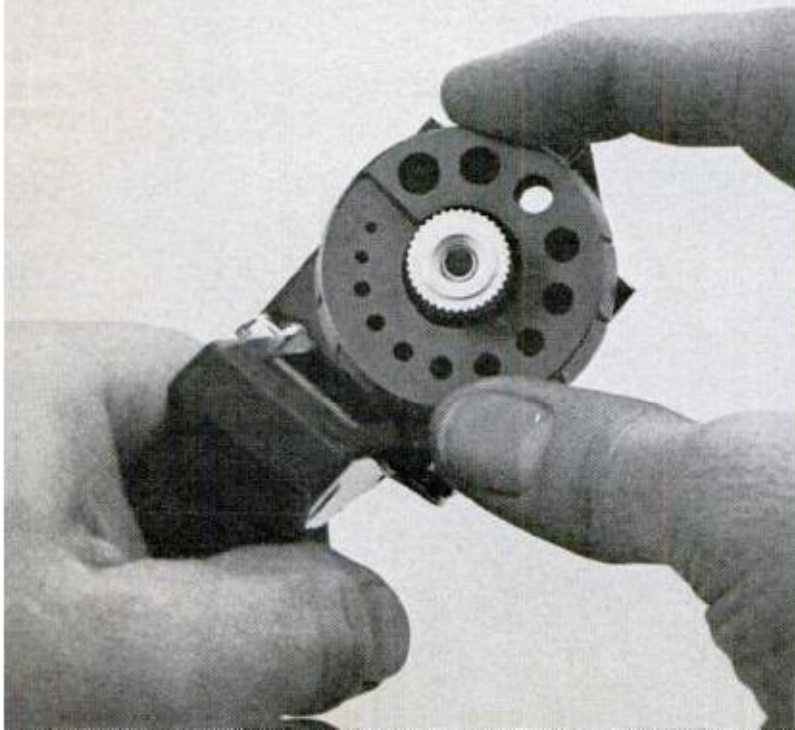
Just rotate the dial on the Drill Guide to the desired bit size. It accommodates 13 different bits, sized $\frac{1}{16}$ " to $\frac{1}{4}$ ". Lock in place, drill away!



Draw a few grid lines — insert your drill bit and go to town! Drill Guide won't let the bit skitter about or mar the surface.

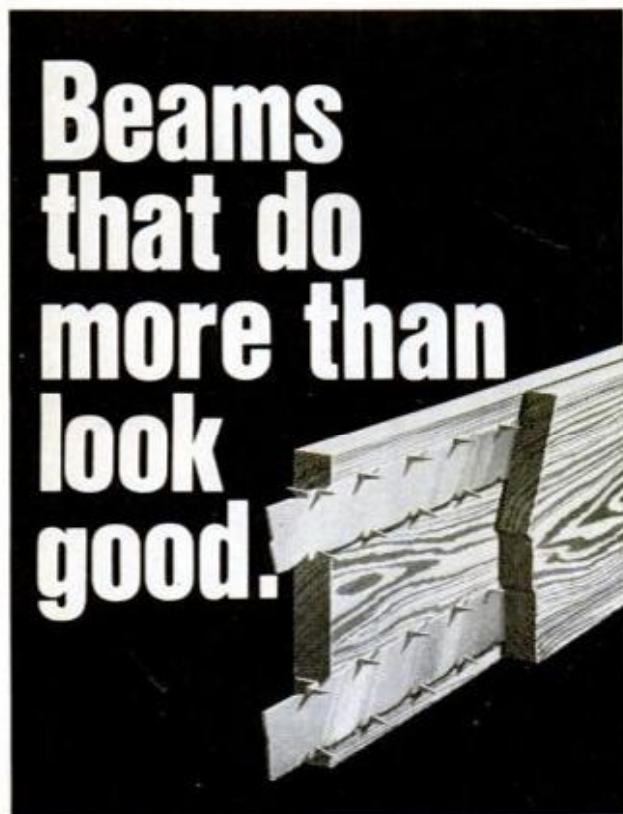
Handy sliding door storage in the handle keeps extra bits available. About \$2.99 for a tool every drill owner will appreciate.

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POPULAR MECHANICS

LETTERS

TO THE EDITOR

Prone? No, soupine

In *Trick-wing glider gets a lift* (page 108, Nov. PM), the pilot shown in the lower picture is certainly not in a prone position. He is supine. You might point out to your writer the way to remember the difference: When you are supine you can hold soup in your navel; when you become prone, the soup runs out.

DRUMMOND, QUE.

FORD K. SAYRE

Backward roofer

Your September issue has a picture that's a classic of disregard of safety (*Be your own roofer*, page 176). You show a novice roofer straddling the ridge of his home while nailing capping shingles in place.

A roofer *never* works backward, but always faces the direction of travel. Otherwise, one sooner or later forgets himself and backs off the edge and leaves a widow with a half-finished roof!

I doubt if the shingler would want to sit on the tar seal tabs anyway, especially if the sun is out.

DE WITT, N.Y.

RAY PARFITT

You make an excellent point. In the case shown, though, the roof runs into a right-angle ridge (which, unfortunately, did not get into the picture), so he won't fall.

(Our Home and Shop Editor claims that roofers who straddle the ridges really created the term "hot pants.")

They're on the way

Please publish an article on electronic calculators—the different types and how they operate. I've been a subscriber for 45 years.

NEW YORK

OSCAR FRANK

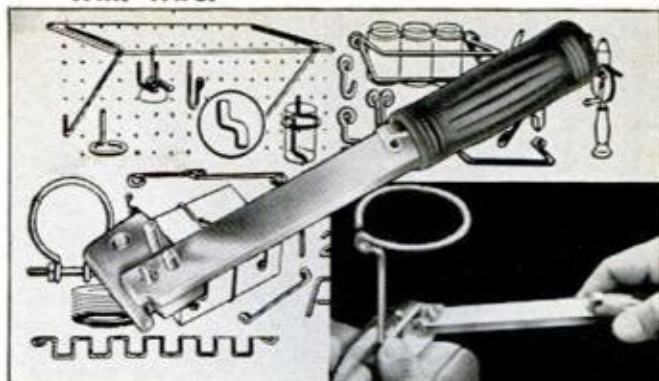
Stick with us one more month and you'll have the article.

Versatile tool

Congratulations on the masterful article, *Now Surform makes anyone a sculptor* (page 81, Nov. PM). This kind of presen-

(Please turn to page 8)

New Tool Works Wonders With Wire WIREFORMER



IT BENDS! IT CUTS! IT STRAIGHTENS!

WIREFORMER is a simple, precision made, vise-held tool of innumerable uses. Make your own peg board hooks, clamps, handles, braces, brackets, etc.—any shape you want. Forms an eye of 3-16" inside diameter (just right for any nail, screw, or bolt up to that size). Even uses coat hanger wire. No pliers needed. WIREFORMER does the work with the pressure of one finger. Straightens the wire if you make a mistake. Cuts the wire just where you want it. Forms any angle, arc or circle. Bends both right and left. Tool is case hardened, plated, with a plastic handle. Fits in your pocket. Complete instructions, illustrated brochure showing many things to make.

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LETTERS

(Continued from page 7)

tation should make every latent wood carver reach for a tool.

We were especially interested because we use Surform tools in our educational program. The program encompasses instruction for senior citizens, vets, the incarcerated and the handicapped.

NATIONAL CARVERS MUSEUM HARRY MEECH
CHICAGO

They've been around

I am surprised at you. Here I read your November issue and find to my astonishment that something brand-new has appeared: wipers for headlights (*It's New Now*, page 134).

Your editors should certainly be aware that headlight wipers/washers have been standard equipment on Saabs in Europe for a couple of years now . . . and soon will be required on all cars in Sweden.

Unfortunately, these cannot be made available over here because of the requirement for round sealed-beam lights.
SAAB-SCANIA LENNART LONNEGREN
OF AMERICA, INC.
ORANGE, CONN.

Those British products we showed are on round lights. But in addition to Saab we should have mentioned (as we did on page 106, Oct. '70 PM) that a washer system is a Chrysler-Plymouth option.

Credit where it's due

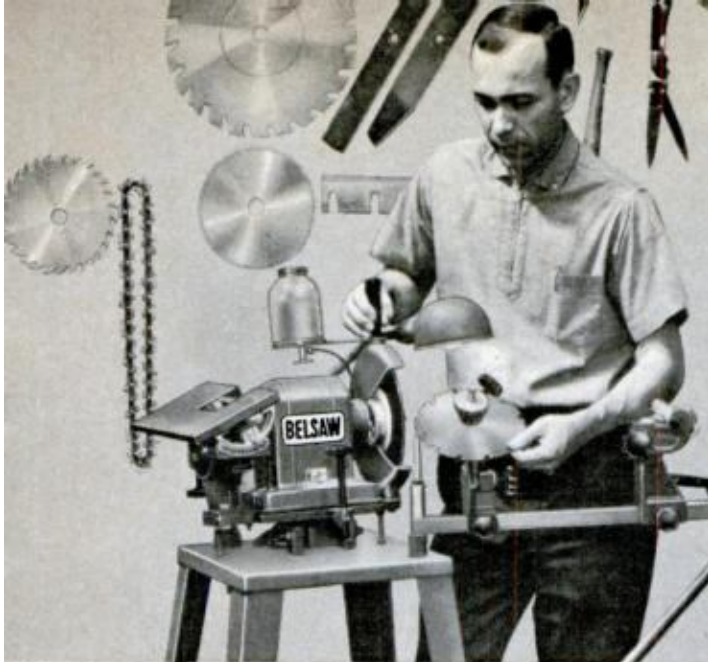
In *Science Worldwide* (page 64, Oct. PM) you show a picture of an underwater oil-storage tank that was fabricated by Chicago Bridge & Iron Co. The first such tank was fabricated by CBI back in 1969 and acclaimed as one of the outstanding engineering achievements of the decade. Would it not be proper to mention CBI and give credit where it is due.
SOUTHAVEN, MISS. RON EVANS

It would be proper.

Intrigued by the dolly

Your recent series on *Bench-saw know-how* (July, Aug., Sept. and Oct PM) was interesting and informative.

What intrigues us in the pictures is the
(Please turn to page 10)



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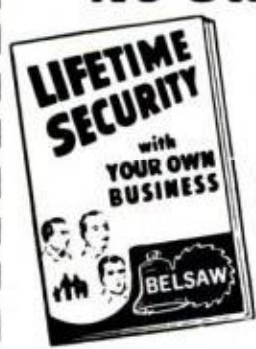
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CUT ALONG DOTTED LINES

LETTERS

(Continued from page 8)

device to which the saw is mounted. We are most anxious to know how it was constructed so that we can make a duplicate when our new saw arrives.

SANTA BARBARA, CALIF. DAVE WILLIAMS JR.

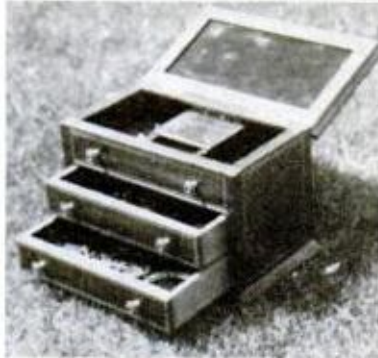
The saw in our photos is mounted on a frame constructed by Workshop Editor Harry Wicks about 15 years ago. It consists of a pair of 2x6s, angle iron and four casters. He made the dolly for both portability and additional saw height.

So many readers have requested how-to instructions that we are planning to present the item in a future issue.

No workbench? Use the patio

Browsing through some old PMs, I came across the lovely *Jewelry Box* (page 124, July '71 PM). I knew constructing

such an intricate project would be a challenge, since I am not a craftsman and possess only a 6½-inch circular saw, an X-acto knife and eight small C-clamps. I made a makeshift table saw with my circular saw and, not having a workbench, used the patio



for sawing, rabbeting, dadoing, etc.

In spite of all the handicaps, the finished project was well worth the effort. But, oh, how much easier it would have been with a manufactured table saw!

EUGENE, ORE.

D. J. METZGER

'Encouraged' rightly

Having just purchased a radial saw last fall, I was wondering just what kind of project I might start. Then came the September 1971 issue with the *Spanish-Style Chest* (page 148). My familiarity with power tools was limited to my hand drill,



but I thought I could start this project without being set back too far if I botched it. The results are told in the picture.

My wife placed the chest in the entry-way of our home where everyone can see it (she helped build it). I am encouraged about woodworking from this excellent project.

SAN DIEGO

VANCE DAVIDSON

Electronic wheel balancing

As manufacturers of electronic wheel balancers, we were depressed to learn that your September issue proclaimed a mechanical, off-the-car balancer to be the best (*Wheel balancing: How to get your money's worth*, page 144) in the face of the facts that in off-the-car balancing:

1. A tire is not in a position that could be described as "true running."

2. A tire is balanced without regard for brake drum or disc, hubcap and trim ring.

Electronic on-the-car equipment balances the entire wheel assembly—both dynamically and kinetically.

We read in your article that the electronic balancer has as its primary disadvantage the skill the operator must have to use it. We submit that if one can tell time, he can balance wheels with an Alemite Electronic Balancer. It's that simple.

STEWART-WARNER CORP. WARREN COUGHLIN
CHICAGO ADVERTISING MGR.

Author John Miles responds: "Neither does 'on-the-car' balancing give a true running position. The tire in its true running position carries the car's weight;

(Please turn to page 12)

YOU GET ALL THIS with new NRI Master Automotive Technician home training. Included is the NRI Achievement Kit we send you the day you enroll . . . ten outstanding kits of automotive testing and repair equipment, plus educator-acclaimed NRI "bite-sized" texts — all yours to keep and use for years to come.



NRI announces a dramatic new way to learn Automotive Repair at home

Top auto experts praise NRI's new training plans

NRI's two new home training programs in Automotive Servicing and Repair have been acclaimed by three of America's foremost automotive experts. Richard Petty, America's winningest stock car racer says, "I especially like the way NRI has programmed essential training equipment they give you into step-by-step instruction." Tom McCahill, car tester and writer, commented, "The Master Automotive Technician

course gives ambitious guys a great start on a top dollar career. And that Tune-Up and Electrical Systems program can save do-it-yourselfers a bundle." William H. G. France, president of NASCAR reported, "The new NRI courses for mechanics are amazingly complete and seem to cover all major aspects of today's sophisticated cars. If you're at all interested in automotive training, I suggest you investigate NRI."

Professional equipment included at no extra cost

NRI gives you the choice of Master Automotive Technician training or a shorter Automotive Tune-Up and Electrical Systems course for the man seeking greater understanding of basic car repair. The Master course covers every major aspect of auto repair, from changing spark plugs to operating your own garage or car-care center. You not only learn the how and why with NRI's proved-in-use "bite-sized" texts, but you also get professional training equipment you need to actually do the work on your own or other cars as you move along in your home training. Equipment you get—at no extra cost—includes your own ignition-analyzer scope, as well as a dwell-tachometer, timing light, complete set of tools, volt-amp tester and assort-

ed gauges. You get ten kits in the Master Automotive Technician course, eight with the shorter Automotive Tune-Up and Electrical Systems Training program. The professional tools and equipment you get from NRI are yours to keep and use in the years to come, as you build a top-pay career as a Master Mechanic, or earn \$5 to \$7 an hour in spare time, or simply save money by repairing your own cars at home.

Train with the leader

The same pioneering home training methods and innovations which have made NRI the leader in other career training fields are now offered to ambitious men who want to turn their interest in cars into a solid, well-paying career. Take a tip from Richard Petty, Tom McCahill and Bill France, and train at home with the leader. Rush coupon now for free NRI Automotive Catalog. NRI, 3939 Wisconsin, Washington, D.C. 20016. NO SALESMAN WILL CALL.

APPROVED UNDER GI BILL—If you have served since January 31, 1955, or are in service now, check GI line in the coupon.

946-013

**Rush coupon
for FREE catalog**



NRI Training
3939 Wisconsin Avenue, N.W.,
Washington, D.C. 20016



Please send me your new Automotive Catalog. I understand there is no obligation. NO SALESMAN WILL CALL.

I am interested in Master Course Tune-Up Course.

Check here for facts on G.I. Bill

Name _____ Age _____
(Please print)

Address _____

City _____ State _____ Zip _____

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LETTERS

(Continued from page 10)

spinning on or off the car is the same.

"As for 'balanced without regard for brake drum or disc, hubcap and trim ring,' the article pointed out that seldom is it necessary to balance the entire assembly. However, off-the-car balancing can be done including everything but the hubcap if need be.

"And it is true that if one can tell time, he can designate the position of the reference mark on the wheel as being at 9:00 o'clock which indicates a weight at 3:00 o'clock. But it's not all that simple beyond that point. It is usually necessary to spin and stop the wheel five or six times to get the little needle to stay in the green area. All that time, the clock is running and the man down the street has already balanced two or three wheels effectively by his despised 'touch.'

"To summarize, I have never contended that the electronic balancer is not a good balancer. It is the only on-the-car balancer I know of that does dynamic balancing. But I do contend that it requires much practice to use and that it requires

much more individual 'intuition' than the 'touch' of others."

Nothing wears out

With the help of PM, I have a 1953 Buick running like a clock... shoes lasting 10 years or better... tools that never give out... toys from scrap... and a lot more.
NEW ORLEANS G.M. LABORDE

Panels, panels, panels

Looking through some old PMs, I noticed that in three different articles by Wayne Lecky (*Coffee Table for \$35*, page 174, Sept. '71; *Handsome Buffet*, page 140, Dec. '71; and *Octagonal Lamp Table*, page 154, Aug. '72) the author uses the same simulated wood panels. I realize that using these panels is an easy and fast way to make a project look elegant, but how about some new ideas?
CHATSWORTH, CALIF. CHIP BOLLIER

They are fast and easy and elegant. But don't worry: After Wayne finishes shingling his house with them, his supply will be exhausted. ★★★

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Jewelry·Emblems·Patches·Psychedelia
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PLAYBOY MAGAZINE says: "Johnson-Smith opened to me a world of fantastic wonders . . . fabulous."
NBC-TV TODAY program: "Thanks for 'vanishing money.' We used it on show on Income Tax Day." LIFE reprinted excerpts from catalog.
HARVARD CRIMSON: "JS book supplied humor for decades."

The Most Unusual Catalog in the World
MAD, NEW YORKER, CORONET, COLLIERS, TIDE, etc., have written stories about this interesting catalog. Some quotes: "Magic wish book - fabulous treasure trove of novelty goods." "Only concern of its kind in America." Ranks with Disneyland, carnivals and the world's fair in popularity over the years - over 10,000,000 customers since 1914 who range from Shirley Temple to the King of Nepal and Johnny Carson. (Johnny Carson often reminisces about Johnson-Smith with his guests.)



Which Things Listed Below Would YOU Like?

NEW 1973 EDITION

No Other Catalog Like It Anywhere!

Live Sea Monkeys
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Fluorescent Shirt Emblems
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Psychodelic Black Lights
Mod Cloth Patches
Playboy Decals & Emblems
Candles, Incense, Body Oil
Helium Gas & Balloons
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"Big Ear" Sound Detector
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200,000 Volt Generator
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T-Shirts with Emblems
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Rubber Masks with Hair
Lifelike Wigs, Instant Hair
Electric Spinning Tie
Comic License Plates
Popul Tie, Jumping Hat
Solar Furnace & Litter
8 mm. Sound Films
Flying Spacecrafts
Optical Prism \$1.50
Solar & Steam Engines
Computers \$2.95 Up
Magnet Lifts 100 Pounds!
Disappearing Spy Paper
Sun Batteries
Stereo TV Specs
Sun Powered Radios
Induction Shocking Coil
Cordless Electric Drill
Loud Electronic Megaphone
Atomic Energy Lab
Projector Enlarges 100X
Receive Big Mails
5-Color Printing Set
Secret Money Belt
12 Color Ball Pen
Leather Sewing Awl
Electric Poker Game
Spanish Wine Flask
Pocket Dry Spaver
Doctor's Stethoscope
Blood Pressure Meter
Electric Water Heaters
Blackhead Remover
Teeth Whiteners

Joke-Magic Playing C.
Spirit Writing Slates
Finger Chopper
Miracle Wand
Phony Chicken
Black Eye Joke
Fake Bullet Holes
Crooked Cards
Ouija Board
Oriental Wood Puzzles
Candy Covered Bugs
Electric Shocker
Comic Jumbo Hat
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Drabble Glass
Foaming Sugar
"Red Hot" Joke Gum
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Talking Toilet
Famous Military Medals
Wrist Alarm Watch
Chinese Luck Rings
12 Rings in One!
Fireball Ring
Mammoth 16-Ft. Balloon
\$1.00 Pedometer
Replica Gold Coins
2-Headed Real Coins
\$1,000,000 U.S. Bill
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Replica U.S. Currency
Bank Vaults
Coin Changer & Purses
Truckers Wallet
Electroplating Set
Wankel Engine
Color Organs
Resurrection Plant
Fresh Eating Plant
Cactus Plants
Imported Mouth Organs
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Ship in Bottle
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95¢ Rapid Hair Cutter
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Tractable Hot Seat
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Remote Hover Craft
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Johnson Smith Co. Dept. C101
Mt. Clemens, Mich. 48043

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Why is it Free? Read it for fun and entertainment, but it pays us to send it to you Free because most people find things they want and order them. **Is there any obligation?** Absolutely none!
Are there things to interest Me? Yes! We think you'll find plenty to amuse and amaze you. Every item guaranteed. No other catalog like it.
Johnson Smith Co., Dept. C101, Mt. Clemens, Michigan 48043

Tear Out & Mail Coupon Now for YOUR Free Catalog

A million jobs have disappeared since 1960

Will Your Job be Next

Shouldn't you start your own business NOW
...while still employed?

Before more jobs disappear through mergers, automation, and mechanization, shouldn't you at least investigate the way so many men have become owners of profitable businesses—starting spare time and now are independent of bosses, strikes, layoffs and automation? All that's needed is your name on the coupon. Facts mailed free. No salesman will call.

Here are facts: With some ambition and little over a thousand dollars, you start your own Duraclean business in spare time, without risking your job or paycheck!

It's a nationally advertised, worldwide business. It does not require skill, more than an average education, or traits except the willingness to work to start grossing \$12, \$19, or \$26 profit per hour. By return mail, we will explain how.

You build by adding servicemen and/or servicewomen . . . and we pay for their equipment so you can expand rapidly.

This is a service to homeowners as well as offices and stores and institutions—a sensationally improved method of cleaning carpets and upholstered furniture right on the customer's premises—the EXCLUSIVE DURACLEAN SYSTEM!

When you have had your own carpet and furniture cleaned, you know that ordinary methods grind fibers with harsh scrubbing, leaving carpet soggy for days.

This exclusive ABSORPTION METHOD lifts out dirt and greasy soil with a gentle, almost dry foam. Do-it-yourself "so-called" cleaning methods and scrubbing drive soil deeper. You TAKE IT OUT. Carpets and

furniture can be used again in a few hours! This is vital to stores, offices, motels.

You operate under a nationally known name—use an exclusive process recommended by the nation's leading carpet mills and in the editorial pages by House & Garden, McCalls, Parents, and House Beautiful. You receive our step by step guidance and help.

Your training shows you how to perform your 7 superior "on location" services . . . how to get customers, how to control your expenses, how to make the maximum profit. You become an expert in the care of furnishings. It is an interesting, exciting career.

Although in time you will wish to buy one or more trucks from your profits, no truck or office is needed to start. You can carry all equipment in your car trunk. Your phone calls can be received at home.

As a Duraclean Dealer you are the sole owner of an independent business and are your own boss. You keep all the net profits.

This business can pay you far more than most men earn—with only the talent and ambition you now possess, and you can operate in any one of three ways.

Many let servicemen do the work while they make a substantial profit on each.

to Go?



Some men operate permanently in spare time for the extra money they need. Some start in spare time and quit their jobs only after they see they can make a lot more money as a full time Duraclean Specialist.

Even small one-man businesses with one or two helpers can and do bring in \$30,000 and more annually. A very high percent is clear profit to you.

The Duraclean Business can be as small as you want or it can be expanded to the level your ambition dictates. There is no limit on income for an ambitious man.

We are about to appoint a limited number of men who are truly ambitious, and anxious to do something about their futures. We want men who will follow our proven plans for success and who want—with our help—their own successful businesses.

If this opportunity interests you, please send your name, on the coupon at the right, for a FREE 24-page booklet which gives complete details on the Duraclean Business. No salesman will call on you. After you've read the facts, decide in the privacy of your home if you wish to take the next step toward starting a business.

WE SWITCHED!

"For the first time in 20 years I've got security—without fear of losing my factory job."

H. E., Ohio

"When I was 40 I decided to retire before I was 50 years old. With Duraclean I gained financial security in only 8 years—then sold my business at a big profit."

J.H., Ill.

"Duraclean brought security and an education for my daughters. We've done as much as \$3000 on a single job."

Mrs. B.B., Mass.

"Life is happier and more prosperous for my family and me. Without Duraclean I'd still be going from layoff to layoff. Now moving to new 5-bedroom home."

R.J.B., Mich.

THESE ARE JUST A FEW OF THE LETTERS IN OUR FILES FROM MEN AND WOMEN WHO HAVE FOUND SUCCESS AS DURACLEAN DEALERS. (IN ANOTHER YEAR YOUR STATEMENT COULD BE HERE, TOO.)

Duraclean[®] International



3-161 Duraclean Bldg., Deerfield, Ill. 60015

WITHOUT OBLIGATION send me the free booklet which shows me how I can start a Duraclean Business in my spare time without risking my job. No salesman is to call.

Name _____

Address _____

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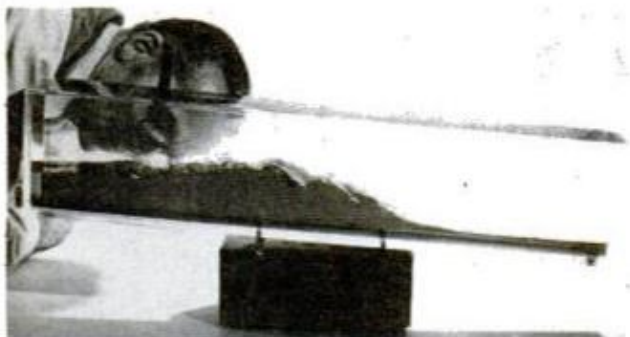
State & Zip _____

NEWS BRIEFS



Movies in your hotel room

If you don't feel like going out to a theater, you can have a movie wheeled in at the Commodore Hotel, New York. The projector (top photo) looks something like a home TV set. The film, in a six-by-six-inch magazine (bottom photo), runs 2½ hours. The system is by Zeiss-Ikon of Germany.



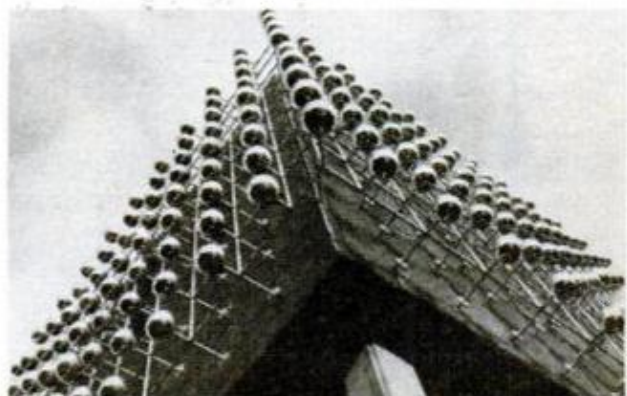
Waves in your living room

You can be soothed by "ocean" waves right in your living room. "The Wave," a clear, plastic tank, rocks gently back and forth, creating waves in a blue liquid inside. Sold by Hammacher Schlemmer, New York.



His point is safety

Convinced that conventional, flat-front cars are lethal in head-on collisions, Richard Ihm, a hairdresser in England, has added pointed steel-and-fiberglass noses to three cars. He says that a pointed nose deflects another car in a collision, minimizing the impact and damage. He recently demonstrated by driving one of his cars between two oncoming cars—all traveling 50 mph; the two other cars were only 18 inches apart, but all came out with only scratches.



Globe-covered museum

Some 639 aluminum balls cover the exterior of the new County Museum in Munster, Germany, "creating the most unusual facade of any museum," according to the architect. Each ball has a colored light bulb shining through an opening toward the wall.



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The Accountant. You should earn his salary.

Learn how to become an Accountant in your spare time.

You are looking at an influential and often envied man in the world of business.

He is a special kind of authority. He usually knows more about a firm's financial affairs than anybody short of the highest company officers. There's hardly a single major decision made without calling on him for advice.

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Why don't *you* become an accountant?

Of all the professions, few offer a greater welcome to newcomers than the accounting profession. That's because there are frequently more fine positions open than there are trained people to fill them.

Do you know that, regardless of your present position or previous experience you can learn to be an accountant—or add accounting to your qualifications for advancement—through spare-time home study?

With the low-cost training offered by LaSalle, you study in privacy, during hours of your own choosing, without the need for travel or for taking time from your own job.

Your lessons are mailed to you. LaSalle's CPA-supervised faculty starts you right at the beginning, explains basic accounting principles and methods, gives you actual accounting problems with your lessons, then corrects and grades your work. By the time you are finished, you are well prepared for the major accounting tasks you will be expected to handle in the business world.

LaSalle has been a leader in home study for over 60 years. It has enrolled more than 2,000,000 students in that time. That is why a LaSalle diploma is a recognized and respected credential.

If you are truly seeking a more rewarding career with higher pay, a solid position in the business

world and the good things that affluence can buy, you owe it to yourself to read LaSalle's famous booklet "Opportunities in Accounting." Send for a free copy. You will also receive a free sample lesson in accounting which will demonstrate how LaSalle makes home study interesting and practical. No obligation. Mail attached card or write LaSalle, Dept. 85-057, 417 S. Dearborn Street, Chicago, Illinois, 60605.

Mail card for
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and sample
lesson





Sawhorse 'workbench'

A SAWHORSE need not be just a sawhorse; it can be the handiest home-repair "workbench" you ever saw. Fitted with a flat top, it provides a benchtop surface for all kinds of layout work, plus a place to clamp a vise.

When a shallow tray is fitted between the legs, you can keep your hand tools, nails and screws all in one handy place such as a toolbox.

When a piece of perforated hardboard is fastened to one side of the horse, you have a built-in tool panel on which to store countless small tools with clips.

And when you install a duplex receptacle in one of the sawhorse legs and wire it to a retractable

(Please turn to page 22)

TOP WORK SURFACE is simply bolted-on length of 2x6; ample for drilling, sawing, most other carpentry jobs. Horse is made of 2x4 stock. Commercially made brackets eliminate need for mitering legs at the top

BASIC SAWHORSE with a few easily added parts is handy work center at the job site. Perforated board and hooks will hold generous complement of tools and yardstick fits on top edge



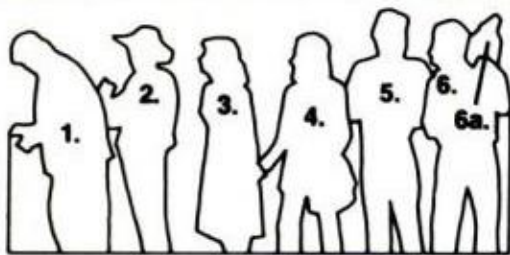
By **KEN PATTERSON**

POPULAR MECHANICS

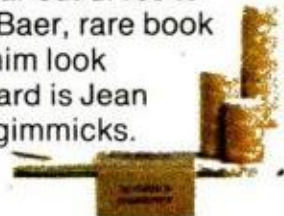
Can you spot the Camel Filters smoker?



©1972 R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

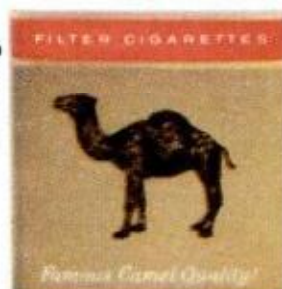


In this picture everybody has a gimmick... almost everybody. Try picking the one who doesn't go along. **1.** Nope. He's Alfonso Cliggitt, divorce lawyer. Gimmick: far out dress to intimidate the opposition. Smokes cigarettes made of dried tundra. **2.** Harold A. Baer, rare book expert. ("Books Old and Rare from Harry Baer.") Thinks rolling his own makes him look younger. A real dingbat. **3.** If she's the Camel Filters smoker, the guy with the beard is Jean Harlow. **4.** Gene Harlow. **5.** Right! He's just himself. And he sees through all the gimmicks. That's why he smokes an honest, no-nonsense cigarette. Camel Filters. Easy and good tasting. Made from fine tobacco. **6.** A. Boswell Farquar. Gimmick: a white (not green) parrot. Hasn't seen a movie in years. They won't let his parrot in. **6a.** Parrot. Smokes a meerchaum pipe but has trouble keeping it lit.



CAMEL

Camel Filters.
They're not for everybody
(but they could be for you).

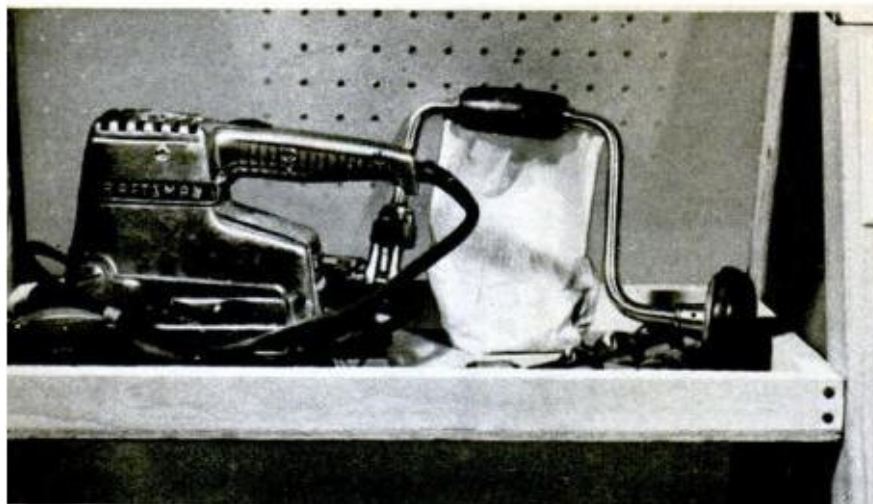


Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

20 mg. "tar", 1.4 mg. nicotine av. per cigarette, FTC Report AUG. '72.

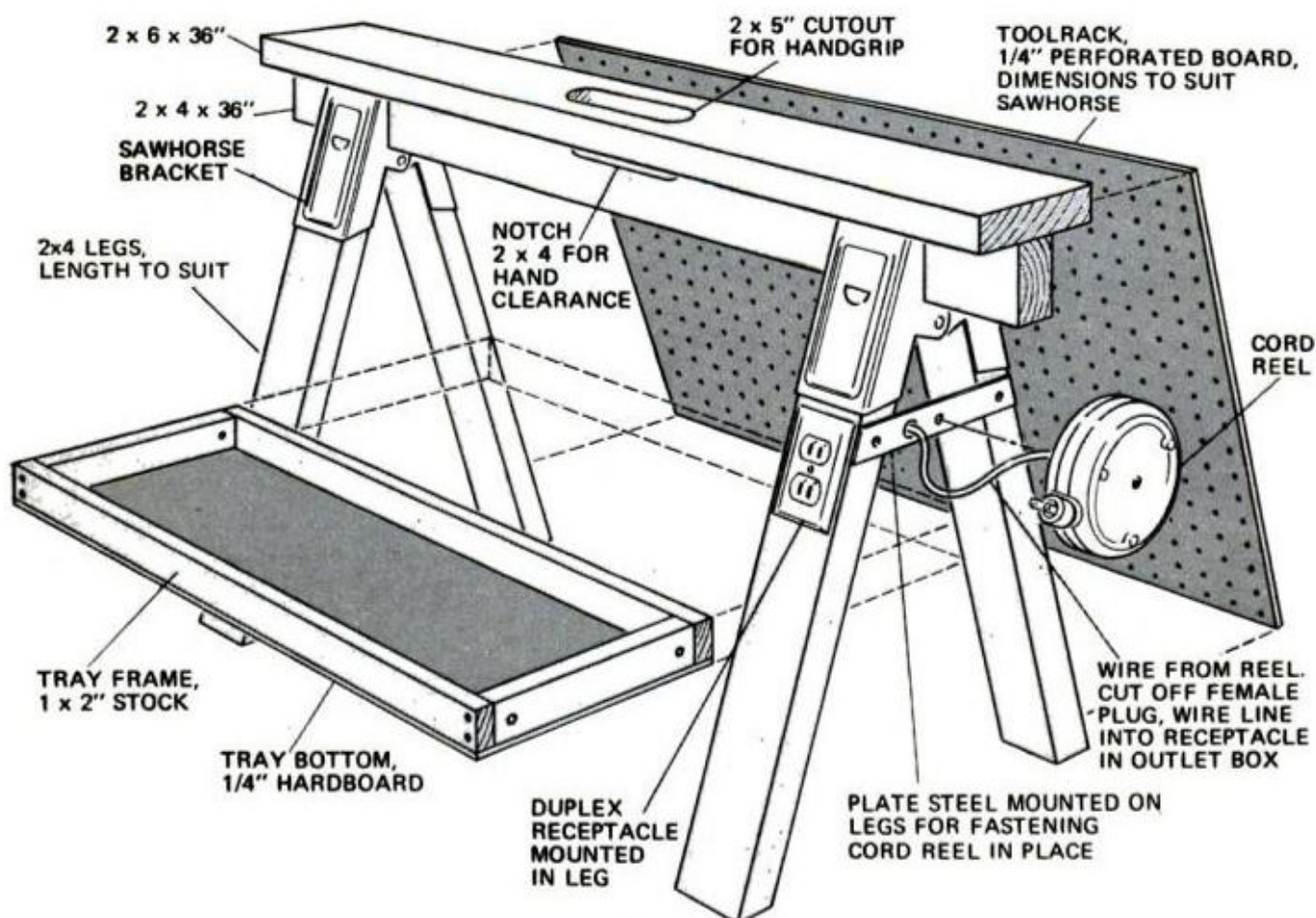
SAWHORSE 'WORKBENCH'

(Continued from page 20)



TOOL TRAY is permanently affixed—and adds rigidity—to the sawhorse legs. It offers a good storage area for portable power tools, small parts, screws, nails and the like

ELECTRICAL OUTLET BOX is installed in one leg, with line from a cord reel connected to the duplex receptacle. Other end of the line is simply plugged into nearest power source



power-cord reel, you have convenience plus when plugging in power tools.

To add such a receptacle, an outlet box is first installed in the leg in a cutout made to receive it. The female plug is cut

off the end of the cord reel and the line is attached to the outlet box with a Romex connector. Finally, the receptacle is installed in the box, which is then fitted with

★★★

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They're people very much like your other neighbors. Businessmen and maintenance men. Lawyers. Doctors. Bakers. And patternmakers. They live in your community. They work for your community.

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They serve the community as they serve the nation. They get involved in more community projects than just about any other single group of people in the nation.

Like running hospitals on weekends, building parks and summer camps, and solving local environmental problems.

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Tell me more about how the
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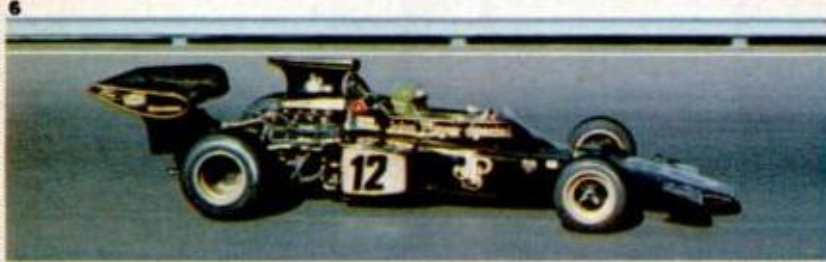
Phone _____ Age _____

PM 1-73

**The Army Reserve.
It pays to go to meetings.**

IMPORTS AND MOTORSPORTS

BY BILL HARTFORD



PHOTOS BY BILL HARTFORD

HALF THE FUN of the one and only U.S. Grand Prix at Watkins Glen is getting there. Speeding to New York's Finger Lakes region and idling into the Glen every year is an international parade of cars: Fast sports cars that are shipped to this country by boat and are driven by owners who like to fly; small economy cars, some tuned for mileage, others tweaked for all the performance possible from a liter and a half; cars that are classics and cars so exotic you may see them only once a year—if that.

There are so many imports in Watkins Glen at Grand Prix time you think you're in California. That's where almost one of every three (!) cars sold is from Europe or Japan. The other imports that buzz and bounce down the rutted roads at the circuit are motorcycles—some of the

(Please turn to page 26)

ON STARTING GRID for U.S. Grand Prix, Howden Ganley 1 buttons up while Jackie Ickx 2 in his red Ferrari focuses on three rows of cars ahead. Teammate Mario Andretti 3 discusses last-minute strategy and Derek Bell 4 steels himself for a drag-race start of 59 laps around 3.377-mile road course. But Jackie Stewart 5 dominated the field in his Tyrrell-Ford, turning 120.991 mph for the pole and 117.483 for the race. Emerson Fittipaldi had already wrapped up the 1972 World Driving Championship in the John Player Lotus 6, here driven by teammate Reine Wisell. The biggest-ever '73 season, with new races in Brazil and Sweden, starts Jan. 28 in Argentina

LET MOTOR'S NEW 1973 AUTO REPAIR MANUAL SHOW YOU How to fix almost any part of almost any car



**Shows You Where To Start...
Which Tools To Use...
Exactly What To Do!
Quickly...Easily...Right!**

Over 1,000 pages, over 3,000 pictures and diagrams cover 2,300 models (1967-1973) . . . 225,000 facts that make those "tough" repairs come easy

MOTOR's great new illustrated 1973 **AUTO REPAIR MANUAL!** Here is the "meat" of over 300 factory manuals, brought together for you in the most complete, up-to-date auto repair guide ever prepared! Here are the easy directions and "see-how" pictures that help you sail through virtually every auto repair... from a simple carburetor adjustment to a complete transmission overhaul! Here are over 1,000 almost-foot-high pages that can lick your toughest problems—quickly, easily, right the first time!

Yes — fix practically any part of any car! This revised, improved 1973 edition immediately identifies 2,300 models (1967-1973) for you. Just look up make, model, and repair in the handy Instant-Reference Index—and go to it! MOTOR's **AUTO REPAIR MANUAL** takes you all the way—shows where the trouble is, which tools to use, what to do to fix it fast. Over 3,000 pictures and diagrams detail the parts... clear, simple

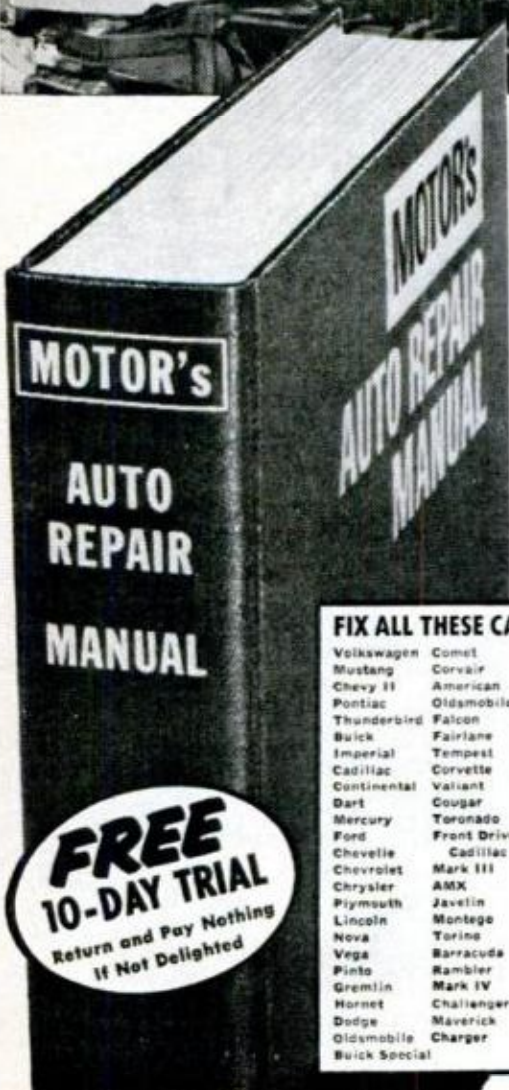
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IMPORTS AND MOTORSPORTS

(Continued from page 24)

more than 4-million dirt and street bikes in the country.

Millions of motorcycles, over a million imported cars each year and the million-dollar sport of auto racing. That's what *Popular Mechanics'* new column is all about.

BMW WITH BOUNCE. The foam nose and tail-pieces cover energy-absorbing hydraulic rams on the experimental Turbo from the Bavarian Motor Works. Turbo is the work of the same designer who did much of the Mercedes C-111, Paul Bracque, and proves that frumpy cars are not the necessary result of U.S. safety standards. (For



a closer look at a sharp, safe front bumper of the home-grown variety check the '73 Corvette.)

The Turbo gets its name from the fact that the two-liter, fuel-injected, four-cylinder engine, transversely mounted amidships, is turbocharged and good for 200 hp. The idea car has a built-in roll bar, and doors are the gull-wing type. Advanced instrumentation includes a radar warning system that automatically adjusts car speed (for more on this see the radar braking story on page 99).

BEST LOOKING BIKE among the '73s we've seen to date is the Kawasaki Z-1 900. You're right, the 900 stands for the displacement of Kawasaki's first four stroke—903 cubic centimeters to be exact. The volume is divided among the four cylinders of the transverse, in-line, air-cooled big



banger. Designed to be the ultimate touring machine, the 130-mph Z-1 was tested extensively before introduction.

Lots of pow and little pollution was the approach in designing a hot dohc with, of all things, a PCV system! Hp is 82 at 8500 rpm and torque, 54.3 ft.-lb. at 7500 rpm. A low, 8.5 compression ratio means regular gasoline can be used and is, in fact, recommended. The 506-pound machine has electric starter for quick starts and hydraulic front disc brake for quick stops. Expected to be less than \$2000 (\$1995?), the Z-1 is 86.8 in overall on a wheelbase of 58.7 in. Seat height is a comfortable 31.5 in. That's how it sizes up in dimensions; now we're looking to size it up in handling when production models become available.

NEW HALF-TON TOYOTA is successor to the earlier Hilux. The restyled model, a lot better looking, comes with wider, 7.00 x 14 white-wall tires as standard and larger, 13.5-gallon



fuel tank. Result is greater range and better handling and traction for the half-tonner. Payload is same 1400 pounds, engine the same two-liter ohc Four 18R-C. P.o.e. price is up only \$77, making the pickup an attractive \$2299.

RACING DRIVERS ONLY NEED APPLY. The Porsche Carrera is a limited-edition version of the 911 series. Only 500 of the 2.7-liter machines will be imported (the number needed to homologate



the car for GT racing this year). The sizzling performer (150-mph plus, 0-60 less than 6 seconds) doesn't meet safety and emissions standards so it can't be registered for the street. The horizontally opposed, six-cylinder air-cooled engine puts out 200 hp in a car that has been trimmed amazingly to 1984 pounds! Fiber-

(Please turn to page 30)

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IMPORTS AND MOTORSPORTS

(Continued from page 26)

glass and aluminum components are given the credit for bringing down the weight from the 2425 pounds of the street version 911.

A 2.0-liter version of the mid-engine 914 is the other significant news from Porsche Audi for the 1973 model year. The two-liter version also has as standard equipment forged alloy wheels and appearance group, front and rear stabilizer, center console with instrumentation and storage.

HARLEY HOGGED the motorsports spotlight by taking the Manufacturers' Championship of the American Motorcycle Assn.'s National Championship Series in 1972. Spotlight on its '73 line reveals the most changes in Harley-Davidson's 71-year history. All two-stroke street bikes now have oil-injection and the big V-twins have hydraulically-actuated front disc brakes, the 1200s with discs front and rear. If it's too cold to think of riding to your Harley dealer to catch the new bikes, you can get some fascinating reading in *The Story of Harley-Davidson*—a motorcycle history as well as a history of the company. The 55-page book is full of fascinating photos, starting with one of Walter Davidson Sr., after he won the Federation of American Motorcyclists' endurance run in 1908. It's free. Write to Harley-Davidson Motor Co., Inc., Milwaukee, Wis. 53201.

ROCKET RECORDS were set when driver Dave Anderson blasted to 158.842 mph in the quarter-mile from a standing start on the Bonneville Salt Flats. The Pollution Packer



rocket rail is the idea of speed-freak Tony Fox who has also posted speed records in snowmobiles and boats, and who owns a waste-compacting firm—therein lies the promotion gimmick of a "clean sweep" with the rocket dragster: Thrust gases were harmless superheated steam and pure oxygen.

The land speed record (LSR) stands at 622.407 mph—set by Gary Gabelich in the Blue Flame rocket car in 1970. Gary wants to go faster and break the sound barrier on land; Craig Breedlove wants to do the same in another Spirit of America. Who'll be first? Stay tuned. ★ ★ ★

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For a fast temperature reading

HOW MUCH MILK SHOULD YOU DRINK? It's all a question of heredity, says Stanford's Dr. Norman Kretchmer, a specialist in problems of human growth and development. If you come from northern European or white American stock, chances are that milk is okay for you. But if your ancestors came from parts of Asia or Africa, where cow juice is not a traditional food, milk may give you indigestion. The reason: Your body does not produce lactase, an enzyme that breaks down lactose, the milk sugar. The problem is greater with children between the ages of 2 and 4, according to Dr. Kretchmer. Their intolerance to milk sugar causes diarrhea and vomiting.

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A HOLE NEARLY A MILE DEEP will be drilled into Antarctica's bedrock this winter to help trace the frozen continent's climatic and geologic history. Thirty scientists from Japan, New Zealand and the United States will work on the project, part of a three-year program that calls for the drilling of bore-holes at a minimum of 10 sites on Ross Island, along the Antarctic Coast and inland in the dry valleys. A diamond-bit rig will be used to extract a rock core with a diameter of 2½ inches. The project marks man's first deep geological probe in Antarctica.



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(Please turn to page 34)

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SCIENCE WORLDWIDE

(Continued from page 32)

twin, the DSRV-1, the new sub can also be used for oceanographic research.

The environment

HEAVY TRAFFIC at Vaals, a crossing point on the Holland-West Germany border, created such potent fumes that guards began to suffer from bouts of nausea. As an experiment, Dutch authorities made available a portable oxygen tank for the men at Vaals, permitting them to take a few beneficial



whiffs before the onset of illness. The oxygen therapy has proved to be so effective that the officials are now planning to supply oxygen tanks to all of their busy points along the border.

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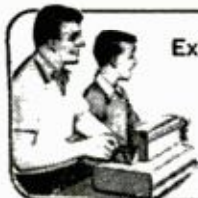
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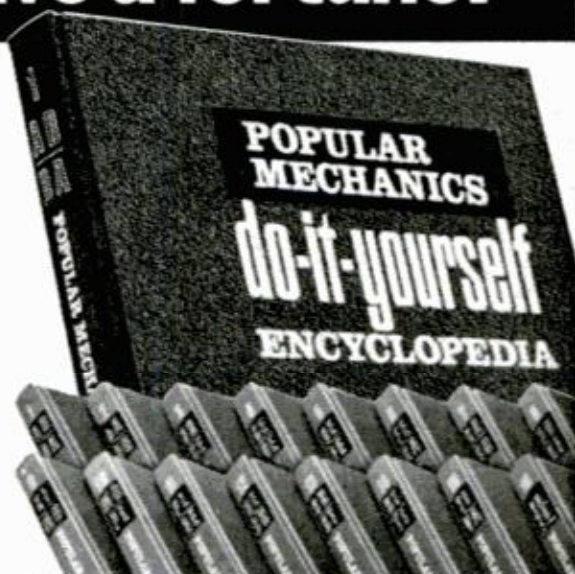
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LISTENING POST

BY ROBERT LUND

PREDICTION 1: It's a fair bet, but short of a sure thing, all four American automakers will offer Wankel-engine cars by the fall of 1976, for the '77 model year.

Two companies, GM and American Motors, are already in the sure-thing column. The two holdouts, Ford and Chrysler, are gradually shifting from wouldn't-touch-it-with-a-10-foot-pole position on the rotary engine to a we'll-look-at-it attitude.

GM's all-out enthusiasm for the engine hasn't quite made believers out of anti-Wankel engineers at Ford and Chrysler, but now you can begin to see the ice melting; the skepticism is wearing off.

American Motors hopes to buy Wankels from GM, possibly in time to put the engine in a '76 model. Ford and Chrysler are getting too late a start to build their own rotaries, so the options they have are to buy engines overseas or to work a deal with a foreign company to put Ford/Chrysler nameplates on Wankel-powered cars for sale in the United States.

Ford and Chrysler still have strong reservations about the engine. At best, they see it as an interim power source between the conventional piston engine and a yet-to-surface something better. Maybe the turbine. But they don't buy the pitch that the Wankel will replace the piston.

You always leave yourself an out in making predictions like this, because the game plan is subject to change as conditions change. The out on this one is that if GM runs into serious problems with the Wankel, either preproduction or within the first year that the car is on the market, all bets are off. Meaning that the other car builders will back out on the Wankel faster than you can say, "None for me, thanks."

PREDICTION 2: Detroit's going to build a lot of things other than cars over the next decade. Motorcycles, snowmobiles, moving sidewalks, robot lawn mowers, farm machinery, construction equipment, new types of travel homes, monorail cars—everything except aircraft. The automakers aren't ready to confirm any of this, but it's quite obvious that this is the direction in which they're headed.

The car companies will have to turn to new

products to survive. That's the advice of their own economists and forecasters.

The seers see several factors working to limit the sale of cars. One, restrictions on use of automobiles in congested areas. Two, more durable cars, longer car life, a trend among motorists to trade less often. Three, a leveling-off of the birth rate to match the death rate, so there will not be a constant increase in the number of customers for cars.

Add 'em up, the forecasters say, and it's obvious car sales are going to slacken off. Not immediately, not sharply overnight, but tapering over a period of years as the negative forces come into play.

The private passenger car, in one shape or other, will continue to be Detroit's No. 1 product. But it's not going to dominate the way it has for the past 70 years. The automobile will have to move over to make room for a raft of new relatives.

The Automobile Manufacturers' Assn. (AMA) has even changed its name to the Motor Vehicle Manufacturers Assn. (MVMA) . . .

PREDICTION 3: Automakers are beginning to do some serious thinking about ultramini cars. But there'll be a long wait before you'll be able to buy one.

The serious thinking consists of studying the plans various cities have for building mass transit systems. The auto companies are trying to get a feel of when the time would be right to put one-seat, two-person cars in production. That's contingent on when the mass transit systems are completed, how many people will ride the systems, where they live, where they work, provisions for parking at the beginning and end of the transit line and a lot of other factors.

There's not much solid information available up to now. It's mostly speculative, your-guess-is-as-good-as-mine stuff. So it's tough for the auto companies to target on a time to bring out mini cars.

I've got a namesake (but no relation) at GM, Robert Lund, head sales hustler for Chevrolet. Chevrolet Bob is the first GM executive to talk publicly about the possibility of Detroit building true minis.

"To the extent that mass transportation be-

(Please turn to page 38)

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20 mg. "tar" 1.4 mg. nicotine av. per
cigarette, FTC Report AUGUST '72.

DETROIT LISTENING POST

(Continued from page 36)

comes prevalent," Lund says, "we see increasing demand for little commuter-type, two-passenger cars, perhaps getting in the area of 50 to 60 mpg. They'll be used to transport people at either end of the mass transit line."

STYLING RACE WARMING UP. While there's more and more sameness in cars in concealed areas, as the auto companies conform to Federal standards, Detroit's making a real effort to get away from look-alike and develop more distinctive treatments for car exteriors. Designers are under heavy pressure to innovate and come up with styling kinks that will give cars more outward individuality.

This is true at all companies, but the pressure is greater on styling departments in reverse order to the size of the companies. This means the designers at American Motors have to work harder than their counterparts at Chrysler Corp., while the Chrysler crew has to attempt to top Ford, and the Ford troops must aim at one-upping General Motors. Ironically, there's probably more competition among automotive styling departments now than there was before government regulations.

FOUR-WHEELERS COMING. A three-way race is on between GM, Ford and American Motors to determine which one can be the first to turn out a sporty compact equipped with four-wheel drive.

GM and American Motors are running neck and neck, while Ford is coming on fast via a four-wheel system that's been developed by a supplier.

The experimental versions are said to have the handling characteristics and maneuverability of a dune buggy.

FEWER PLAIN JANES. You may get a lot more automobile for a little more money on the '74 cars. All companies, all divisions are reviewing sales of minor options—things like deluxe trim inside and out, wheel covers, lights in the trunk, glove box and engine compartment, all extra charge items—and estimating what it would cost to make the items standard.

There are two advantages to car manufacturers in changing an item from optional status to that of standard equipment: (1) the production process is simplified, and (2) the dealers don't have to wrestle with such a lengthy list of add-ons.

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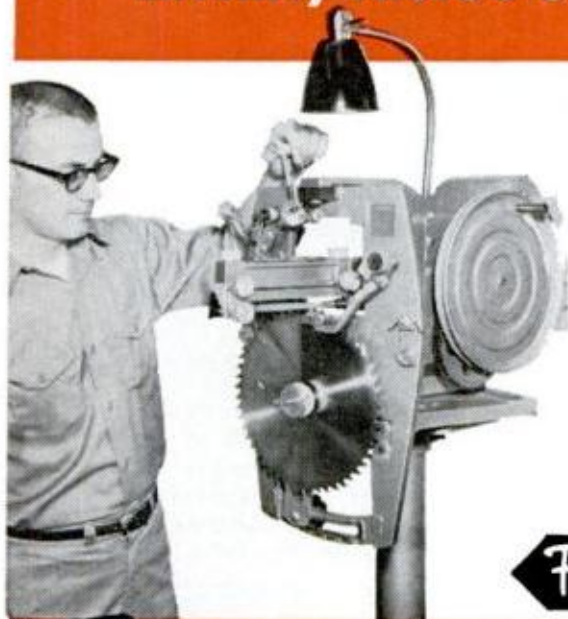
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THE
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 SHOP**
 By EUGENE A. SLOANE

How to repair tubular tires



YOU'LL NEED (top row): waxed linen thread, thimble, rim cement, compound to fill tire cuts on outside, rubber cement to patch tube, talcum powder to put on finished patch so tube won't stick to tire, 3 or 4-sided needle. Bottom row: sandpaper, marker to locate puncture on tire, canvas patch for tire, rubber patch for tube, tweezers



1. INFLATE tire, insert in water. Bubbles will be concentrated around leak. Mark the location of leak with a yellow crayon



2. REMOVE outer canvas by prying up first inch or so with flat blade, then pull up about 3 inches on either side of puncture

TUBULAR TIRES, the kind that come on the more expensive bicycles (over \$250), make a bike easier to ride than "clinchers." But they're more prone to puncture and harder to fix.

Sometimes the tubulars are called "sew-ups" and sometimes less kindly names when these thin, ultralightweight tires exhibit their built-in tendency to puncture.

Tubular tires are different from the tires we knew as kids, or from the clinchers used today on three-speed bikes and on the less expensive 10-speeds. Clinchers are open on the inside so you can pull out the tube for repairs; tubulars are sewn up all the way around in the inside rim, so you must remove stitches for repair.

Tubulars are lighter than clinchers, more responsive and make riding easier, but they're thinner and almost any sharp object on the road will cause a flat.

Finally, clinchers are held onto the rim by a wired edge on the tire which clamps into a bend in the rim when the tire is inflated. Tubulars are held on the rim by rim cement, applied to both the inside of the tire and the rim.

Tubulars are far easier to remove than clinchers. A new one can be rolled onto the rim in a minute. They're so light and compact a spare can be rolled up and carried under the seat.

It's important to know how to fix tubulars because they're expensive (\$8 to \$16 or more). You can carry only three or four spares on a trip, so if you get more than a few flats, you could be without a tire unless you can fix them yourself.

Although tubular tire repair is simple, I've
(Please turn to page 42)



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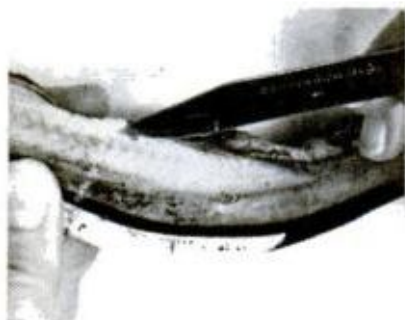


THE BICYCLE SHOP

(Continued from page 40)

found few cyclists willing or able to undertake repairs and, worse, almost no bike shops willing to fix them (at \$3.50 each).

So here are instructions that should make it easier for you to repair them. While you're fixing a puncture, check the tire casing and fill any cuts on the outside with the black rubber compound that comes with the patch kit. ★★★



3. CUT away stitching with sharp knife (don't cut tube below) for 2 inches, both sides of puncture



4. PULL UP old stitching with ice pick (or sharpened spoke) so you can get at it with tweezers



5. USE the tweezers to remove all the old thread that you've pulled up in the preceding step



6. PULL away inner protective liner, pull out tube to find puncture. (Check both sides of tube)



7. SANDPAPER the tube lightly for about half an inch around the puncture to prepare it for cement



8. APPLY drop or two of rubber cement on sanded area, spread and wait till solution is tacky



9. PEEL off tube patch backing, apply firmly over puncture. (This tube had puncture on both sides)



10. CHECK tire for damage. This one was "wounded" by sharp rock author hit on recent Vermont trip



11. SAND tire casing damage, apply rubber cement, wait till it's tacky and apply canvas patch



12. PUT talcum powder over the patches on both tube and tire so they won't stick together



13. USING double thread, overhand stitching, run linen thread through original holes. Knot ends



14. DAB rubber cement over the protective casing and carefully lay it in its original position



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APPLIANCE CLINIC

By PAUL MANN

Drum roll

We own a Skuttle Drumatic power humidifier. The drum doesn't turn. Can you tell me why?—Peter Zink, Morris Plains, N.J.

There are several reasons. Make sure that the drum is engaged in the motor drive coupling and see to it that mineral deposits aren't stopping rotation.

Is electricity getting to the unit? If so, check for a bad wire connection, motor or transformer.

Also check that the trouble isn't being caused by having the humidistat, if there is one, set too low.

Dryer burns wires

I have a Westinghouse clothes dryer that has a habit of burning off its wires at the connector block. This occurs about once every three months, and I'd like to know what I can do about it.—James Whitehead, Birmingham, Ala.

This problem is familiar to servicemen and is caused by the relative closeness of the heater coil to the ceramic terminal block. Heat generated by the coil causes wires connected to the terminal block to start burning. The solution is to allow more space between the terminal block and heating coil.

Remove the coil (some dryers have two; if so, both should receive the same treatment) and stretch out some of the wire from the coil. Reconnect the coil. This extra bit of wire will give you the "cool" space that's needed to keep wires at the terminal block from burning.

Tracking down a switch

My Vornado window airconditioner is over 15 years old, but still in good running condition. However, it needs a new control switch and the manufacturer, A.O. Sutton of Wichita, Kans., has been out of business 10 years. How can I get a replacement switch?—H. J. Eisenberger, Kansas City, Mo.

Vornado is now the trade name of ap-

pliances, including airconditioners, sold by Two Guys From Harrison, a discount-store chain operating in the East. Although Sutton is out of business, you can get parts for its Vornado airconditioner. All Sutton did was assemble the units. The switches are (and were) manufactured primarily by General Electric and Ranco Controls.

Remove the switch from your airconditioner and copy all of the information from the switch housing. Take the information to a General Electric dealer and see if it is a GE switch, which he can supply. If not, mail the information to Ranco Controls, Ranco, Inc., 601 West Fifth St., Columbus, Ohio, and ask for the switch.

Squeaky brakes

I have a Maytag automatic clothes washer which a few months ago developed a loud screech when braking after the spin cycle. It took a serviceman five minutes to correct the noise, for which he was paid \$10. The noise is back as loud as ever. Why?—Gene Richardson, Pennsauken, N.J.

Probably because he did a slapdash lubrication. The noise sounds as if it's being caused by the brake itself—much like the brakes of a car screech when they get wet. The cure is to apply lubricant, but this must be done correctly or the problem will return.

Turn the machine on its side and remove the lower pulley. Apply a teaspoonful of 90-weight, gear-case lubricant on the brake housing and move the pulley up and down so the lubricant works its way into the housing. A Maytag dealer with a service shop can provide the proper lubricant.

Reattach the lower pulley and adjust the drive lug firmly. The lug must not be overtightened or the machine will spin when it is supposed to agitate.

Putting on the pressure

We have owned a Ward's Signature 700 water heater for about four years and have had a continuous problem with the pressure-relief valve. The valve will frequently open with a loud bang, and water will flow out the overflow. A serviceman has not solved our problem. What is your diagnosis?—Charles Arado, Glenview, Ill.

Assuming there is nothing wrong with the heater that would result in a sudden

(Please turn to page 47)

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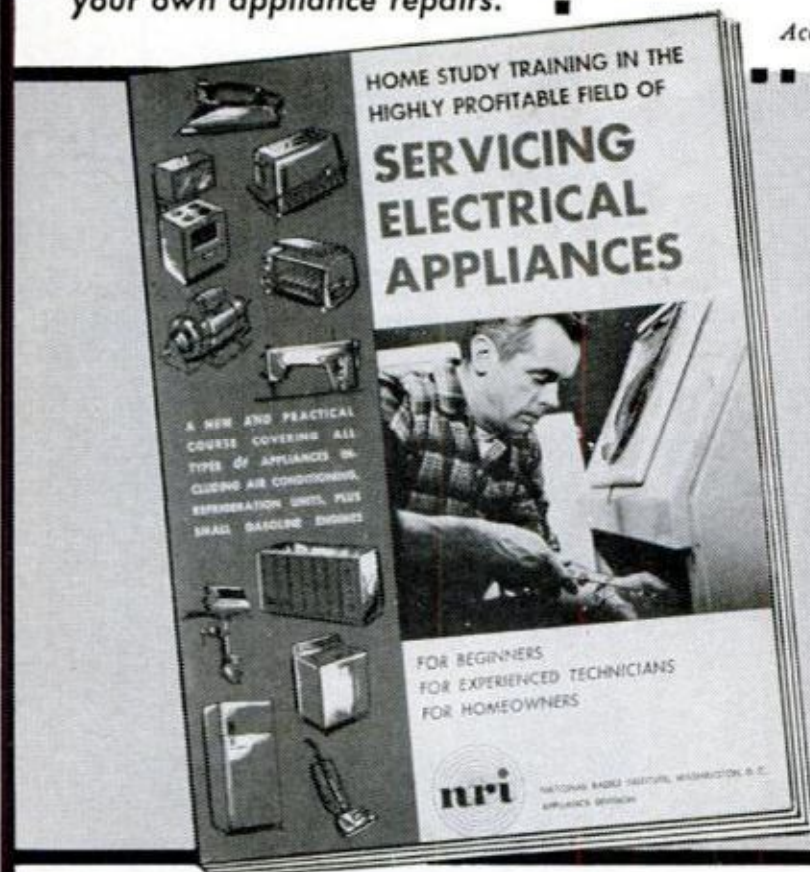
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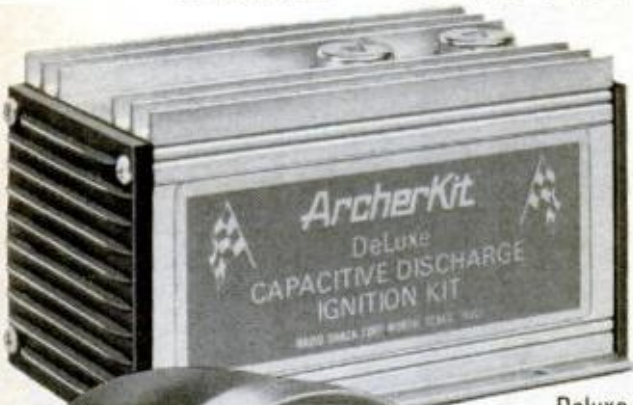
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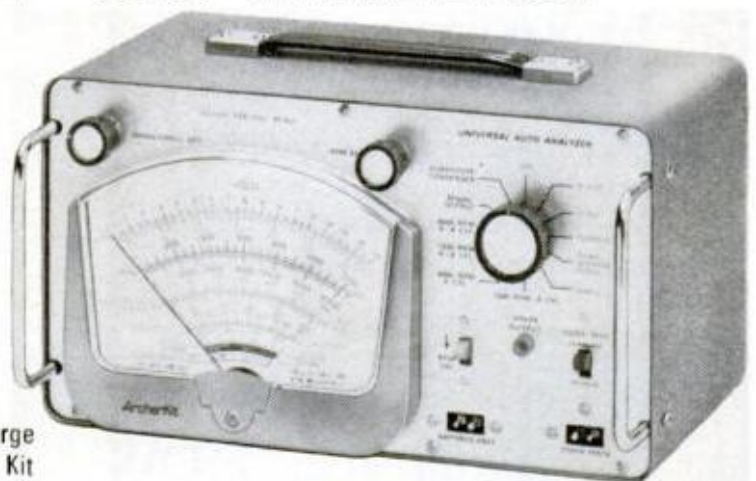


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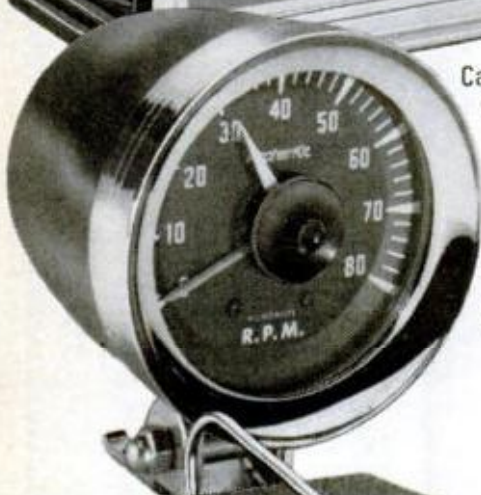
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APPLIANCE CLINIC

(Continued from page 44)

rise in pressure, high water pressure may be your problem if the relief valve is set too low for it. For example, if you have a 125-p.s.i. valve, it will let loose if pressure exceeds 125 p.s.i.

Some relief valves can be adjusted, but most are preset. In this case, I would think your ideal solution would be to install a pressure-reducing valve in your home water system. These valves reduce water pressure by as much as 45 pounds.

Gas-operated refrigerators

Are there any manufacturers who make refrigerators that operate on gas?—M. K. Bilderback, DuQuoin, Ill.

Try Norcold, Inc., 1501 Michigan St., Sidney, Ohio 45365; Instamatic Corp., 2321 Middleberry St., Elkhart, Ind. 46514; and Hadco Engineering, a division of Automatic Sprinkler Corp. of America, 2000 Camfield Ave., Los Angeles, Calif. 90040.

Ironing out a problem

We have a Westinghouse Fabricscope

iron 2½ years old. The sprinkler doesn't work. I tried putting a pin in the hole to clear out any foreign particles, but this hasn't helped. Does my use of tap water in the unit have anything to do with it? Can this be repaired?—Mrs. Gloria James, Houston.

Tap water won't hurt this spray. Westinghouse says you can use it. The spray is controlled by a pump bellows under the knob you depress to operate the mechanism. The pump may be damaged; if so, get a replacement from a Westinghouse appliance dealer. Snap off the dial plate, lift the old pump out and install the new one. Other reasons for spray-mechanism trouble include failure to fill the tank to the top, foreign deposits on the check ball and pump body seat, clogged pump-inlet tube, and improper positioning of the top of the pump (it must be seated in the recess on the underside of the spray knob). ★ ★ ★

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. However, problems of widest interest will be answered in this column.

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ALL By BILL McKEOWN OUTDOORS

NATIONAL HUNTING & FISHING DAY, 1973 seems assured of success, based on reports already in for 1972. Probably no one will ever know the total number of experienced and would-be sportsmen who got together last Sept. 23 to celebrate the appeal of the outdoors, though 4 million is the conservative estimate of Warren Page, president of the National Shooting Sports Foundation and sparkplug of the event.

At least 5000 fishing, shooting, hiking, camping, boating, archery, diving, scouting, mountain-climbing and assorted other clubs were involved, and such organizations as the National Wildlife Federation, Izaak Walton League, National Conservation Committee of the Boy Scouts, American Forestry Assn., the Forest Service of the Department of Agriculture, the Department of the Interior and the National Assn. of Conservation Districts were among participants and sponsors.

The observance, announced here for several months last summer, was the first national opportunity to display the enjoyments of field sports, and for sportsmen to receive the overdue credit we deserve as the country's leading conservationists. Funds from millions of hunting and fishing licenses pay to keep so many natural areas from being despoiled, and provide studies and careful supervision which prevent fish and wildlife game from becoming endangered species.

Growth of urban sprawl and pollution, rather than outdoorsmen, are the threats to the countryside. The Hunting & Fishing Day could be a good yearly reminder of what we have to lose and gain outdoors.

GOOD NEWS FOR FISH and fishermen alike was the announcement by Howard Larson, Boating Industry Assn. president, that first-year results of a two-year study show no trace of ecosystems damage from outboard motors. The research project, jointly sponsored by the Federal Environmental Agency and the outboard engine manufacturers' marine-exhaust research council, is being conducted by independent research firms in Florida and Michigan test lakes. Results so far show no fish kills, no water pollution, no detrimental side effects. The B.I.A. and Larson, an Outboard Marine Corp. v.p., undertook the

survey in advance of any prodding from public or government sources.

SLINGSHOTS will have their day again; in fact they'll have three on Jan. 19-21 at Las Vegas, during the first U.S. Open Indoor Slingshot Tournament. The event will be held in conjunction with the U.S. Open Indoor Archery Championships, being held at the same time at the Convention Center. The rules call a slingshot "any hand-held Y-configured device, with or without wrist brace, which propels a missile from a pouch by means of rubber power bands or tubes which are hand-drawn and released." That should rule out any Cromwells who try to enter with crossbows. Tournament information is available from Saunders Archery, Columbus, Neb.

FOR SNOWMOBILE CLUBS, it's not too late to get in on a trail-grooming plan that could make for a lot of smoother riding. Ski-dozer trail maintenance vehicles, along with a fund-raising program to pay for them, are being made available with long-term low-cost financing for interested organizations. Many so-called "trails" have too many overhanging branches, narrow stretches and obstructions to allow a grader to get through and will need further planning and work this coming summer. But for a club anxious to upgrade its trails, it could be worthwhile to contact Snoplan USA, Bombardier Ltd., 39th Floor, 221 North LaSalle St., Chicago, Ill., or for Canadian Clubs: Snoplan, Bombardier Ltd., 8600 Decarie Blvd., Montreal, Que., for details. Good trails will decrease the criticism and increase the fun.

Maps of 11 free snowmobile trails in Washington and Oregon are available from the Forest Service. Basic rules, notes recreation management branch chief Otis Foiles, include never touring alone, learning about avalanches, proper equipment and physical condition, and constant check of weather conditions. All litter must be packed out, wildlife wintering grounds respected and proper concern shown for other users. Competent leadership is always essential. There are already 19 National Forest snowmobile trails designated in the two Northwest states.

OUTDOORSMEN caught by unpleasant weather have written in recently with recommendations for useful products. One writer was nearly submerged last spring by flood waters in Pennsylvania. Fishing and hunting gear that he had locked in a basement storeroom got a bad dous-

(Please turn to page 50)



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Don't take chances with aerosols



Aerosol containers for paints, hairsprays and deodorants are now familiar household items. Their convenience leads to casual use and that may be dangerous. Here's what researchers are learning about the effects of aerosols.

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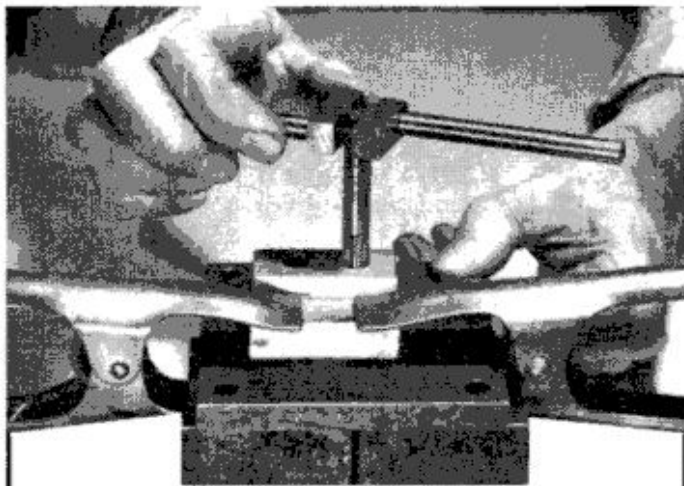
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ALL OUTDOORS

(Continued from page 48)

ing from muddy water. Items such as fishing reels, a shotgun and an electric trolling motor he washed with clean water, disassembled to get any grit out of the bearings and sprayed heavily with WD-40 penetrant lubricant. The treatment, he reports, seems to have prevented extensive rusting and loss of equipment.

Another sportsman had the boom on his small sailboat break during a squall a good distance out from shore. He wrapped the spar back together with 3M Scotch Strapping Tape he had along, and reports it probably would work equally well for temporary repairs to fishing-rod guides or the split handle of a hatchet.

IF EDUCATION CAN PREVENT boating accidents, a new \$1 book by the Coast Guard may be a long voyage in the right direction. It's called *The Skipper's Course* and the 96 pages are particularly lively for a government publication, probably as the result of a direct order from Admiral "Red" Wagner, chief of the Coast Guard's Office of Boating Safety and an officer who seems dedicated to getting things done. Many boat owners don't have Power Squadron, Coast Guard Auxiliary or Red Cross courses available nearby. Others would like, or certainly need, a refresher course in the basics of boat safety equipment and handling. This book is specifically designed for home study, at your own speed, and even includes a test at the end to be submitted to Coast Guard Headquarters for a certificate of completion. Numbered CG-433, and available by mail from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, *The Skipper's Course* is a notable one-buck bargain.

THE GOLDEN EAGLE, that bargain passport for outdoorsmen, will fly again this year after being grounded in 1972.

Not until mid-July did Congress get around to putting him back in business as a prepaid ticket for National Park entry and selected service discounts. The Departments of Interior and Agriculture now agree the \$10 pass can be used for all of 1973 at designated national recreation areas, as of Jan. 1.

It's expected to be on sale at post offices and entrances to areas where a fee is charged. Another discount is available for persons 62 or older. Called the *Golden Age Passport*, it's free and, like the *Golden Eagle*, allows no-fee entrance at 75 National Park Service and Forest Service recreation areas plus lower user fees. ★★★



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Grainless 8x10s from 35-mm? Absolutely!

These 15X blowups show what new H&W control films and developer can do.



OUR TEST: 15X enlargements (far right) from indicated sections of frames like this

By IVAN BERGER, Photography Editor

GRAIN IS GREAT—if you like your enlargements with salt and pepper. But most of the time, you'd rather just see the picture you saw when you clicked the shutter, as grainless as it looked on your contact sheets.

You can't quite do that yet—but the H&W Co., up in Vermont, has a special developer and two matching films that, together, let you come darn close, as a look at the pictures on the right will show. Both are enlarged 15X (equivalent to a 14x21-inch full-frame print) from portions of 35-mm frames like the one above. They show tremendous differences in grain and detail—and even on 8x10 enlargements, 30 percent smaller than these blowups (and without our engraver's screen to contend with), grain should be just about invisible on the H&W film, but still quite noticeable on the Tri-X. Not that you'd know it from hand-held shots, but the H&W film's ability to resolve fine detail is considerably better, too, though Tri-X has well earned its reputation for sharpness.

It might seem more logical to compare H&W VTE Pan with Panatomic-X, the previous standard-setter for fine grain and sharpness—and we did, comparing Pan-X, Tri-X, Plus-X, H&W's VTE Pan and



GRAIN, BARELY VISIBLE on 15X enlargement of H&W Control VTE Pan, would be $\frac{1}{3}$ smaller on an 8x10



TRI-X, grainier (but not as much so as our engraving makes it look), is still sharp. And sharp grain, greater contrast make it look sharper than it is

H&W's slower VTE Ultra Pan. But though each film earned its own, definite place in the scheme of things, I found the Tri-X and VTE Pan films most generally useful (with Panatomic-X not far behind).

Of the ultrasharp films, VTE won my vote for its combination of usably high emulsion speed (80) with its exceptional sharpness and grain characteristics. VTE Ultra Pan was, if anything, a little finer-grained and sharper—but so slow (25) that the slow shutter speeds I needed on an overcast day wouldn't let me hold the camera steady enough to take advantage of the film's sharpness; I'd rate it as a slightly better film for use with a tripod-mounted camera, but no match for the faster of the two H&W films for hand-held shooting.

On a bright day, even VTE Ultra Pan would be usable (though still not preferable) for hand-held use. But bright days bring out the H&W films' mutual Achilles' heel: poor latitude and contrast. On flat, overcast days, the H&W films (especially VTE Pan) give noticeably less contrasty results than standard films. With more contrasty subjects, prints from the H&W films look snappier, but a new problem rears its head: poor tonal range. Highlights start blocking up and shadows turn to featureless black far sooner than on normal films—but the shadows are a very lovely black, because shadow areas of the two new films are clear and grainless.

Considering their origin, the H&W films' limited tonal range and clear "black" areas are no surprise, but their low contrast is surprising, for both are actually microfilms designed for high-contrast, high-resolution copying of documents. In their standard developers, these films yield crisp blacks and whites, but no middle tones; H&W Control developer (the only one recommended for the H&W films) was invented specifically to bring out the middle tones in these films, allowing ordinary photographers to take advantage of their grainlessness and sharpness. H&W Control developer can be used with other microfilms, too, but not as happily; though the company claimed an exposure index of 25 with Kodak High Contrast Copy film (in many areas, more readily available than H&W), photographers I know who've tried it found 8 to 17 more realistic; H&W's ratings for its "own" films, (actually Agfa Copex Rapid and Copex), though, seem more accurate. ★★ ★



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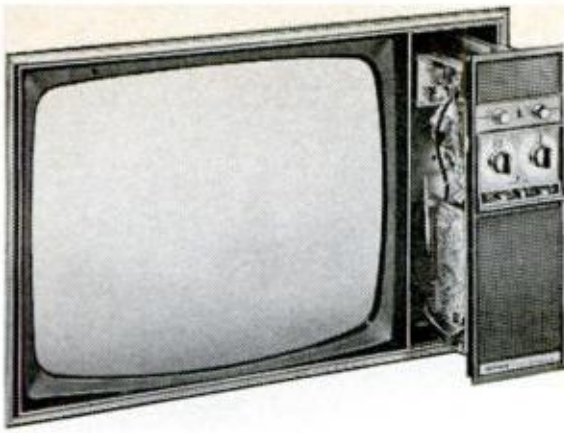
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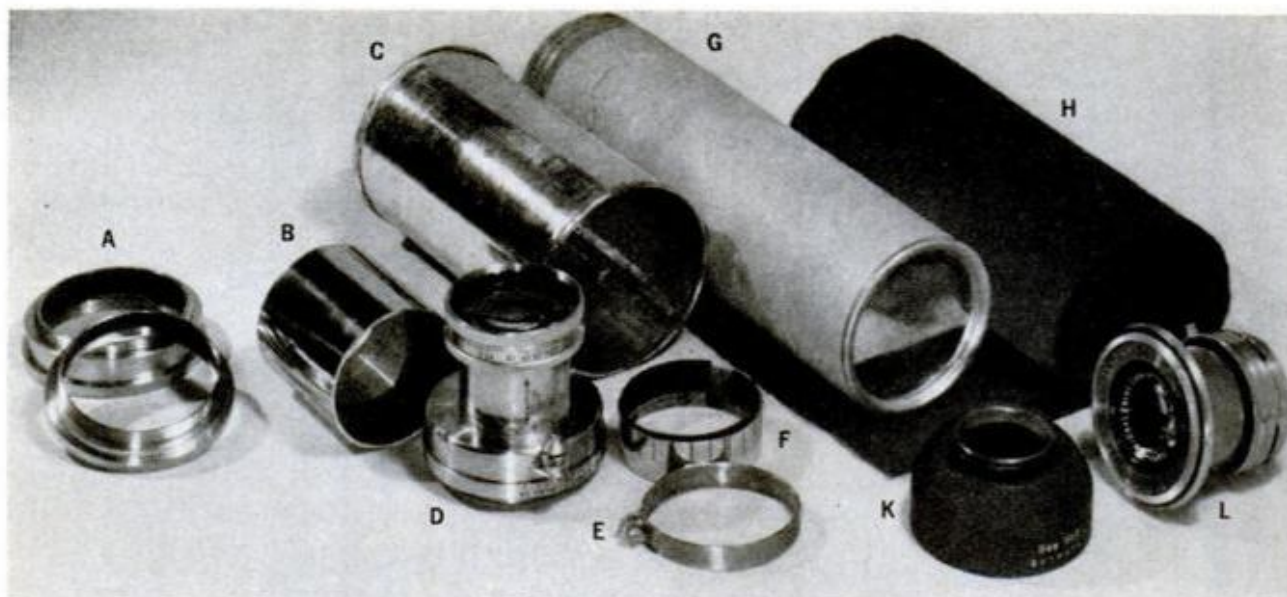
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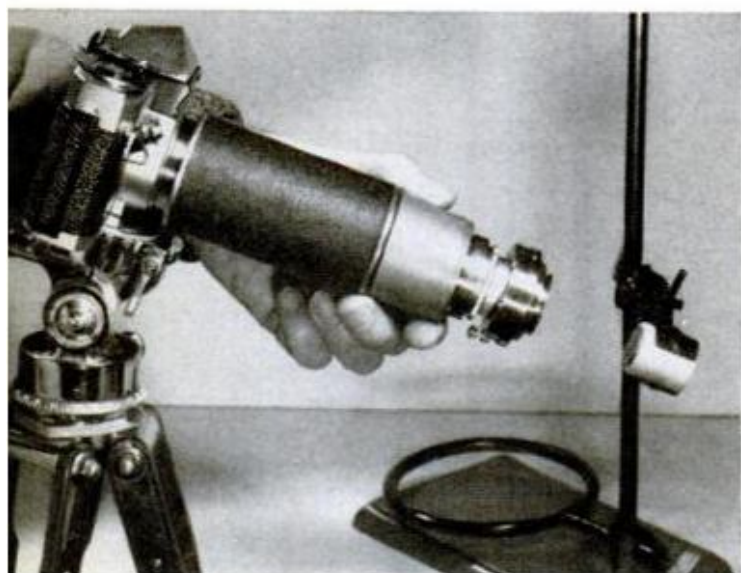
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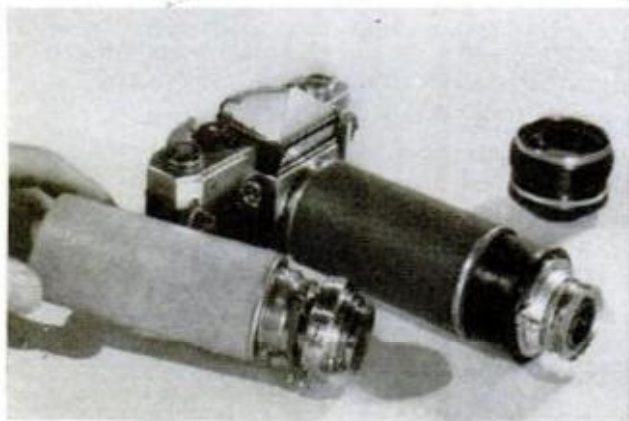


Make an adjustable extension tube for those extra-sharp close-ups

FOCUS-TUBE PARTS: Extension tubes (A) hold juice-can outer tube (C) to camera; lining of felt (H) inside C seals and cushions slide of inner cardboard tube (G). Lenses (D, L) can be fastened with lens flanges (not shown), with reversed lens-hood (K) to fit lens (L), or with toothed ring (F) made from brass pipe (B) and clamped to lens with clamping ring (E). For details, see diagram on page at right and text



SHOOTING COIN (see facing page); note reversed lens



INTERCHANGEABLE inner tubes add versatility; here, to hold one lens normally and another lens reversed

INSTEAD OF A BELLOWS close-up attachment for my single-lens reflex, I built an adjustable focusing tube—from junk parts. Basically, it's just two tubes, one sliding within the other (see diagram on facing page). I made the outer tube (C in the diagram, also in photo above) from a small frozen-juice can, with one end removed. The inner tube (G in diagram and photo) could be another can, if you have one that fits, or a cardboard tube with a metal end cap (that's what I used).

Cement a lining of dark felt inside the outer tube, to provide a light-tight seal and a cushion for the inner tube to slide in. The felt should be thick enough to let the inner tube slide freely but without play. Cut a carefully centered hole in the back end of the outer tube, just large enough to clear your lens mount; then screw two short, extension-tube sections through the hole (see diagram) so you can mount the completed focusing tube to your camera. (If your camera has a bayonet mount, you may have to file or machine the extension rings to allow for the can-lid's thickness.)

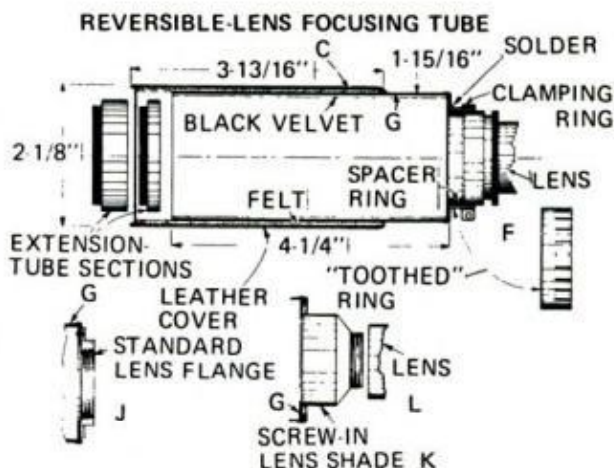
Line the inner, sliding tube with black

velvet, or other nonreflecting material. Make another carefully centered hole in this tube's end cap, for a fitting to hold your lens. This could be a standard lens flange (J in the diagram) if one is available for your camera; it would either bolt on or screw on with a retaining ring. Reversing adapters, also available for many lenses, allow you to reverse the lens end-for-end for a little added sharpness in extreme close-ups; if you can't find one, you could make a clamping attachment like that shown as "F" in the diagram. Cut a ring from brass tubing, saw slots to form a series of clamping fingers, line it with plastic electrical tape and compress with a screw-tightened ring or hose clamp, to hold it on the lens barrel. This ring can be soldered or welded to the end cap. Or you can fasten a lens shade to the tube, and screw on the lens, reversed.

For safety's sake, make sure the lens is safely fastened to tube G, and link the two tubes to one another with a safety chain or cord. Cover the outer tube with leather or stick-on covering.—Walter E. Burton, Akron, Ohio.



SHARP CLOSE-UP made with setup on opposite page; this token has been enlarged four or five diameters



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Just holding this sturdy, lightweight little camera gives you the feeling that now, at last, you can take great pictures. Anywhere. Any time. The Minolta Hi-matic F has a balance, a construction, a "feel" that inspires confidence. Since the "F" is an amazing electronic instrument that does everything for you except focus, the results invariably prove worthy of the confidence it inspires.

For literature, write Minolta Corp., 200 Park Ave. So., N. Y., N. Y. 10003. In Canada: Anglophoto Ltd., P.Q.

The Electronic **Minolta Hi-matic F**





MONDAY'S SESSION starts with discussion of course objectives and saw-filing lecture by "Mac" McConnell

This school turns out sharp grads

In five days students learn how to make good money close to home.

By HARRY WICKS, Workshop Editor
Photos by George Miles Ryan



THOUGH ABSOLUTE QUIET is the norm in most classrooms, the din created by a dozen or more whirring and screeching machines running simultaneously brought a smile to School Director Joe Hussey's face as we walked into the room.

"The secret of our students' picking up professional skills so quickly is that we try to spend a minimum amount of time lecturing and maximum time doing," he shouted over the noise. "Actually," he added, "the only time it should be quiet in here is when one of our instructors is either introducing a technique or giving a demonstration." After spending several days at the Foley Saw and Tool Maintenance School, I can vouch that there is more "doing" than silence.

According to Hussey, the school is unique because "we're the only company making and selling saw and tool-sharpening equipment that runs a nonprofit school so that buyers—in a week's time—can learn to expertly handle the equipment they have just purchased."

Individuals who want to make money in their spare time, and decide that a sharpening business is the way to do it,

NO GENERATION GAP HERE. Boyd Pace, 14, Osseo, Minn., pinch-hit for his dad who couldn't make the seminar

WORTH WRITING FOR

LOOKING FOR IDEAS AND INFORMATION ON HUNTING, FISHING, CAMPING, BUILDING, TOOLS, ETC.? CHECK THESE LISTINGS, THEN USE THE COUPON BELOW.

105. SURFORM MAKES ANYONE A SCULPTOR

Fantastic brochure describes revolutionary new art, and tools that can help you create handsome wood carvings from solid stock, or free-form works of art from twigs and branches. From Stanley Tool Co. 25¢.

106. 1973 CRAFTOOL CATALOG

Craftool introduces its latest full-color catalog with 152 beautifully illustrated pages of fine crafts equipment. This is the most complete crafts catalog ever published. For craftsmen in all fields. Free.

107. A NEW RAINBOW FOR YOUR FLOORS

Glidden has developed a new color card for SPRED Urethane Florenamel, a tough floor coating for application inside or outside on wood, metal or concrete. Free.

108. "OUTDOOR TIPS"

No outdoor family should be without the 190 page Remington "Outdoor Tips" book. Over 1,000 tips on rec vehicles, camping, snowmobiling, archery, fishing, cooking, hunting. \$2.95.

109. GET ALL THE FACTS ABOUT UTAH

Write for detailed info, highway maps, color brochures; complete Utah Travel Kit and 52-page fact book. Free.

110. "HOMEOWNER'S GUIDE TO FAUCET SELECTION"

New 16-page booklet from Bradley Corp. explains what to look for in the various types of

faucets now available. Bright and factual. Free.

111. DO-IT-YOURSELF IDEAS WITH ALUMINUM

Here are 3 booklets from the Macklanburg-Duncan Co. full of wonderful and unusual decorator ideas with aluminum. Free.

112. TAKE THE PAIN OUT OF PAINT REMOVING

This new booklet offered by the Savogran Co. simplifies methods and procedures in paint removing. Send for this and remove paint and elbow grease. 25¢.

113. HOW TO DO IT WITH SKIL

Skil Power Tools offers a full-color, 48-page booklet loaded with instructions, tips and short cuts for home improvement. A "how-to" booklet for people who don't know how. 50¢.

114. KEEP YOUR EDGE

Learn how to sharpen a knife professionally for any purpose with this most informative booklet from Arkansas Abrasives. Free.

115. OPEN UP TO NEW IDEAS

Exciting new ideas to open up your home and let the sunshine in! Full-color booklet from Pella (Rolscreen Co.) is Free.

116. 1972 PM INDEX AND SHELF WRAPPER

Find that special PM article you've been looking for fast. The new 1972 PM Index has references and cross-references on all the thousands of items that have appeared through the year. Order now. \$1.49.

117. DICTIONARY OF METAL WORKING TERMS

What can you say about metal working . . . ? It's all here in this comprehensive guide by Gerald Cowell that covers any and all terms from drafting to heat treating. \$3.95.

118. MAKE YOUR HANDS MORE CREATIVE

This book from X-acto Inc. teaches the many uses of X-acto knives and tools and also illustrates interesting hobby projects that everyone can enjoy. 35¢.

119. TWO CATALOGS IN ONE!

This catalog from Birchwood Casey offers tips on wood and metal care plus many unique ideas. A must for all do-it-yourselfers. Free.

120. BATHROOMS CAN BE BEAUTIFUL

Learn how to decorate your bathroom with this booklet from Borg-Warner. Contains 25 plans and innumerable suggestions to help the homeowner be his own interior designer. 50¢.

121. QUITE A BIT ABOUT BITS

Irwin Auger Bit's "How to Select, Use and Care for Wood Bits" tells all there is to know. Recommended and Free.

122. LEARNING TO ARC WELD AT HOME . . .

Can be easy using the simple approach designed for non-professional or occasional weldors that is contained in this 16-page *Weldor's Guide* from the Lincoln Electric Company. Free.

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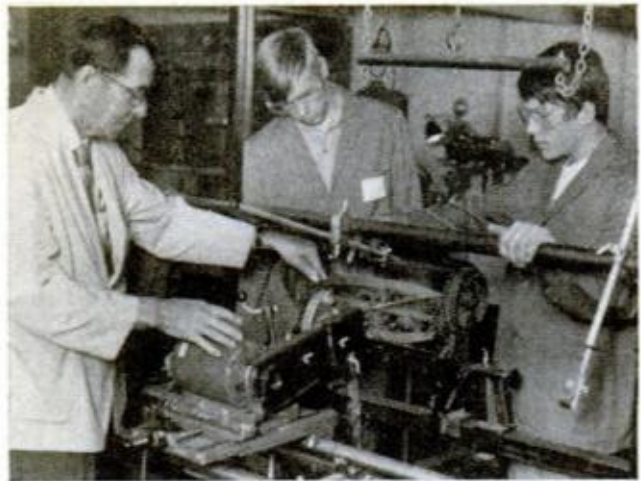
purchase their equipment from Foley. Then they attend the school, set up so a novice can become proficient at his new trade in the least possible time. According to instructor Jerry Henricks, a great percentage of them do. He estimates that the average student who "isn't afraid to hustle a little" can add \$100 or more a week to his income in his spare time.

The five-day crash course costs \$195. For that price, each student gets meals and lodging during his stay in Minneapolis, plus daily transportation between his motel and the school.

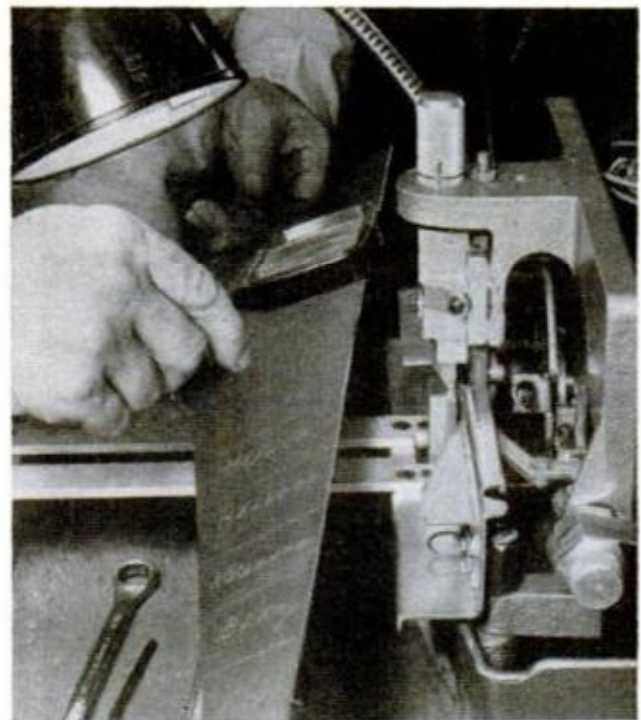
Monday's session starts with an outline of course objectives, discussion on saw filing and instructor demonstrations of setters and filers; then students practice on the machines discussed during the day. On Tuesday, it's the lowdown on grinders and grinder techniques; Wednesday, general carbide sharpening is covered. Thursday morning is spent on lawnmower sharpening techniques and the afternoon is devoted to good business practices, advertising and how to get business. The week is reviewed Friday morning, and during a special lunch session, students receive their diplomas. After a VIP tour of the Foley plant on Friday afternoon, the class heads home.

Besides Hussey and Henricks, the team that has been turning out 10 to 12 students a week for three years consists of Andy Peterson and Duane "Mac" McConnell.

For more information about sharpening equipment and/or the school, write to Director Joe Hussey, Foley Saw and Tool Maintenance School, 3300 Fifth St. N. E., Minneapolis, Minn. 55418. ★ ★ ★



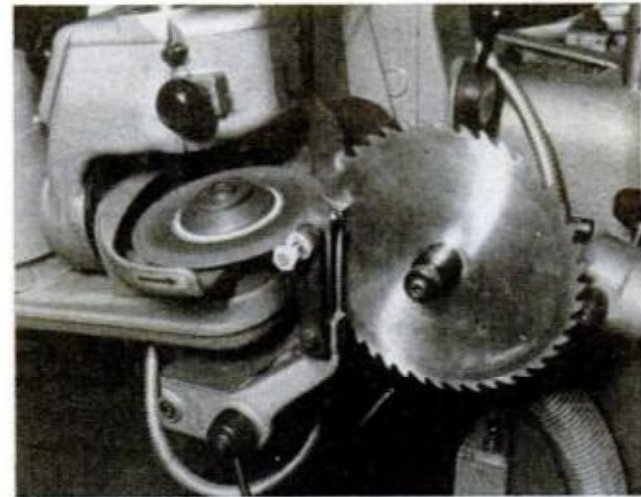
ON FOURTH DAY, students get thorough instruction in rotary-mower and reel-mower sharpening techniques



EACH STUDENT is assigned small section of handsaw to set. Then instructor inspects, criticizes, grades



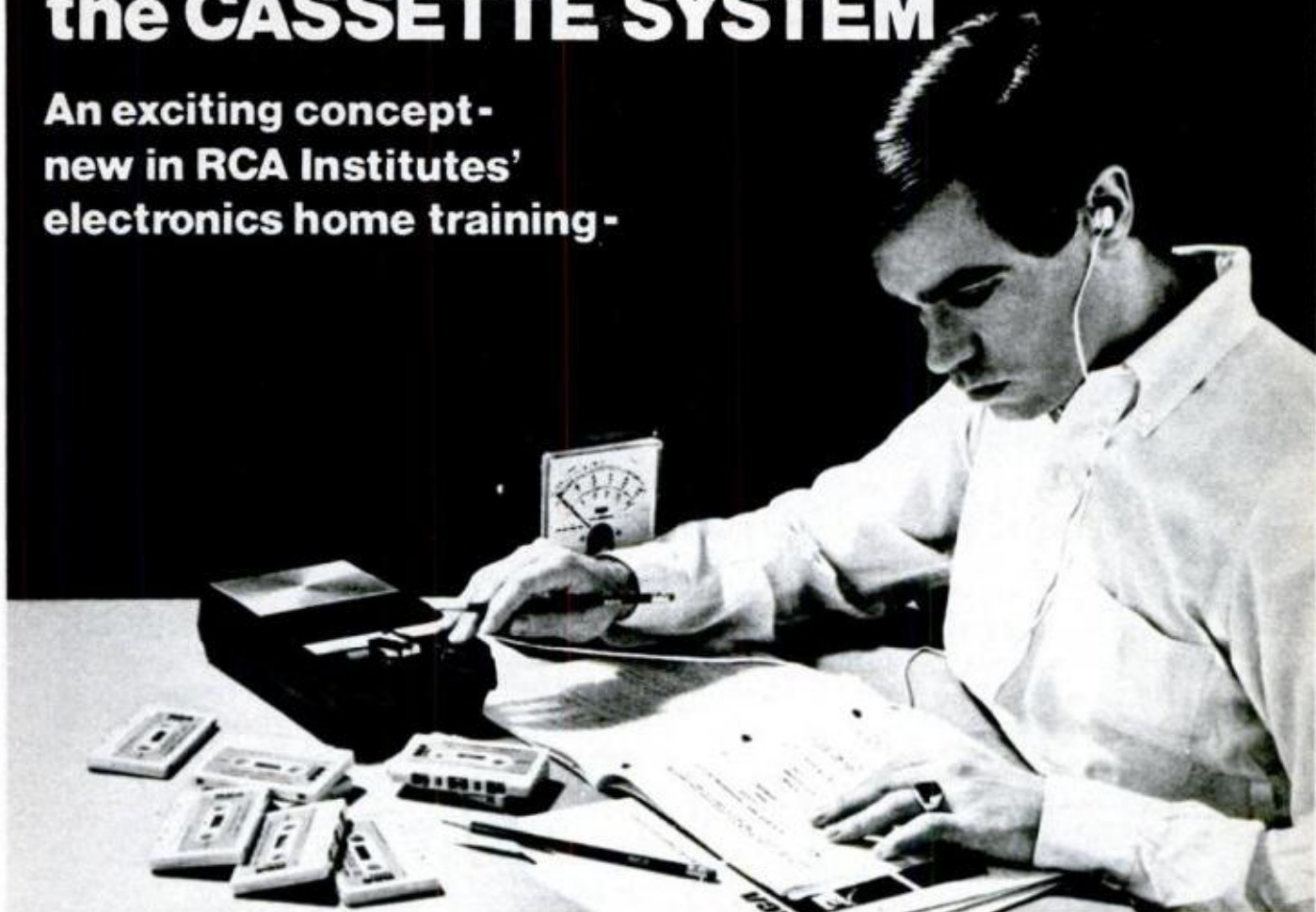
GRINDER WHEEL on saw chain grinder is set with angle to assure definite hook when the chain is ground



RIP SAW is ground with face of teeth straight with a 30° hook. Other blades require different settings

RCA Institutes introduces the CASSETTE SYSTEM

An exciting concept -
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It's almost like having an instructor in your own home.

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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Snow blows in attic louvers

Last winter snow blew through our attic louvers dampening, but not ruining, plaster in the room below. I'm told to close the louvers in winter, also not to close them. What do I do?—Ralph Larsen, Rochester, Minn.

There's a difference of opinion. I favor leaving the louvers open, principally because ventilation tends to keep frost from forming in the attic. This is fairly common, especially in ranch-type houses having low-pitched roofs. You can close the louvers against snow by stretching a burlap cloth over the screen on the inside, tacking the cloth in place. Since this does reduce air circulation I'd suggest that you watch that frost does not form anywhere in the attic. If it does, open louvers to allow free air circulation.

Table leaf warps seasonally

I have a rather old drop-leaf table. One leaf warps slightly, but straightens in winter when the heat's on. It appears to be a replacement. How can I prevent it from warping?—F.M. Wales, Philadelphia.

If the leaf is a replacement, it may stabilize in time. Thus, I'd let well enough alone for a time. But if it remains warped, you can usually correct this by cutting several 3/4-in.-wide dadoes crosswise on the underside to a depth about half the thickness of the wood. Space dadoes about 10 in. apart and don't extend them all the way across if the edges are decorative. Fasten strips of the same stock in the grooves, using glue and screws.

Preventing 'bubbles' in varnish

Recently I varnished a tabletop and ended up with what appear to be tiny bubbles on the surface. Steel-wooling doesn't take out the imperfections. What did I do wrong?—H. Stanley, Los Angeles.

If the top is of hardwood, did you remember to apply a filler before staining and varnishing? Possibly you stirred the varnish or shook the can before application. Though some modern clear finishes

do require stirring or agitating, varnish doesn't. Or, the bubbles could be particles of dust which were on the surface or in the brush at time of application.

Always clean a brush with compatible solvent and wipe the surface to be finished before you apply any finish.

Brass changes color

The brass weights and pendulum in my grandfather clock are changing color. It's not a very old clock—what can I do to restore the original bright brass?—B. Hanscom, Atlanta.

There is such a thing as "old brass" but it's more likely a special lacquer coating on the brass is changing color—rather than the metal itself. The lacquer tends to darken slowly with age—I wouldn't remove it as it protects the metal. If the metal is turning color, use a commercial cleaner intended for brass.

Making throw rugs nonslip

I have several rugs that slip on my hardwood floors. Is there a way to slip-proof these rugs—before somebody breaks bones in my home?—Mrs. J.B. Shell, Fresno, Calif.

There is a liquid-rubber backing that can be applied to nearly all types of fabric rugs. It comes in a container that also acts as a spreader. Or, you might try double-faced tape designed for this use. Most hardware and department stores stock both items.

Paint over wallpaper?

What type of paint should I apply over wallpaper?—Mrs. Jack Loomis, Detroit, Mich.

Think of the job of getting the paper off after you paint it—even one coat! I never suggest this procedure. In rare instances there may be a good reason for painting over paper; otherwise, no! Why not remove the old paper, even if it is several layers thick, and begin anew with the attractive and easily applied interior paints that are now available? You'll be pleased in the end. ★★★

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. While letters cannot be answered individually, problems of wide interest will be discussed in this column.

Get away from hot taste.
Come up to KOOL, with pure menthol,
for the taste of extra coolness.



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Milds 14 mg. "tar," 1.0 mg. nicotine av. per cigarette,
by FTC method. Kings 18 mg. "tar," 1.5 mg. nicotine;
Longs 18 mg. "tar," 1.4 mg. nicotine
av. per cigarette, FTC Report Aug. 72.

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



14 mg. tar,
1.0 mg. nicotine
Now, lowered tar KOOL Milds



I'd like to give this to my fellow men... while I am still able to help!

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

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

By Victor B. Mason

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

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

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

I Have All The Money I Need

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

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

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

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

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

VICTOR B. MASON
1512 Jarvis Ave., Suite M-2-CA
CHICAGO, ILLINOIS 60626



\$300 pool table for \$107

By JOHN CAPOTOSTO
Technical art by Fred L. Wolff

A POOL TABLE is an expensive item to buy, but if you are good at making things, you can save almost \$200 by building this beauty. I spent about \$107 to build it, and that includes everything—even balls and cues. Such hard-to-get items as billiard cloth, cushion rubber and foam padding come in a kit (a source for which is given at the end of the article).

The table features a sturdy pedestal base, plastic-laminated aprons, drop pockets which simplify the construction, and padded rails—an extra usually found only on the more expensive tables.

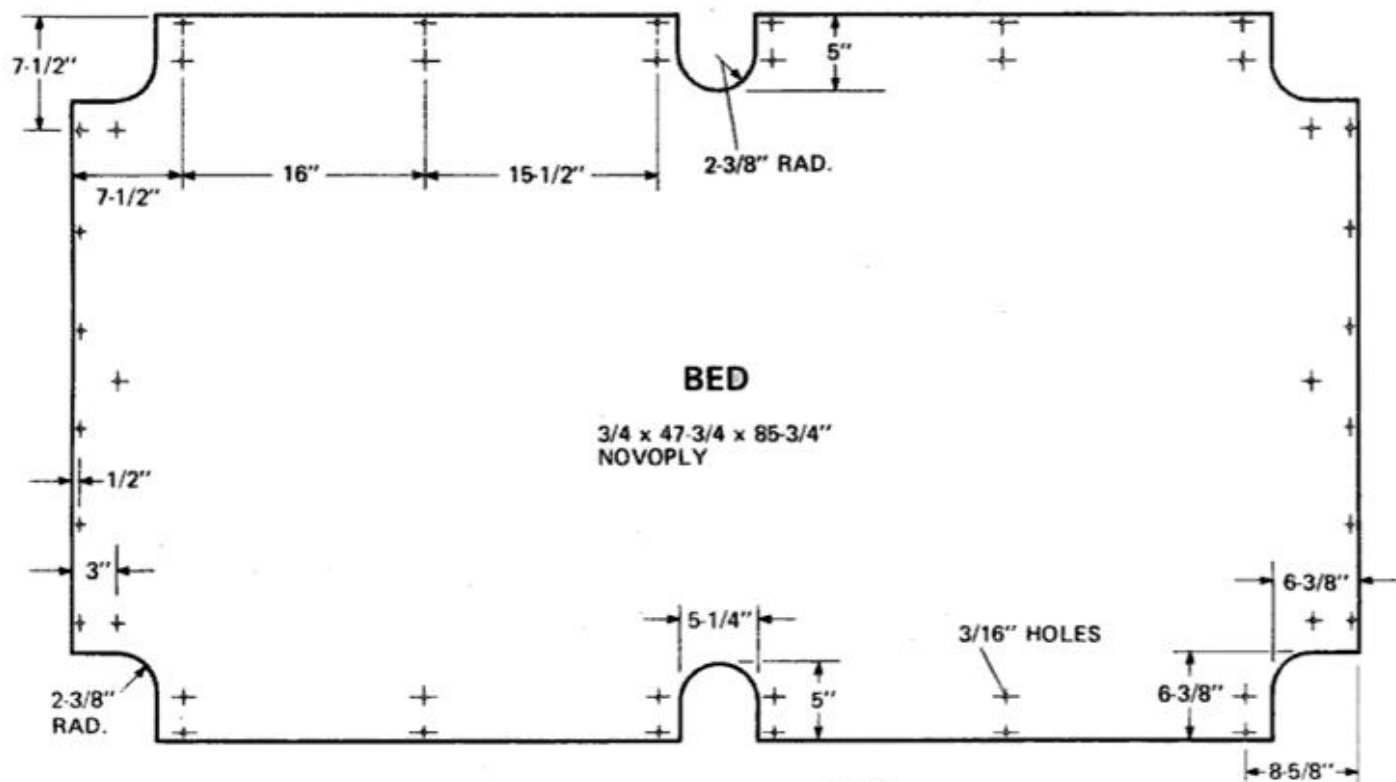
The table is standard size (3½ x 7 ft.) and uses 2¼-in. balls.

● **Base.** All materials used in the table

are readily available. Except where noted, ¾-in. plywood is used. Even the pedestal legs and base are made of plywood, using box-type construction which adds much to rigidity and sturdiness. Leg uprights are rabbeted to minimize edge grain, and base sections are butt-joined.

To insure accuracy and to simplify assembly, the uprights should be temporarily mounted to the pedestal *before* the scallop at the bottom of the pedestal is cut. Mount the uprights individually before they are "boxed." You will note in the material list that extra length has been allowed for this reason.

Miter the uprights at 76° top and bottom, then at the center of the pedestal



mark two lines $8\frac{15}{16}$ in. apart. Align the uprights on these marks, keeping the bottom even with the bottom edge of the pedestal. Tack the pieces in place with $\frac{1}{4}$ -in. brads, then drill pilot holes for the screws. Use four screws in each upright. Once located, you can remove the uprights and cut the scallop in the pedestal and recut the bottoms of the uprights to match the scallop. Uprights now may be permanently glued. The leg filler pieces are rabbeted, leaving $\frac{1}{8}$ in. of stock as indicated. These are glued just short of the top and extend slightly into the base.

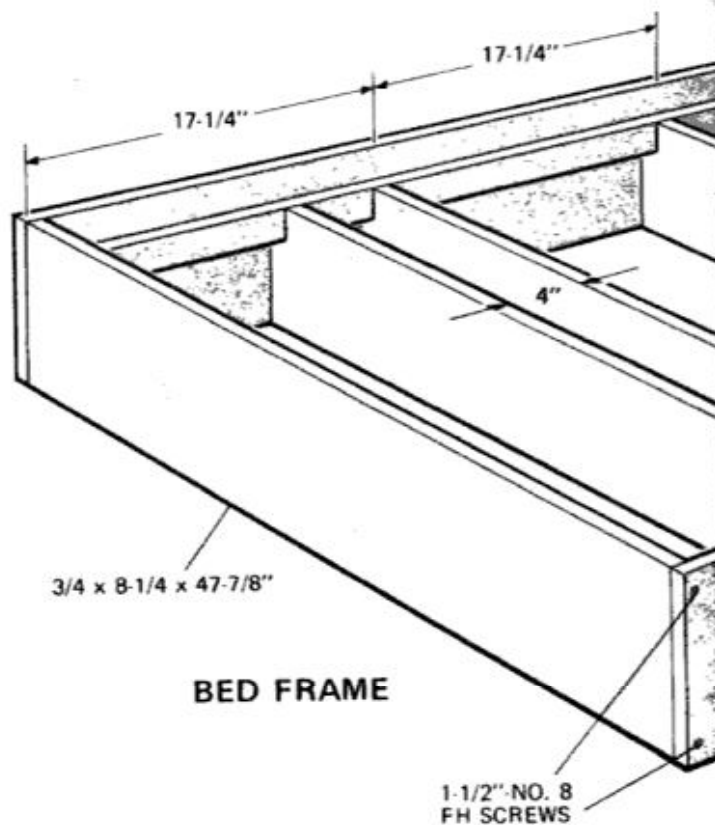
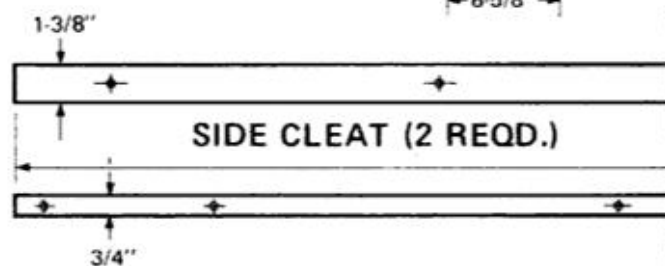
Note: When gluing edge-grain stock, glue-size the edges. Apply thinned glue (thin with water if white glue) to edges and allow to dry before regular application of glue. This seals the edge, preventing excessive absorption of glue which would cause a weak joint.

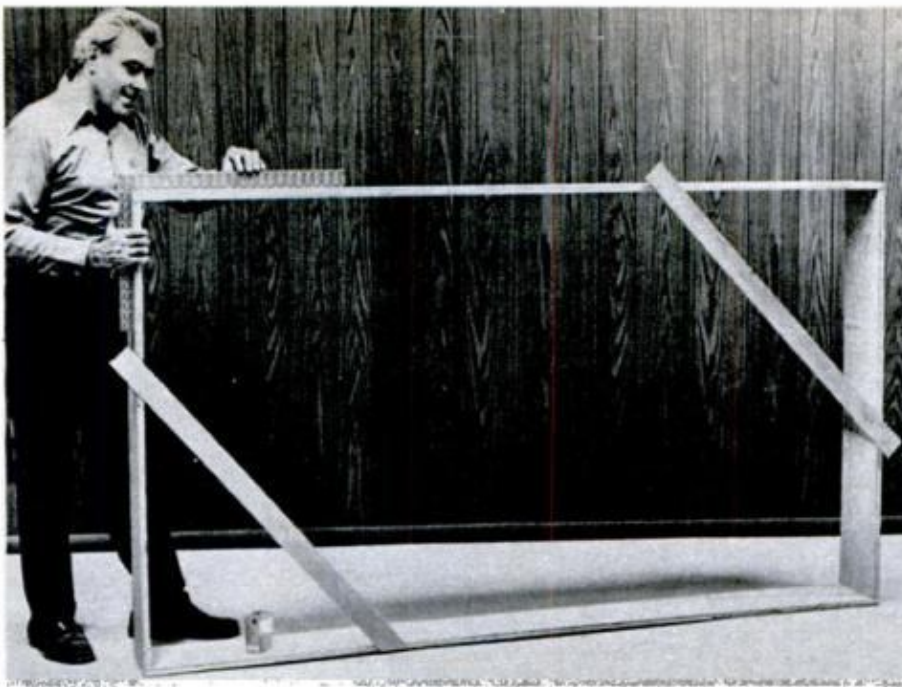
Before installing the base pads to the scallops, drill a $\frac{1}{2}$ -in. hole at the center of each and insert a T-nut. These are for the leveling jacks. The flange of the nut must be to the outside when the pad is mounted.

When the pedestals are completed, add two furring strips to the upper ends; these will help support the table and simplify mounting the pedestal later.

The stretcher can be made now and the two pedestals connected to it. Lagscrews are driven from the inside to join the

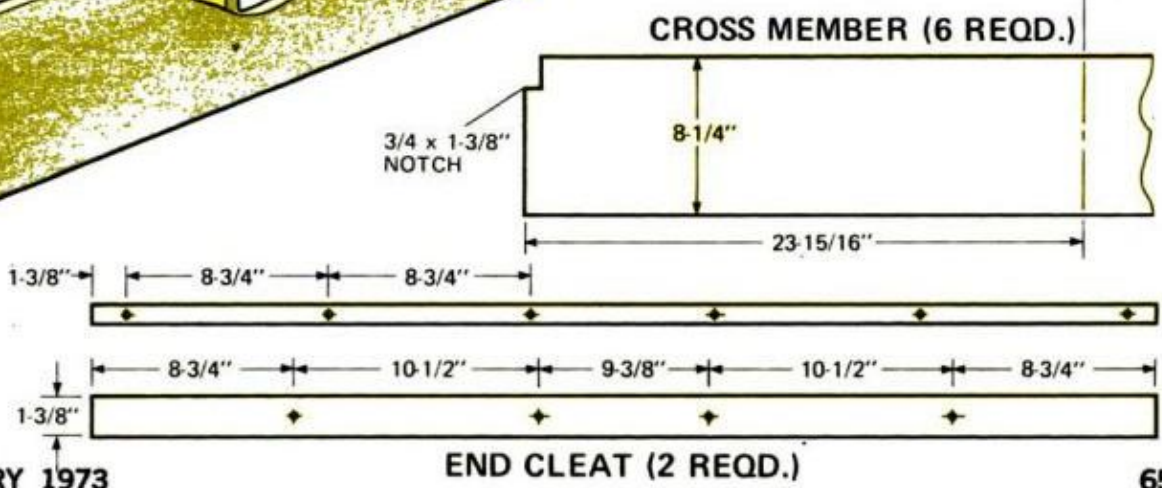
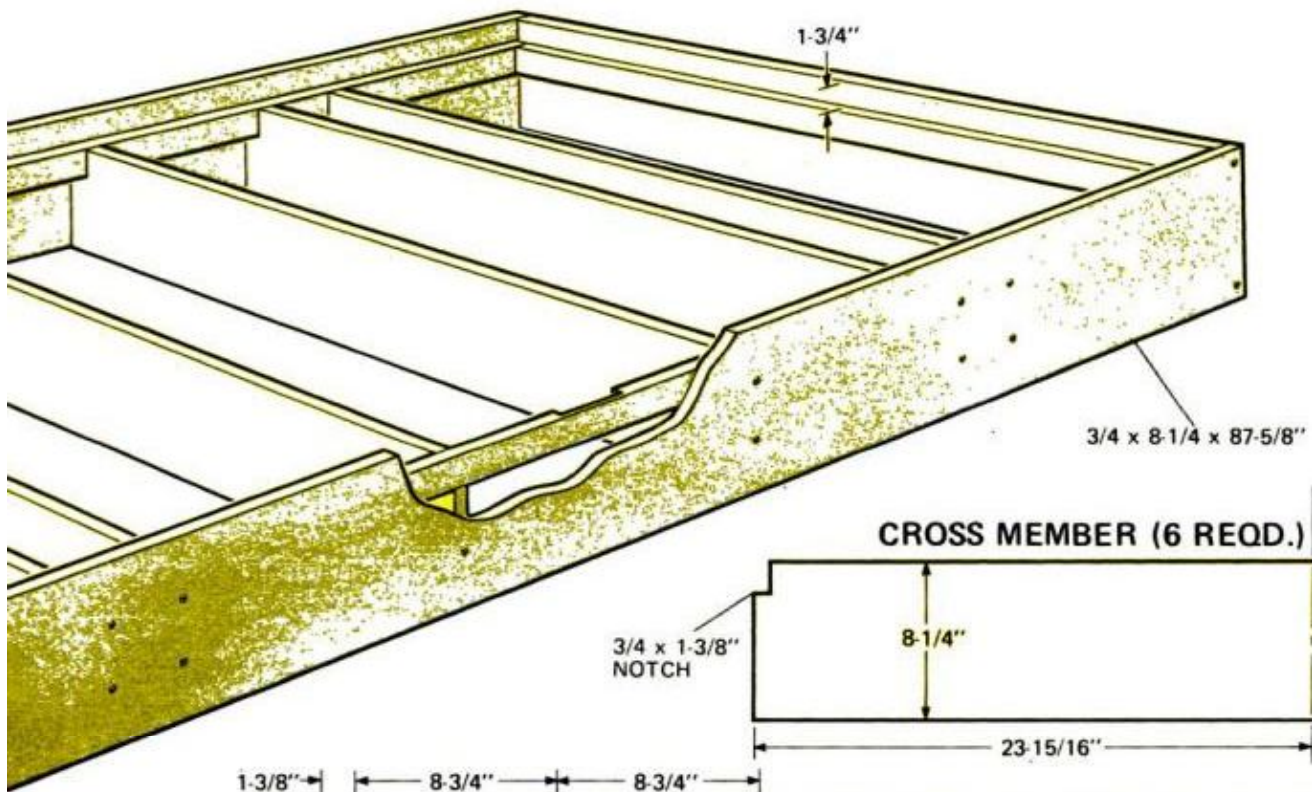
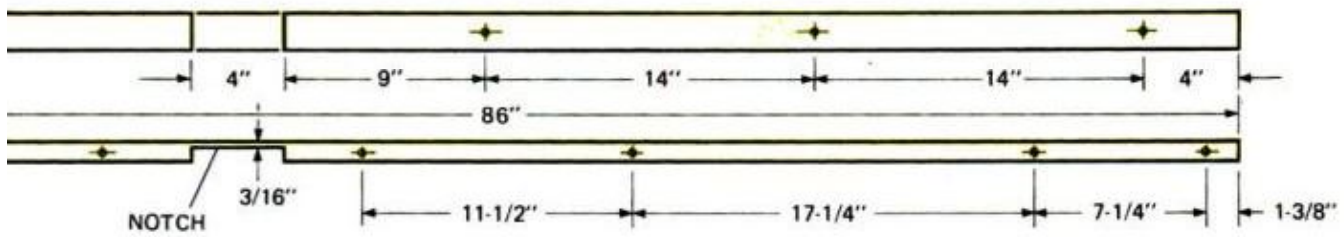
(Please turn to page 176)





APRON ASSEMBLY is squared up with temporary diagonal braces of scrap placed across two corners

SCREWDRIVER BIT in a variable-speed drill makes quick work of driving home the many screws needed



How to fix your automatic

A MALFUNCTION in your automatic washer usually affects a basic function: fill, wash (agitation), drain or spin.

The troubleshooting charts on these four pages will help you pinpoint a problem and correct it. To determine what the common components look like and their location, re-

fer to the illustration below. It's a composite that's typical of most machines.

When testing electrical components, consult your machine's wiring diagram, which is glued on the back of, or inside, the machine. The chart on page 69 will help you interpret the electrical symbols.

COMMON WASHER COMPONENTS

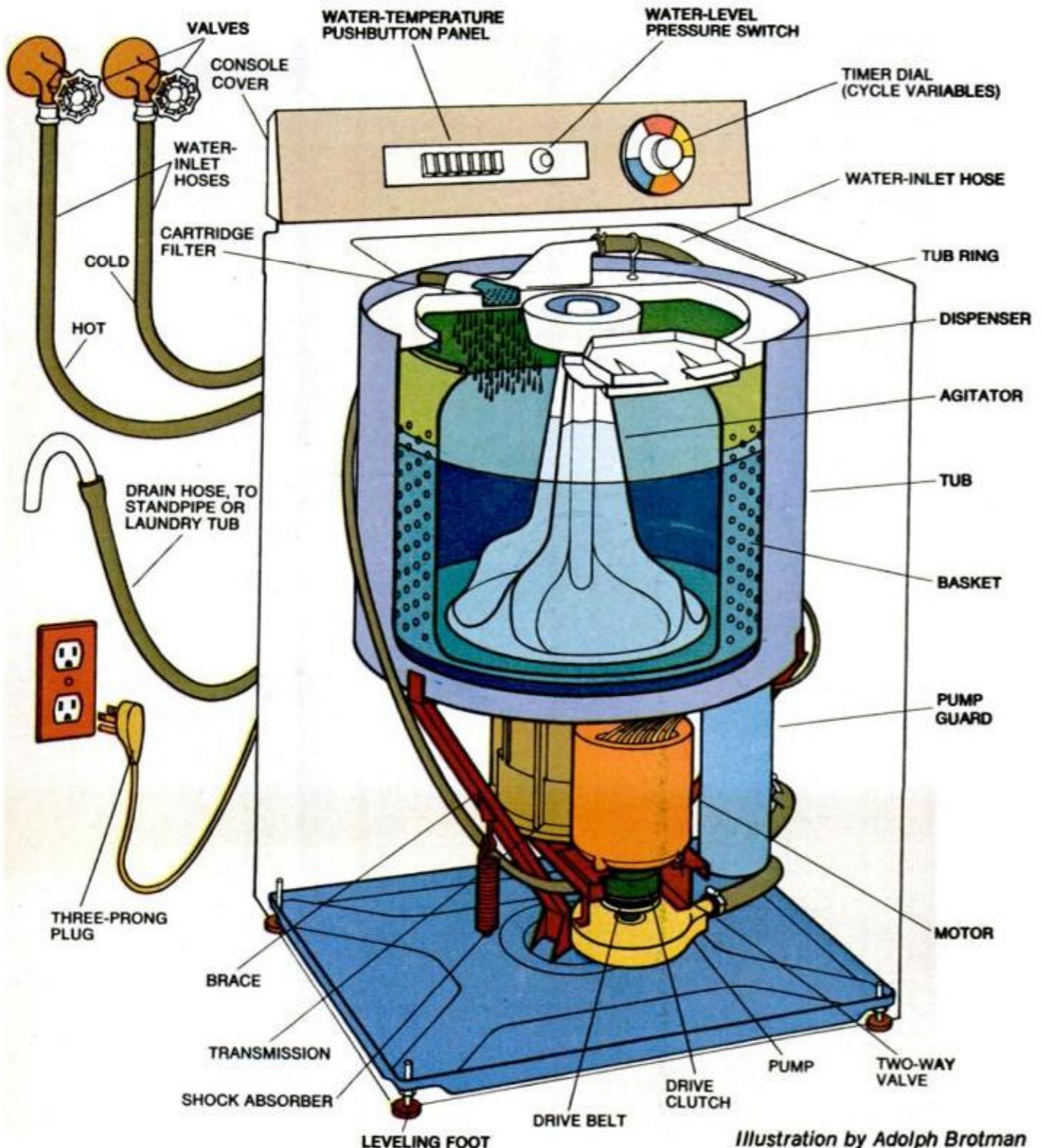


Illustration by Adolph Brotman

POPULAR MECHANICS

washer

To test the timer, turn the control knob slowly from the 'Off' position before the regular cycle to the spot in the cycle where the machine isn't working properly as you count the number of increments (clicks). Count the corresponding increments on the timer cam chart and determine which

terminals should be closed. Timer contact terminals are marked on the timer and timer cam chart by a letter or numerical code. Connect a 115-v. test light to the terminals and turn on the machine. If the test light fails to light, the timer is faulty in that model and should be replaced. ***

Washer doesn't fill

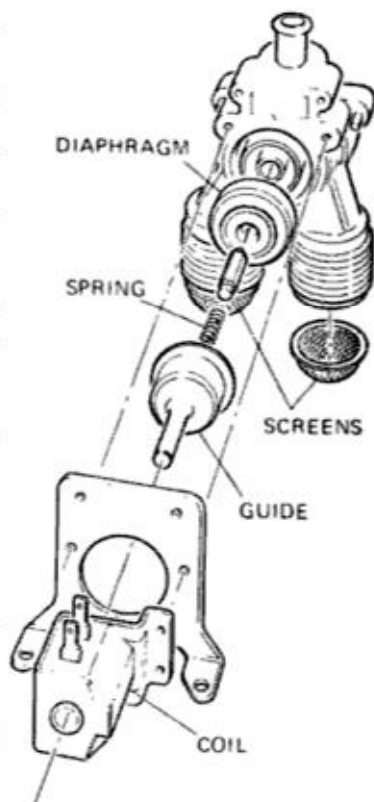
CAUSE	ACTION TO TAKE*
1. Water faucet(s) closed.	Open faucet(s).
2. Water inlet hoses kinked.	Straighten hoses.
3. Clogged water valve screens.	Remove screens and flush out sediment.
4. Damaged water valve solenoid.	Remove leads and connect a 115-v. test light across terminals, turn on electricity and move control knob to "Fill." No light signifies a bad solenoid. Replace.
5. Defective timer.	Test as described in text above.
6. Defective water temperature switch.	Remove leads and connect a 115-v. test light across terminals, turn on electricity and move control knob to "Fill." No light signifies a bad solenoid. Replace.
7. Defective water-level pressure switch.	The switch normally has three terminals. With switch in "Fill" position there is contact between two of the terminals with the third terminal "open." Make sure you connect a 115-v. test light across the terminals affecting "Fill." Consult the wiring diagram. Turn on electricity and move control knob to "Fill." No light signifies a bad solenoid. Replace.
8. Water valve internal malfunction.	Disassemble water valve and check each part for damage, paying particular attention to the guide assembly and diaphragm. Replace the bad part, if possible. If not, replace the whole valve.
9. Open circuit.	Using the wiring diagram as a guide, probe each wire connection with a 115-v. test light to determine if defective wiring or a loose connection is causing the problem. Be sure control knob is at "Fill" position.

*After taking each "action," reconnect power and test operation, but be sure to pull plug from wall receptacle before continuing.

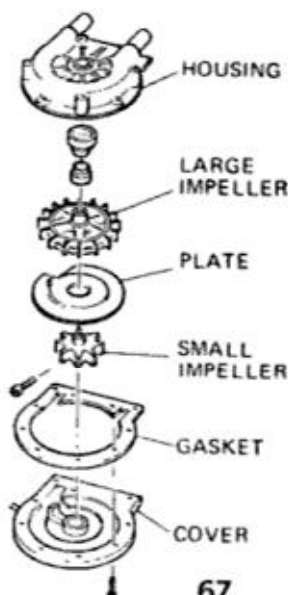
Washer doesn't drain

CAUSE	ACTION TO TAKE
1. Kinked drain hose; clogged drain.	Straighten hose; clear drain.
2. Broken or slipping drive belt.	Replace or tighten.
3. Defective pump.	Usually pump is clogged or impeller goes bad. Pump may be taken apart for cleaning or replacement of defective parts, or it may be replaced as a unit.
4. Defective timer and open circuit.	If the motor doesn't kick into "Drain," test timer as described in text above. Also check for open circuit. Be sure the control knob is set to "Drain" position.

Water valve



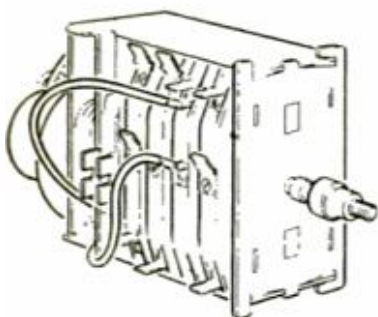
Water pump



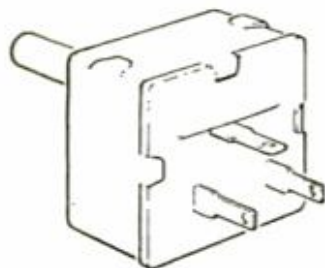
Washer doesn't agitate (wash)

CAUSE	ACTION TO TAKE*
1. Broken or slipping drive belt.	Replace or tighten.
2. Defective drive clutch.	Remove the drive belt and turn the clutch by hand with the control knob in the "Wash" (agitate) position. If there is no "grab," the clutch is defective and should be replaced.
3. Defective transmission.	With the drive belt off, manually rotate the transmission pulley in agitate direction (usually clockwise) with control knob in "Wash" (agitate) position. If this doesn't drive the agitator, the problem is in the transmission.
4. Defective timer.	Test as described in text (pages 66 to 67).
5. Faulty water-level pressure.	When water has filled the tub, contact reverts to the third terminal of this switch and to one of the other two terminals. The remaining terminal reverts to "Open" position. Make sure to connect a 115-v. test light across the terminals affecting "Filled." Consult the wiring diagram. Turn on the electricity and move the control knob to "Wash." No light signifies that you have a bad switch.
6. Open circuit.	Using the wiring diagram as a guide, probe each wire connection with a 115-v. test light to determine if either defective wiring or a loose connection is causing the problem. Make certain that the control knob is set at the "Wash" position.

*After taking each "action," reconnect power and test operation, but be sure to pull plug from wall receptacle before continuing.



Timer



Water-temperature switch

Washer doesn't spin or spins slowly

CAUSE	ACTION TO TAKE
1. Broken or slipping drive belt.	Replace or tighten.
2. Loose motor pulley.	Tighten pulley.
3. Defective drive clutch.	Test as described under "Washer doesn't agitate," Cause 2 (above); be sure control knob is in "Spin" position.
4. Spin brake doesn't release or transmission is frozen.	The brake is not part of the transmission, but since they are attached and work together, they are checked as a unit. Set control knob in "Spin" position and remove drive belt. Turn brake stator; it should move freely. If not, the brake assembly or transmission is defective. Both units can be repaired.
5. Defective timer or open circuit.	If motor doesn't kick into "Spin," test timer as in text (pages 66-67). Also check for open circuit. Be sure the control knob is set to the "Spin" position.



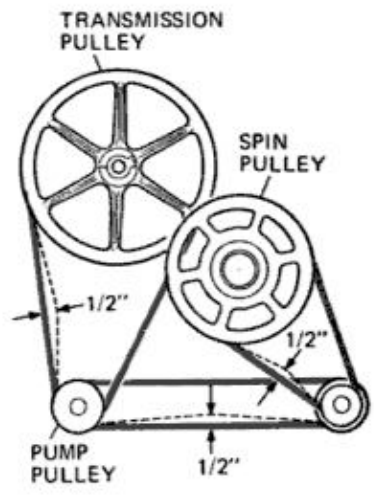
Water-level pressure switch

Abide by the following precautions:

- Be sure that electricity is turned off before handling components.
- Turn off water when working on water-handling components, such as the water valve.
- Before replacing an electrical component you believe is faulty, make certain that a loose connection isn't causing the problem.
- After replacing an electrical component, tighten connections.
- Before reconnecting your electrical service, see to it that ground wires are tightly attached.
- Make sure that water connections are secure.
- Install replacement parts that meet factory specification. You can't go wrong using parts made by the manufacturer of the washer.

Motor doesn't run

CAUSE	ACTION TO TAKE*
1. Electrical service cord isn't plugged in; blown fuse or a tripped circuit breaker; possible malfunction in branch circuit.	Be sure that plug is connected and fuse or circuit breaker is okay. If there is no power at the wall receptacle, check the circuit.
2. Defective timer.	Test as described in text (pages 66-67).
3. Defective lid switch.	Many models have a switch in the lid which automatically turns the washer off if door is open during cycling. If the machine refuses to operate with the lid closed, connect a test light across the lid switch. No light indicates a faulty switch. Replace.
4. Defective motor.	<p>Most motors are protected by an internal overload circuit breaker that stops operation if the motor overheats. If this protective device halts motor operation, but the motor can be started again after about 30 minutes, consider the following conditions:</p> <p>(a) If the motor trips off when the machine goes into the spin cycle, the cause of trouble may be in the clutch, brake or transmission—not the motor. To find out, remove transmission drive belts and let the motor operate. If it doesn't trip off now, there is no motor problem.</p> <p>(b) If the motor operates in agitate position, but won't operate in spin position or vice versa, check timer and lid switch, and look for broken wire before condemning the motor.</p>
5. Open circuit.	This possibility always exists, so before you rip the motor out of the machine conduct continuity tests with your test light at each wire connection.



PROPER belt tension is reached when you can deflect it 1/2 in. Minimum belt tension after extended use should be 15 pounds. To check this, hook spring scale at mid-point and note what force is required to deflect the belt 1 in.

*After taking each "action," reconnect power and test operation, but be sure to pull plug from wall receptacle before continuing.

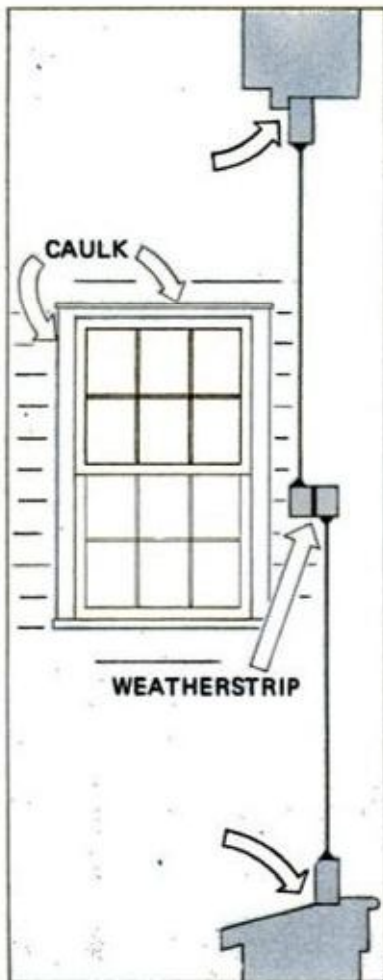
Symbols found in wiring diagrams

ITEM	OLD	NEW	ITEM	OLD	NEW	ITEM	OLD	NEW
Ballast			Terminal			Double-throw thermostat		
Adj. Thermostat			Timer motor			Internal conductor		
Thermocouple			Plug connector			Harness wire		
Neon light	None		Starter (automatic)			Permanent connection		
Transformer	None		Light (incandescent)			3-prong plug		
Thermistor	None		Pressure sw.			Timer sw.		
Transistor	None		Fluorescent			Automatic sw.		
Diode (rectifier)	None		Coil			Manual sw.		
Rectifier (controlled)	None		Capacitor			Double throw		
Coil and switches			Resistor			Crossover		
Motor, single speed			Centrifugal sw.			Heater (wattage shown)		
Motor, multispeed			Thermostat			Ground		

How to cut fuel bills

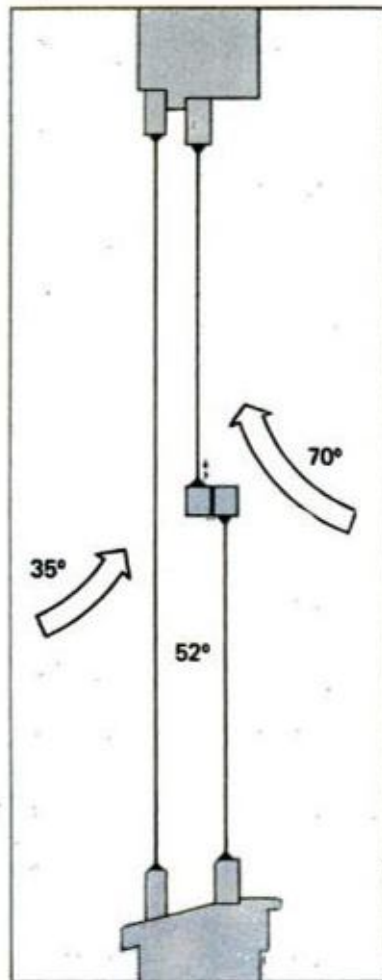
AS DEMAND for all types of energy rises, prices of bituminous coal, natural gas, fuel oil and electricity soar. According to the National Bureau of Standards, the federal government has instituted a program to cut back energy consumption in government buildings. Since conserving energy will also reduce environmental pollution as well as hold the price line, homeowners and industry are being urged to

follow suit and put the program to the test. Shown and described here are seven steps you can take to reduce energy consumption with little effort. Some of the methods you may already practice, while others might seem so obvious you'll wonder why you never thought of them before. All of the suggested steps will aid in the fight against environmental pollution and lower your heating costs.



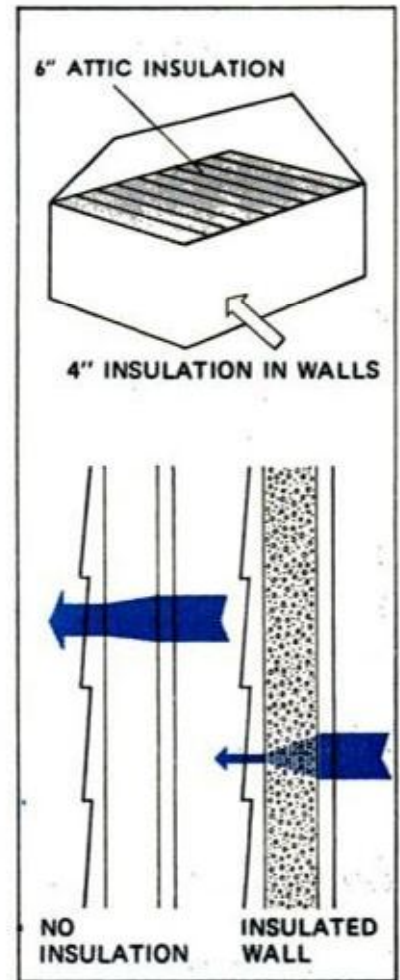
Eliminate window drafts

Next time you feel a cold draft from a door or window, think of it in dollars and cents. Warm-air leakage or cold-air infiltration can mean 15 to 30 percent of your heating bill is going "out the window." To stop drafts, install weatherstripping at meeting rails and other movable joints. Outside, apply caulk where windows meet siding.



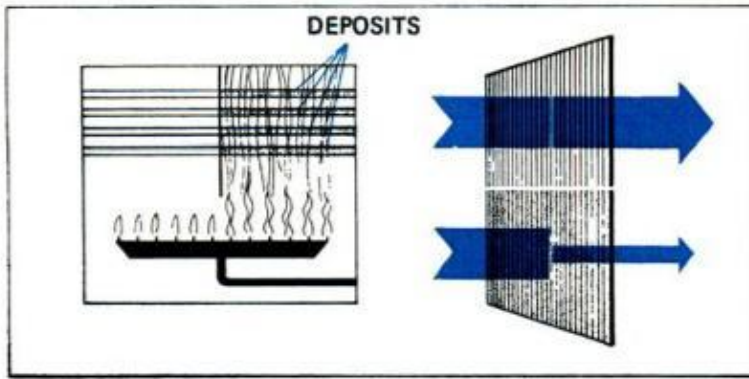
Install properly fitted storm windows

It's estimated storm windows will just about cut in half the amount of heat that is needlessly lost through the windows of a house. An investment in quality storm windows will pay for itself within 10 years (including 6 percent interest charges) and from then on, they pay a dividend of about 13 percent in fuel bill savings.



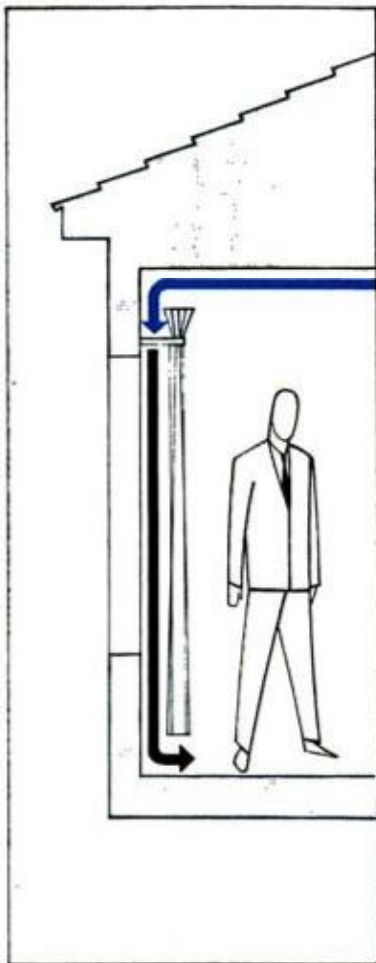
Insulate to cut down heat loss

At the least, an unused attic floor should have 6 in. of insulation between joists, whether you use batts or loose insulation. In an existing house, insulating sidewalls is tricky—and a job for a pro. Done improperly, without adequate venting, wall insulation could cause moisture problems on some buildings. For walls, use 4-in. material.



Maintain your heating plant's efficiency

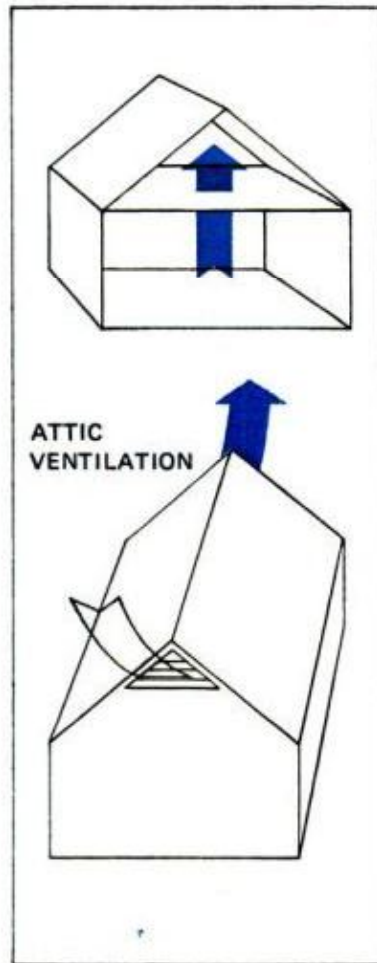
Operating efficiency of your heating plant is extremely important in relation to fuel consumption. Be sure that heat-exchange surfaces are cleaned regularly by an expert. If your plant has air filters, make it a habit to clean them frequently or replace them when they become loaded with dust and lint.



Close all draperies in the evening

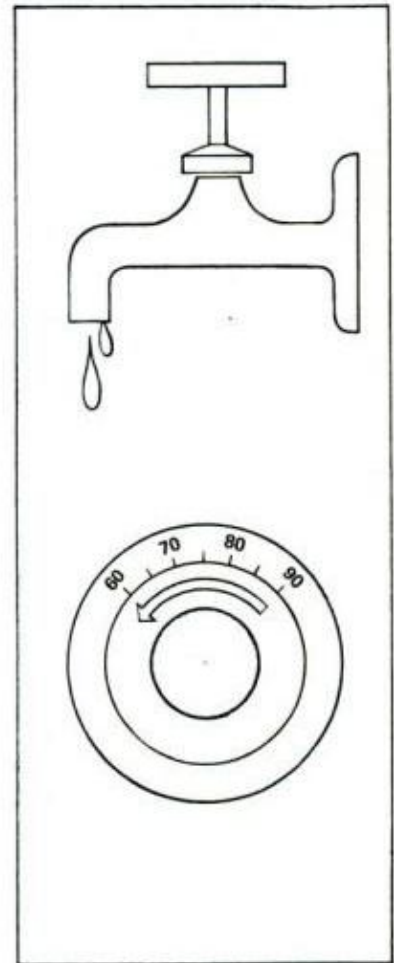
Though no substitute for storm windows or double glazing, draperies (if closed at night) will reduce radiative heat loss of people sitting near windows—enough to increase comfort appreciably. Most draperies, however, are not tightly fitted; thus, room air moves freely by convection in and out of space between window and drapery.

JANUARY 1973



Stop warm-air leaks, assure attic venting

Since warm air rises, all spaces through which it can pass into the attic should be sealed to minimize heat loss. Look for such heat-loss spaces around loose-fitting attic doors, drop-down attic stairways, fans and ductwork. To prevent chance of moisture condensation in or on insulation, keep all vents open in the attic and crawlspaces.



Check hot-water faucets, thermostat

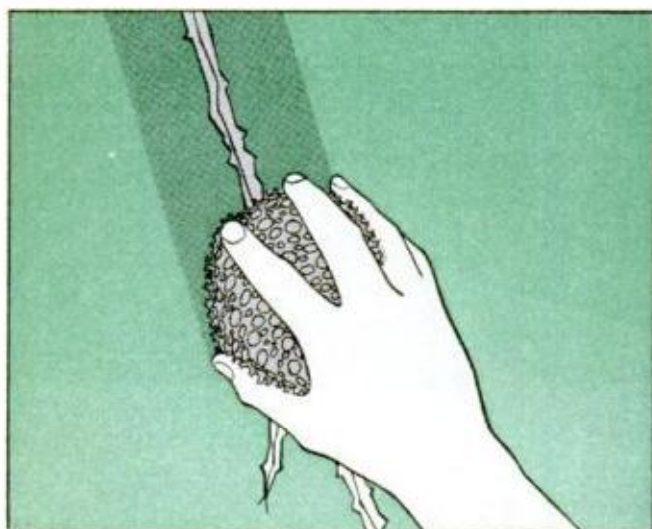
Repair dripping hot-water faucets—a drop per second means 650 gallons a year of water you've paid to heat. You'll also save if you lower the thermostat for eight hours each night: Fuel savings can be $\frac{3}{4}$ of 1 percent for each degree Fahrenheit the setting is lowered. Thus, a 4° reduction would save \$1.80 on a \$60 monthly fuel bill.

How to make cracks disappear

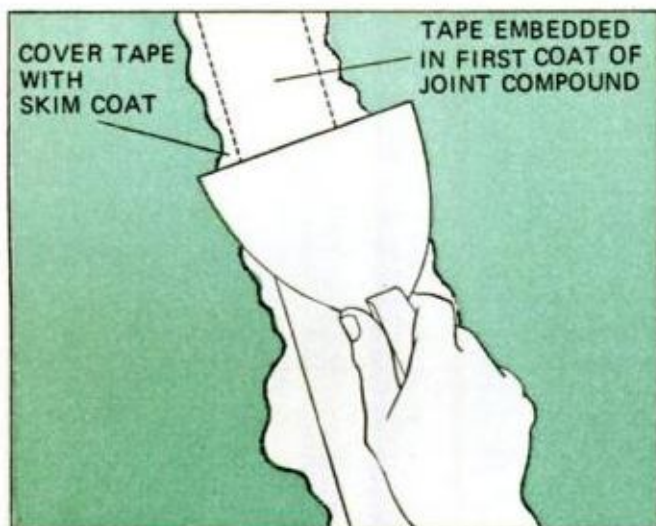
ANY PAINT JOB is only as good as the surface preparation that went into it. In most cases—on inside paint jobs—this is not much more than a thorough surface cleaning before applying paint. But as a new home settles with age, cracks are sure to appear on the walls, especially if they're plaster. And cracks can show up in plasterboard walls too.



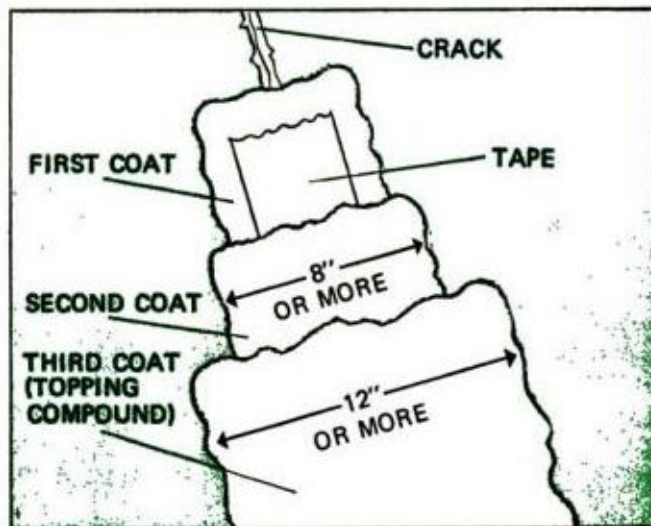
1 First patching step is to clean out the entire crack, making certain no loose particles remain. (Patching compound must be applied to a solid surface to be permanent.) Paint stores sell tools for gouging out cracks, but a punch-type can opener does the same job. If you're repairing plasterboard, you may have to cut away some paper on the surface. Dust off the crack with a dry brush.



2 Soak a large sponge in water and squeeze out the excess. Then thoroughly dampen the surface to which the joint compound will be applied. The idea is to slow down moisture absorption and thus achieve a better bond between new material and old. To keep floor or carpeting underfoot free of damage during repairs, spread layers of newspaper to catch the scrapings, water and compound.

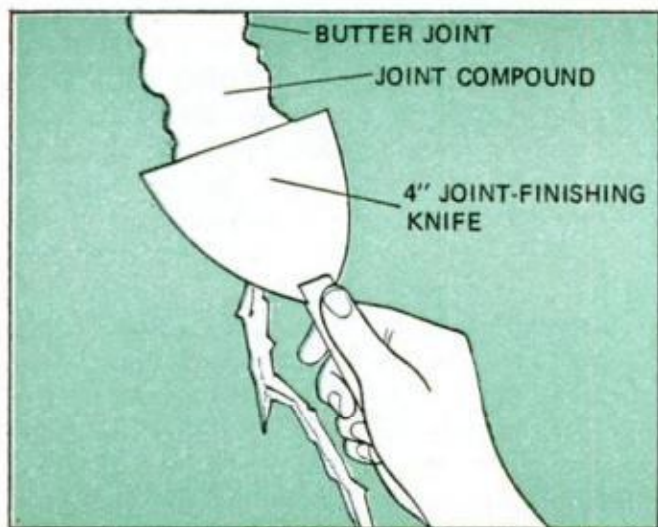


3 When entire crack has been covered with tape, take your wallboard knife and firmly press the tape into the bedding compound with the knife held at 45° angle. You'll know that pressure is correct if you squeeze out some compound from under the tape—but enough must be left for a good bond. When it's dry, if air pockets (bubbles) have formed under tape, cut them out with a sharp razor blade.

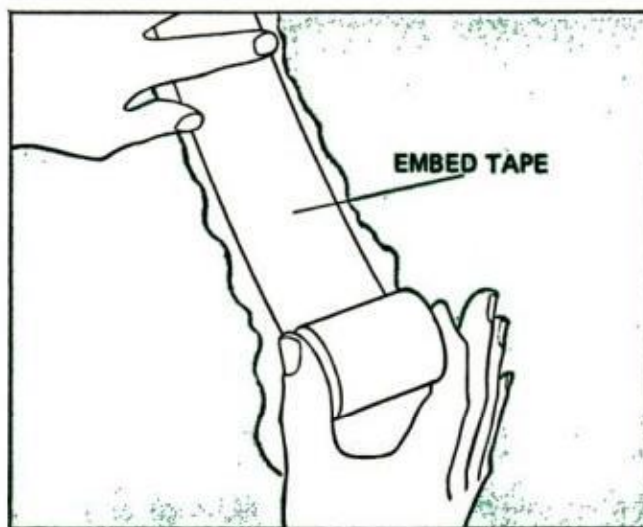


4 A minimum of three coats is recommended for all patches—embedding coat and two coats over tape. Last coat can be topping compound; it's extra smooth. Successive coats are progressively wider, allow each to dry thoroughly before applying the next. Check between coats and sand off any high spots. If patching plasterboard, don't oversand adjacent paper surfaces.

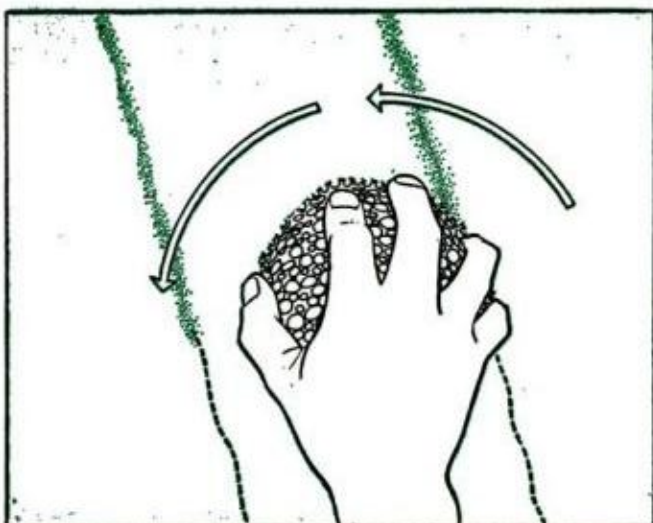
Regardless of how they got there in the first place, the chore is to eliminate them for good before you dip your brush or roller in the paint. As you'll see on these pages, you can. Some of the tricks have been around awhile; others are those used by professionals. Now, you can add them to your bag. ★★★



3 While gouged surface is still moist, apply the joint compound, forcing it into the cracks. You can use a dry compound that requires mixing with water, but to save time, a premixed compound is recommended. It comes in quart, gallon and 5-gallon sizes and, if kept covered and protected from freezing, lasts indefinitely. After buttering the cracks with compound, smooth off the surface.



4 Apply wallboard tape to the buttered crack. Using your fingers, loosely press the tape in place. Basically, there are three types of tape you can use: heavy paper (one with perforations and one without) and a gauzelike material that is available at many paint stores. All do the job, but if you are patching plaster, gauze is the best. If desired, paper tape can be moistened slightly before use.

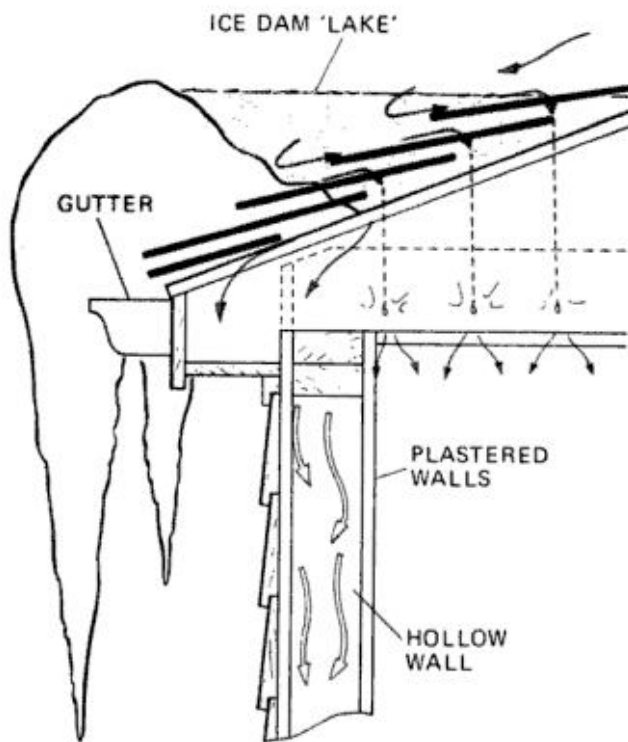


7 When dry—at least 24 hours after applying a topping coat—the surface can be sanded to feather into adjacent surfaces. One good way is to “sand” with a damp sponge. Since the joint compound is water soluble, don’t get the sponge too wet and don’t rub continuously in one spot. This prevents your breathing fine sandpaper dust and eliminates most dusting and cleanup afterward.



8 After patched area has been sanded, compound and the wall surface should be primed with a suitable sealer (vinyl or oil base primer/sealer, or shellac) to equalize (paint) absorption difference between existing wall and joint compound in old crack. You should now have a uniform surface texture ready for final decoration following the paint maker's instructions.

How to prevent roof ice dams



HOW ICE DAM CAUSES LEAKS

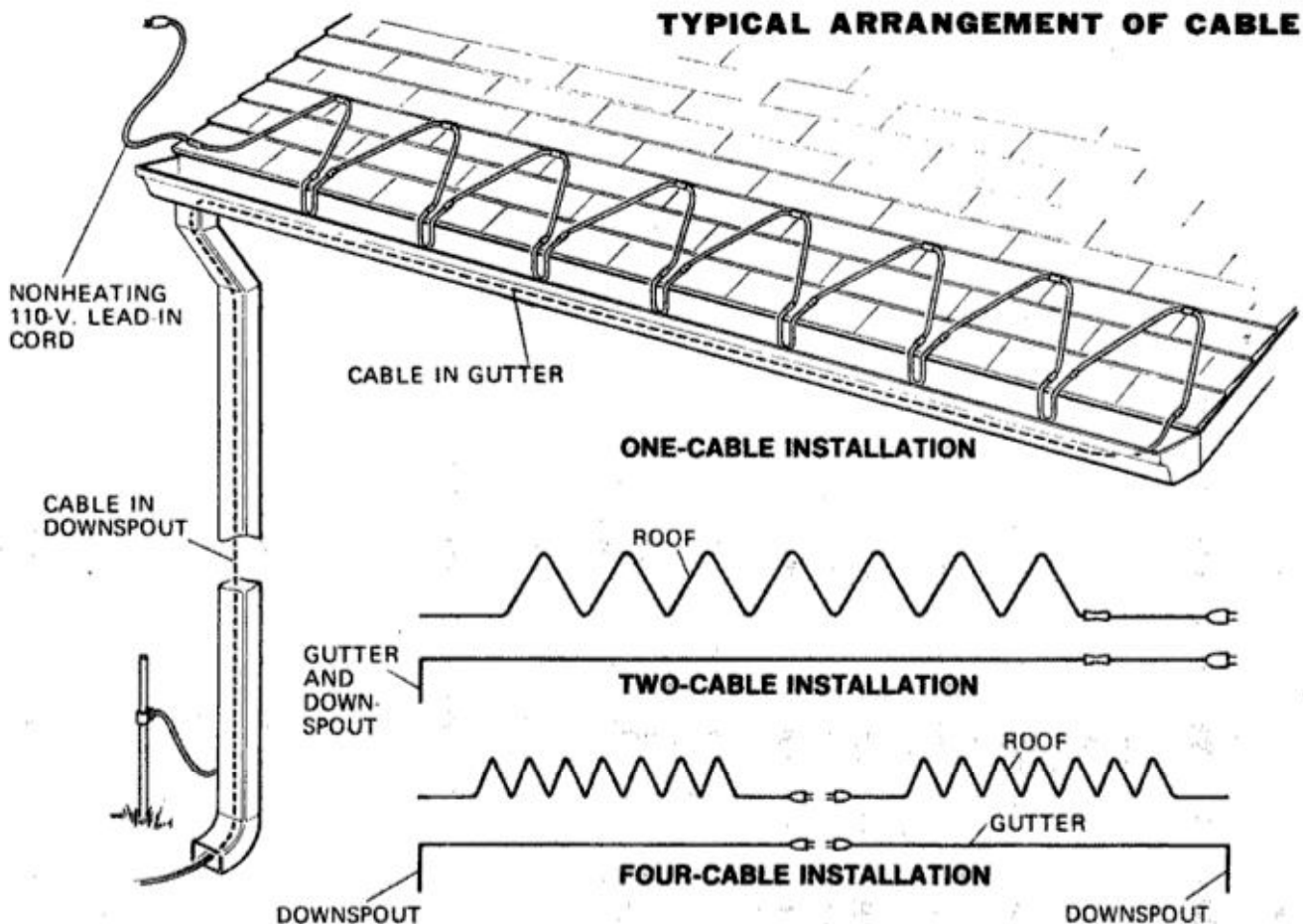
DRIFTING SNOW on a roof makes a pretty picture but it can wind up as water inside your home. How is this possible? Unless removed, mounds of snow along the roof gutters will alternately thaw and freeze over a period of sunny days and cold nights, resulting in the formation of a dam of ice and a pool of water. With gutters clogged with ice, melted snow trickling down the roof forms a puddle. With no other place to go, the water starts to back up between the shingles, leak into the attic and finally drip through the ceiling.

Once started, an ice dam builds up rapidly and the water often will flow over the dam to form huge icicles.

Low-pitch roofs are more prone to ice dams than steep roofs, and homes with roofs having little or no overhang are subject to greater interior leakage. But if weather conditions are right, ice-clogged gutters can be a problem on all roofs.

The simplest solution would be to clear

TYPICAL ARRANGEMENT OF CABLE



snow accumulations from the roof as they form, but no one in his right mind is going to get up on a slippery roof in winter. The safest and most practical solution is to install electric heating cables. They produce just enough heat to prevent ice from forming and can be turned off when not needed. Some are controlled by a thermostat which turns the cable on when the temperature dips to 40°F. They're installed in the gutters and along the "cold" edge of the roof where interior heat loss is less, and you can buy them in lengths of 20 to 200 ft. for 120-v. or 240-v. circuits. Electrical consumption ranges from 160 w. to 1650 w. depending on the size cable used.

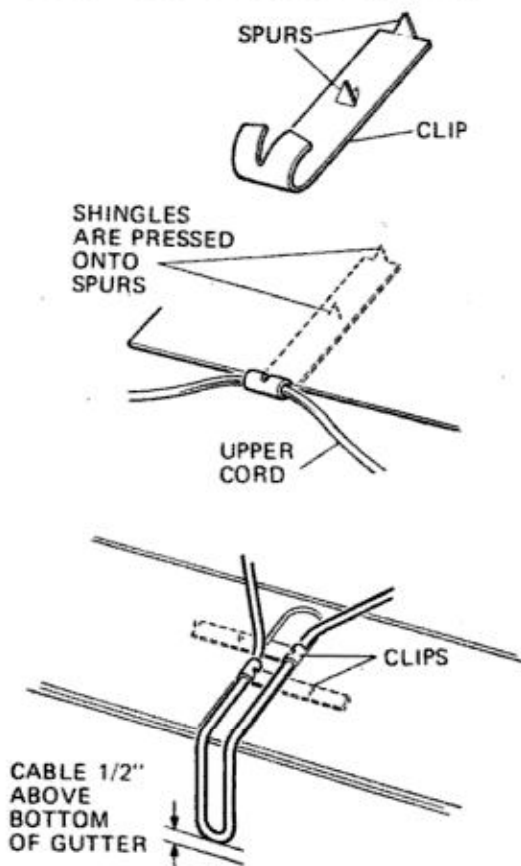
The best time to install heating cables is during warm weather, of course, but where it has to be done during freezing weather the cable should first be unrolled on the ground and plugged in to allow it to warm up. This will make it more pliable and easier to install.

Heating cables are mounted with special clips zigzag fashion along lower edges of the roof. Clips must be pushed up under the shingles and then the shingles are pressed down so that tiny spurs in the clips will embed. Exposed ends of the clips have hooks to hold the cable. Clips can be attached to slate roofs with thick roofing compound.

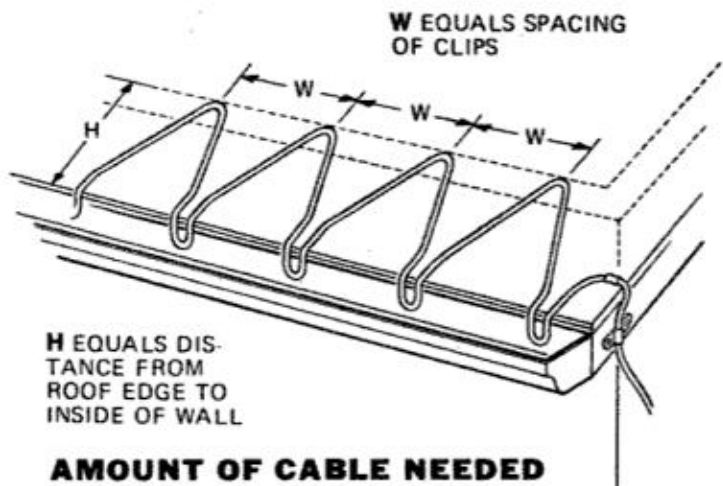
The cable should project down past the edge of the roof, forming loops that dip into the gutter to within 1/2 in. of the bottom. Do not cross or overlap the cable, nor space it closer than 1/2 in. Use two clips to assure the right spacing where the cable loops into the gutter.

Once the electric heating cable is in place, the lead-in can be plugged into an outdoor receptacle on a properly fused circuit that won't be overloaded by the cable's power needs. Gutter and downspout should be grounded to a water pipe or rod. ★★★

HOW CLIPS HOLD CABLE



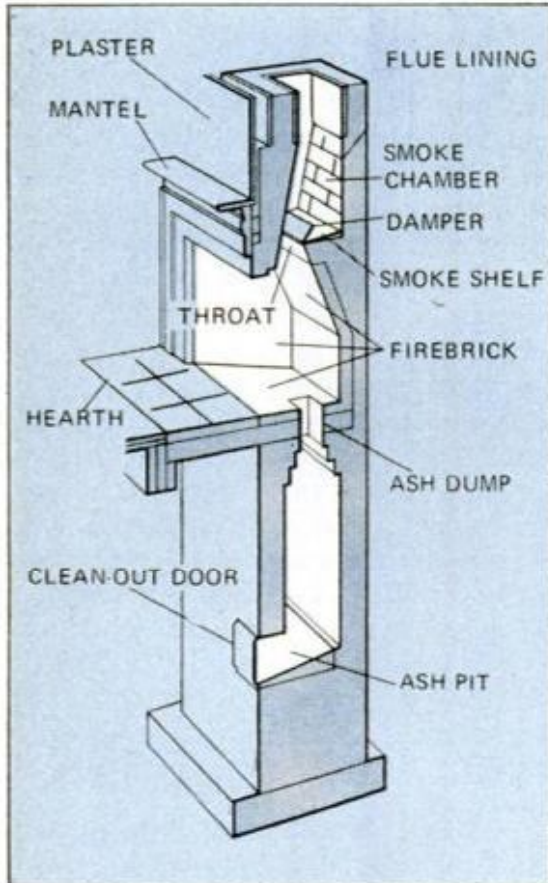
SPACING OF CABLE



AMOUNT OF CABLE NEEDED

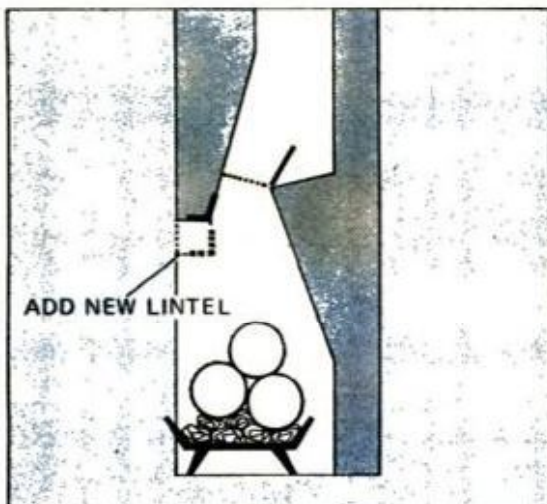
SNOWFALL	H. (in.)	CABLE LENGTH (ft.)
Light W = 24 in.	12	2.8
	24	3.6
	36	4.5
Medium W = 12 in.	12	3.8
	24	5.6
	36	7.0
Heavy W = 6 in.	12	6.0
	24	10.0
	36	14.0

How to have a smokeless

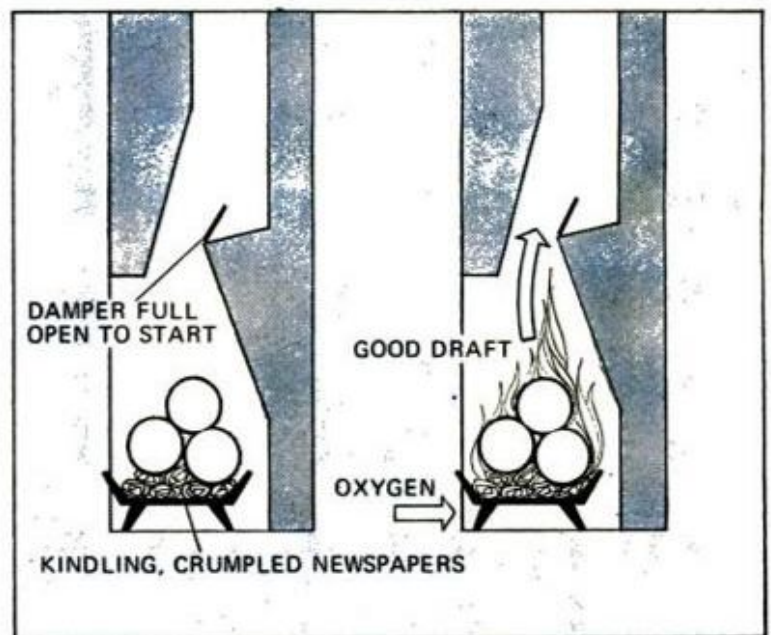


Fireplace construction

To function properly, a fireplace must be proportionally designed within certain limits: Size of throat, flue-effective area and firebox height, width and depth are all relative to each other for good draft. Often a design defect can be corrected by a simple alteration—for example, addition of a hood or lintel, as shown on these pages.



ONE OF WINTER'S GREAT PLEASURES is spending a cold evening in front of a well-laid fire. Too often, however, the spell is broken because the fireplace spills smoke into the room rather than curling it up the chimney. Smoking is one of the biggest complaints about fireplaces. Routine steps you can take to minimize this include periodic inspection of the flue to be sure there is no excessive soot and scale buildup and being selective as to what you burn. Do not burn too much pine or fir because they cause a disproportionate amount of soot buildup in the chimney. Rather, stick to hardwoods. Another cause of smoking is chimney blockage. Usually, it's a fallen nest or brick (in a new home) lodged in the throat. Other smoke-producing causes—and their cures—are described and illustrated here. ★★★



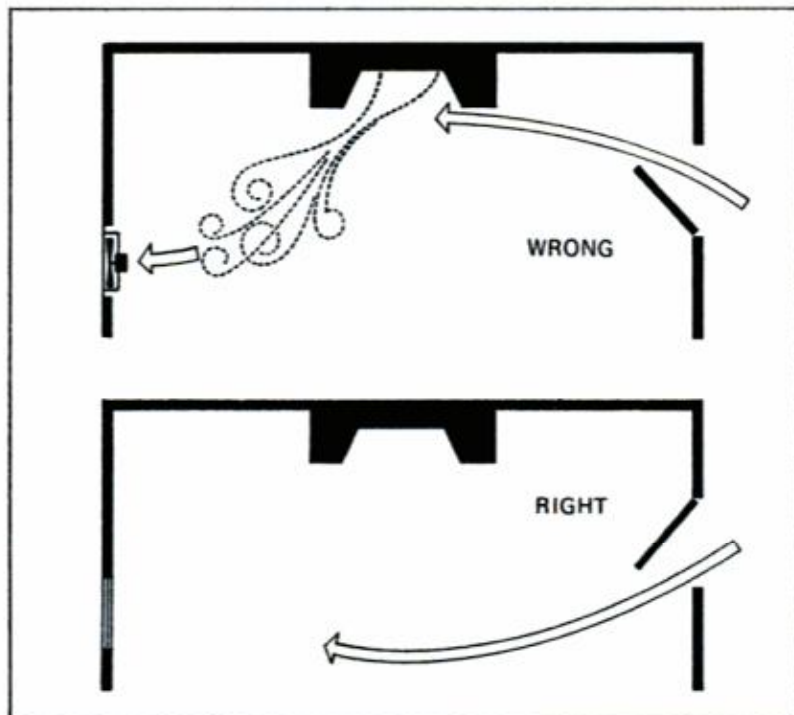
How to get (and keep) a good fire going

Place crumpled newspapers on the grate, add dry kindling, then stack logs so that flames can curl upward around them. (Three logs burn better than two.) Before lighting the fire, get a draft moving up the chimney. Open damper, insert three sheets of newspaper in the chimney and burn them completely. Now, light your fire. You may want to open a window slightly to keep oxygen coming in for good burning.

If the flue is too small

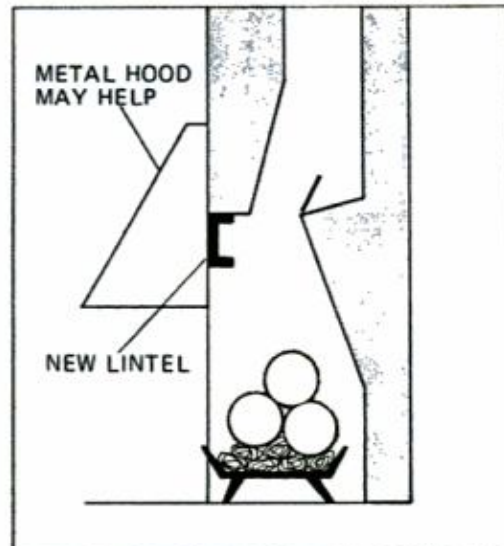
The flue should be about $\frac{1}{3}$ the area of the firebox opening (height x width). To replace it involves tearing down the chimney. Instead, try adding a metal hood or new lintel. To determine correct opening, with fire burning and smoke rolling out at top, hold a piece of metal across the top of the opening. Gradually lower the metal until there's a good draft and no smoke; that's the correct opening.

fireplace



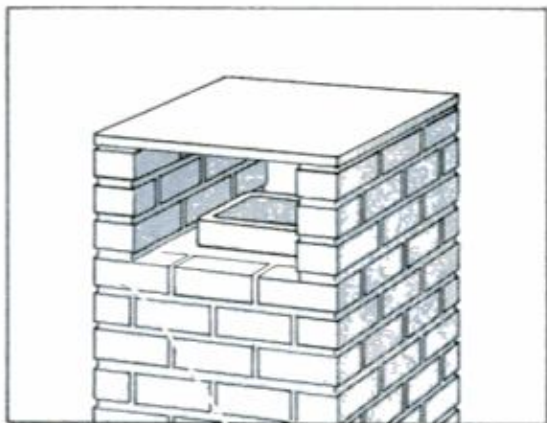
Check out the room's airflow

A door in the room may be so located that when open it causes a draft across the fire. Either re-hinge door on the opposite jamb or use a fire screen. Similarly, an exhaust fan in fireplace room causes smoking. Leave it off when using fireplace.



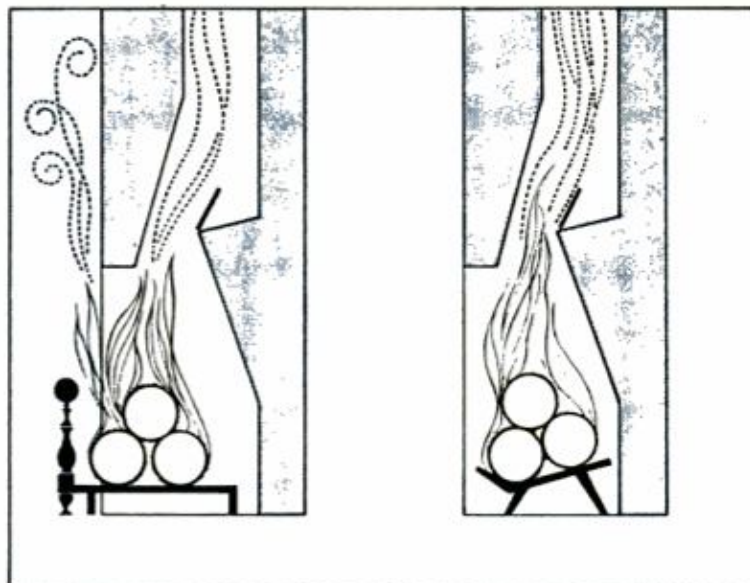
Damper located improperly

If front edge of damper is used as a lintel, the damper is too low. The lintel—a separate piece of angle iron—should be 6 to 8 in. lower than the damper. There's good chance a metal hood or a new, lower lintel may correct this fault. A much more drastic solution would be to rip out brickwork and raise damper to proper height, then rebuild back wall to line up with new damper position.



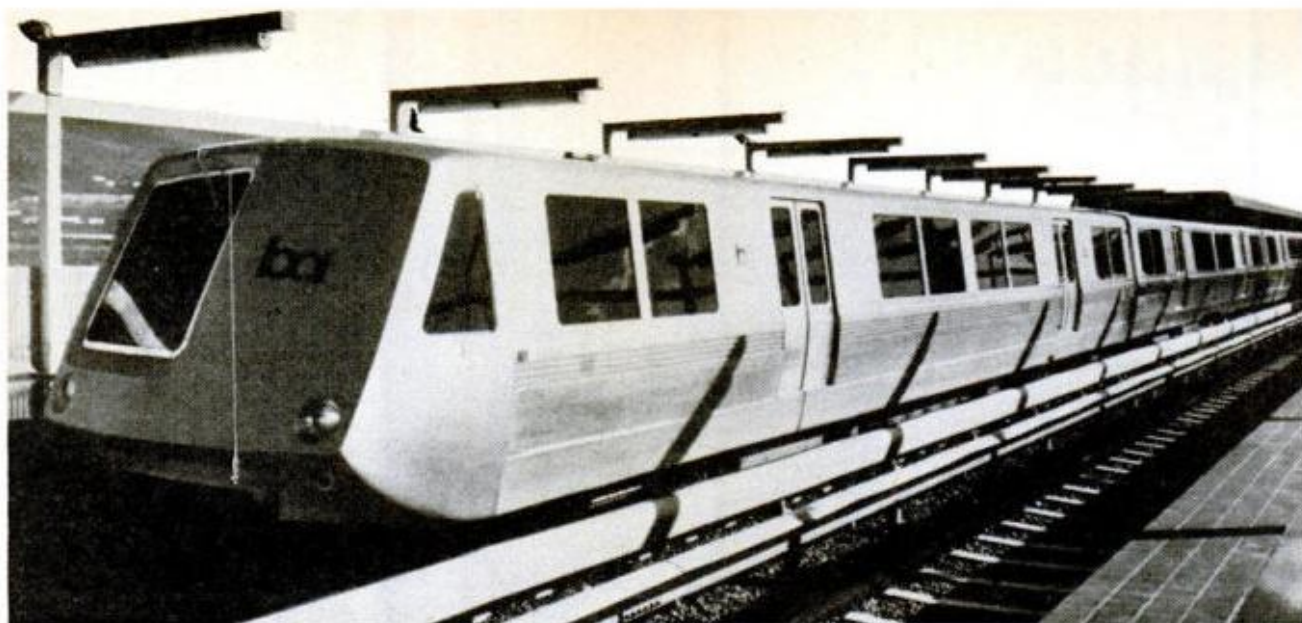
Chimney not high enough

On a house with a peaked roof, the chimney should be at least 2 ft. above the ridge; for flat or slightly pitched roofs the figure is 3 ft. If it's not, chimney should be raised, making certain that the extension is no smaller inside than the diameter of existing flue. Tall trees, surrounding hills and nearby chimneys cause downdrafts too. A shield hood and cap—with the shield toward the wind—usually will eliminate downdrafts from these causes.

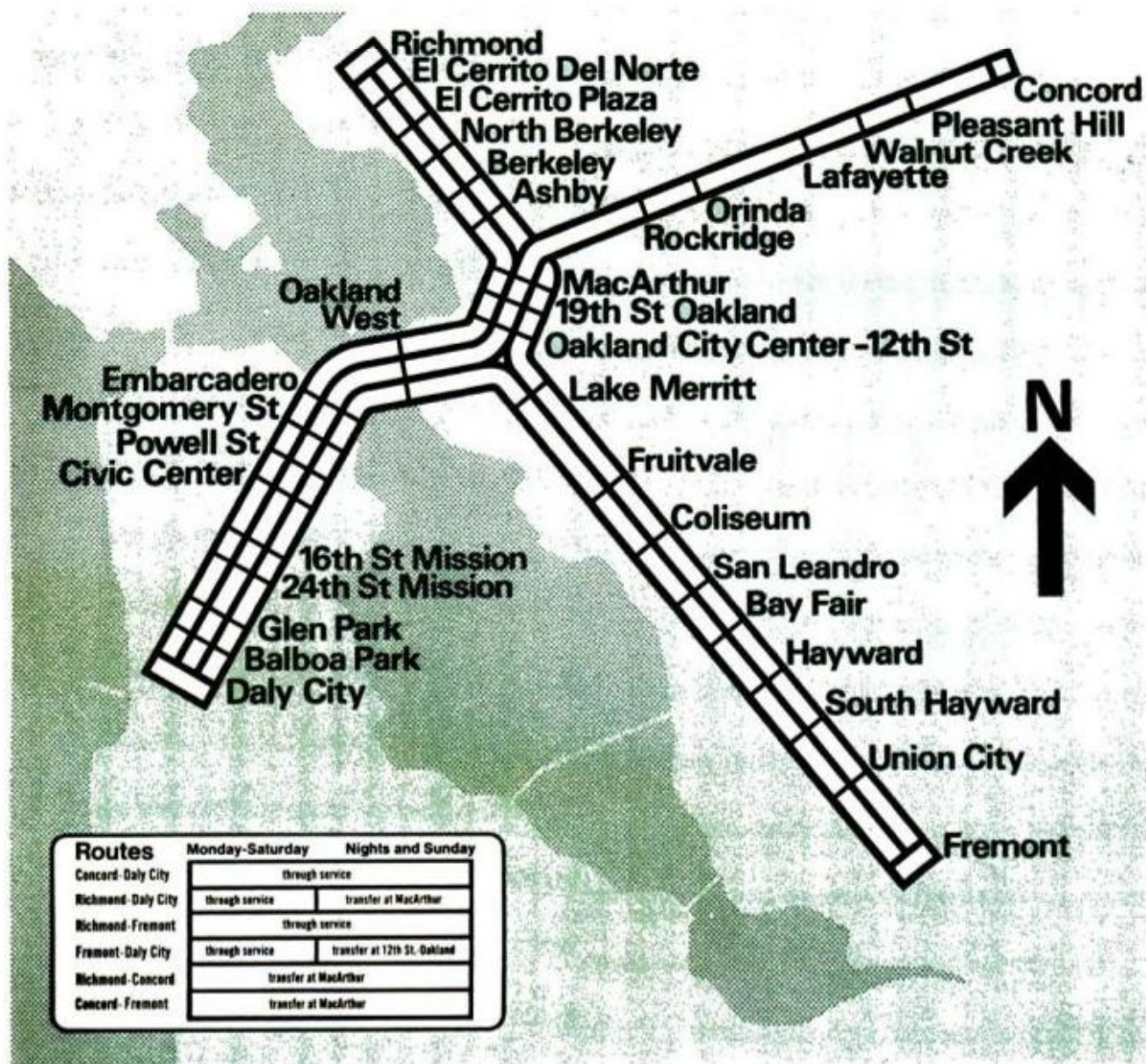


Firebox is not deep enough

The easiest correction for a too-shallow firebox is to use a narrower grate to keep fire well back in the firebox. Precaution: If you see smoke coming out of the chimney anywhere but at the top, don't use the fireplace until the leak is checked and, if necessary, repaired by an expert.



Computerized commuting for San Francisco



Bay Area Rapid Transit—BART—has automated trains, brainy ticket machines and well-designed stations that even have some signs in braille

By MICHAEL LAMM, West Coast Editor

BART HAS A LOT riding on it. If San Franciscans switch to it and leave their autos home in the garage, the city fathers will heave a sigh of relief. But if commuters shy away from BART (Bay Area Rapid Transit) there'll be a lot of second-guessing and grumbling about the \$1.4 billion cost and 20 years spent in planning and building.

BART is the first regional rapid transit system to be built in the United States in more than half a century. If it's a success, a number of other traffic-clogged cities will regard it as a possible solution to their own mass-transit problems and one way of minimizing the auto's contribution to air pollution. BART officials hope that by 1975 their trains will carry 200,000 people daily.

BART's first leg, a 28-mile run between Oakland and Fremont, was opened recently. The complete 75-mile system, linking cities and suburbs in the Bay area, is scheduled to be in operation this year. By then, BART boosters hope, all the bugs will have been eliminated from the automatic control system.

BART is a space-age railroad. Twin computers in Oakland can route and "drive" as many as 105 individual trains at the same time. Computers control train speeds, stopping and acceleration rates, station waits, even the length of time that doors stay open (ouch!). If anything goes haywire along any portion of the track, little local computers are designed to shut down that portion of the line. A master computer constantly scans and rates the

ATTENDANT SITS at console (top photo) in the lead car. If need be, he can override automated control

WHEN FULL LINE operates, all trains will be monitored from central control room (second from top)

CARS ARE BRIGHTLY LIT and provide comfortable seating for 72 passengers. Rush-hour capacity: 216

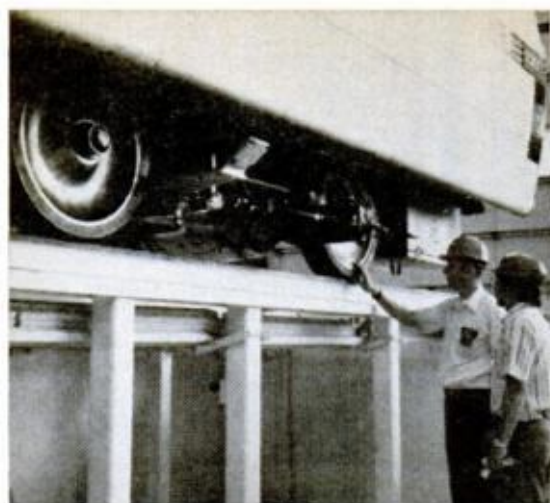
MODERN STATIONS (right) are clean and pleasant. They also contain devices to help the handicapped

JANUARY 1973





ALL SWITCHING, inventory and communications functions are directed by this computer in BART's big repair yard



BART CARS have steel wheels with aluminum centers. The combination reduces weight

system to calculate the best combination of service and economy.

Each train has a control module up front, manned by a uniformed attendant. This attendant, according to BART officials, is there mostly to reassure passengers who otherwise might feel they were riding a ghost train. If the automated systems fail, the attendant can stop the train, open or shut doors manually, and move the cars forward at low speeds.

Another bit of cleverness involves the IBM automatic fare system. To ride BART, you buy a credit-card-sized ticket for any amount up to \$20. A machine sells you the ticket and accepts all coins except pennies. It also takes \$1 and \$5 bills. The amount you pay is encoded (printed) onto your ticket in magnetic ink.

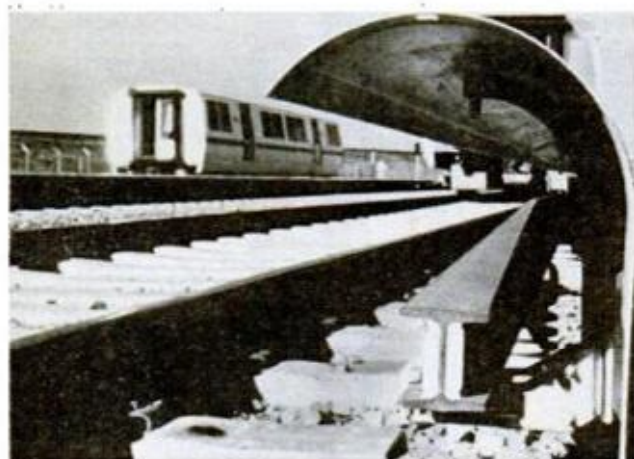
To board a train, you pass through an entry gate, the ticket being the key to the turnstile. You put your ticket into a slot in the entry gate, and a gadget inside encodes location, date, and entry time on it,

then gives your ticket back. You pass through the turnstile.

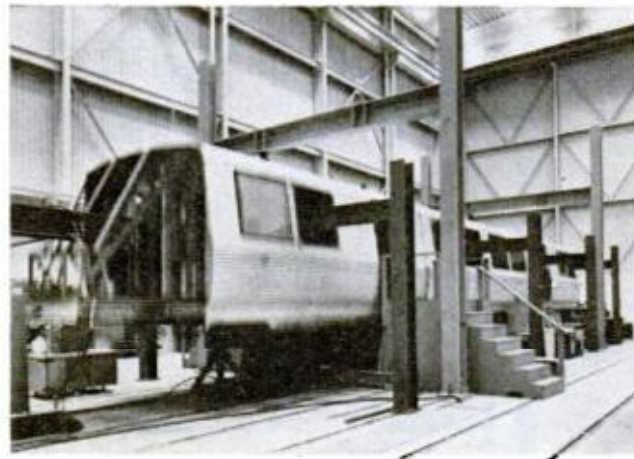
At the end of your ride, you have to pass through an exit gate. Here you again shove the ticket into a slot. An electronic device reads the magnetic coding on your ticket, automatically subtracts the right amount of fare, prints on a new fare balance, and unlocks the turnstile. Fares range from 30 cents to \$1.25, depending on the trip length.

When your ticket is almost used up, with only odd change encoded on it, you can insert it into the ticket-vending machine and receive full credit on your purchase of a new ticket.

BART trains, with up to 10 cars in tandem, ideally maintain a 45-mph average speed, including train stops. Top speed is 82 mph, and full-bore acceleration gets 0-60 mph in 20 seconds. Stopping is accomplished by a combination of conventional Hurst/Airheart disc brakes plus reversing the dynamics of the electric



THE THIRD RAIL is steel-aluminum combination. Inserts made of the lighter metal carry the current



ALL CARS ARE GIVEN vibration tests to insure their ability to handle high loads during operation

POPULAR MECHANICS

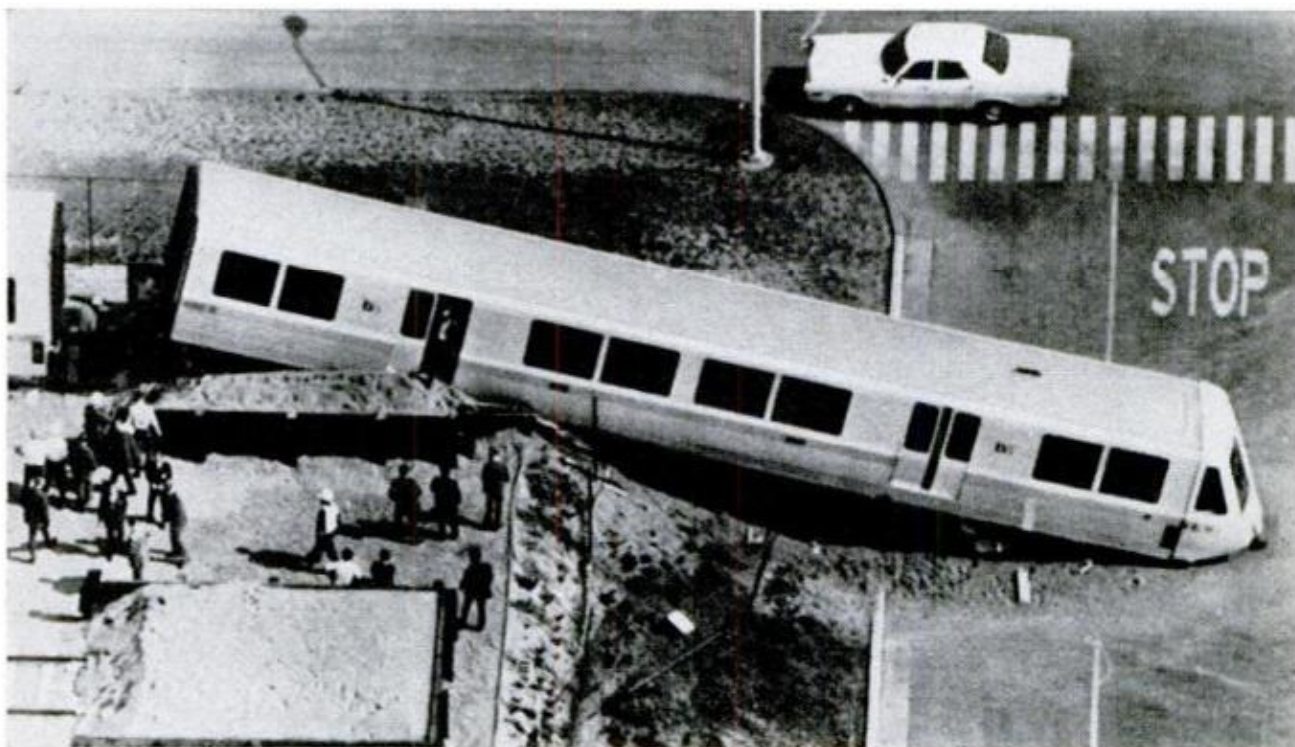
drive motors. Power flows along a shielded third rail at 1000 volts d.c.

The computer-monitored power system uses what's called "chopper" control. This means that current to the traction motors is modulated by chopping it into pulses. Pulse lengths depend on the power. The more needed, the longer the pulses. Acceleration is smooth and steady. (This can't be said for older transit systems.)

BART's cars ride on air-suspension systems. To keep down noise and jostle, engineers have isolated the running gear from the passenger compartment. Rails are 1517 feet between expansion joints to give a lot less clack-clack. And the aluminum car bodies (on steel frames) use sound-

invested in this most modern of transportation systems. It isn't hard to imagine the reaction of BART officials and San Francisco's city fathers when—early last October and after less than a month's operation—a two-car train hurtled through the Fremont station (the line's southern terminus), ran off the tracks and plunged through a sand barrier. The lead car wound up nose down in an adjacent parking lot. Four passengers and the attendant were injured.

A preliminary investigation by BART engineers reportedly pinpointed the cause—a malfunctioning crystal in the electronic gear aboard the train. The tiny unit was supposed to "instruct" the train's motors



LESS THAN A MONTH after the BART system had gone into operation, this train hurtled past the Fremont station and ran off the tracks. The problem was traced to a malfunction in automated controls

deadening materials extensively. To minimize sidesway, tracks are 5.5 feet apart rather than the U.S. standard of 4.7.

Passengers sit in bucket seats, 72 to a car and upholstered in woven and solid vinyl. One car carries 120 passengers comfortably or up to 216 at rush hours.

Stations are thoroughly modern, clean (so far), and brightly lighted. They contain special equipment for the handicapped. Each station has lower-than-normal telephones for people in wheelchairs, elevators for the elderly, braille symbols on certain doors to aid the blind, and special phones for the hard-of-hearing.

Much thought and planning have been

to slow to 27 mph when signaled by way-side radio devices at station approaches. The crystal supposedly got the right message, but instructed the motors to speed up to 70 mph.

The attendant is said to have responded properly. He hit the "stop" button on the control console, activating the brakes. According to BART officials, the train was down to 26 mph when it hit the sand.

So BART is off to an uncertain start. But San Franciscans should take heart. BART has come through rough financial, political and engineering crises. In time, the gremlins sabotaging the automation system should be vanquished, too. ★★



PM OWNERS REPORT: DATSUN 240Z

Demand outpaces supply...

By MICHAEL LAMM, West Coast Editor

OWNERS APPRECIATE good dash layout, say it gives nice man/machine feel, report solid driving comfort

SPEEDOMETER and tach are highly visible and deeply recessed; passenger doesn't know how fast he's going!



GOOD LOOKS, good dollar value, high resale, brisk performance, fine handling, good gas mileage: These are just a few of the reasons why Datsun 240Z owners go down the road smiling. Occasionally you see one frowning, and chances are he's just snapped the head off his choke cable. It's a fairly common occurrence and one of the few little things that bug Z owners. The plastic head breaks off at the end of the cable.

When Datsun introduced its Z-car in 1970, buyers queued up in long lines around dealerships; in some towns there's still a wait for delivery. Dealers tend to load up their cars with accessories, figuring (correctly) that with demand as strong as it is, customers won't mind paying extra for things like mag wheels, air-conditioning, stereo tape, and so on. So most 240Zs are sold pretty well loaded.

Comments a Brooklyn bookkeeper. "The dealer wasn't interested in selling me the car, because he had more orders than he could handle. He was very nasty, and I was tempted to cancel my order." Obviously, though, she didn't. A Staten Island school teacher echoes, "The dealers I spoke with all had the same attitude, 'If you don't buy it now, we'll sell it to someone else in an hour.'"

Once they're bought, though, about half the 240s had to go back to their dealers

for repairs or adjustments of some sort—mostly minor. And 62.9 percent of the owners we surveyed rated their dealers good-to-excellent on service. This is quite good. "I wasn't able to get back to the dealer until 13,000 miles," says a California restaurateur, "but he fixed the odometer on warranty anyway."

A number of owners complained about waits for parts. "Still waiting for replacement for broken choke cable after seven-plus weeks," says a Harvard physicist. He's not alone. "Dealer had to replace a chipped gear in transmission," notes a New York attorney, "and the repair was fine except for a 2½-week wait for the new gear to come from California."

Quality control? An Ohio purchasing director observes, "Control at the Datsun plant has to be tight, because I can find only one small blemish on the entire car, and I've looked very closely." A Washington welder: "Outstanding workmanship that exceeds almost all American cars."

That's the majority view, but others disagree. "Good workmanship, but I have to qualify that by adding that the car was damaged in transit and needed bodywork and complete repainting."—Maine student. "The metal is too light a gauge, because carwashes put dents and ripples

A nationwide survey based on 899,000 owner-driven miles

for new choke cables, too!

Photos by the author

FINE HANDLING proved top reason for buying Z-car. "Spook" (spoiler) is said to aid stability at speed



SOME OWNERS add stiffer shocks to independent rear suspension and would like rear disc brakes optional

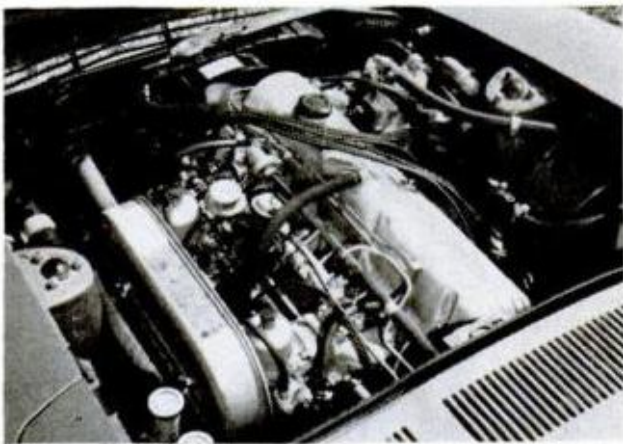


in the roof.”—Memphis priest. A number of owners found the paint too thin.

Performance and handling are two attributes 240Z owners expected from the start. Has the car delivered? “Stiffer shocks all around would greatly improve the car’s low and high-speed handling.”—Detroit student. A New York CPA counters, “Handles extremely well at both low and high speeds; disc brakes are ex-



CARGO DECK is fine for pets but not people. Tiedowns are designed to keep bags from sliding forward



OHC SIX nets 151 bhp, gives sparkling performance with four-speed but tends to be slushy with automatic

cellent under all weather conditions.” A Washington secretary: “A little hard to handle above 85 mph, which I shouldn’t be doing anyway.” Apparently the 240Z does tend to wander and get windblown above about 70 mph, but below that speed it’s very stable.

Several owners added front spoilers (or “spooks”), and they say this gives better stability at higher speeds.

Acceleration from the six-cylinder, overhead-cam engine rates high with owners of manual-transmissioned cars, but others said the automatic tends to be sluggish. Either way, the Z-car’s performance doesn’t penalize anyone at the expense of poor gas mileage. Everyone agrees that 20-25 mpg is more than they’d expected. Here’s one of the few cars where you can have performance and economy too.

In the main, all owners are very pleased with their cars, and we can’t overstress that fact. Yet little things do crop up in any car, and here are a few random shots:

“Would like to see cheap plastic upholstery changed at sides of transmission hump.” “Plastic dash moldings and plastic button-type fasteners do not fasten very well.” “Though the workmanship is good, the materials used are rather poor; for instance, thin paint, thin metal, thin upholstery.” “Hood and decklid need to be stronger to prevent denting in closing.”

“Sticky accelerator pedal,” reports a handful of owners. Another handful isn’t happy with the air conditioner. It doesn’t put out enough cold air, say some, and others claim it helps cause engine overheating in hot weather.

EVERYONE LIKES 240Z’s styling. With demand running strong, some owners griped that dealers had loaded Zs with extras, notably mag wheels and air



Summary of Datsun 240Z Owners Reports*

Total miles driven	889,148
Average miles per gallon	
Local driving	20.3
Long trips	24.3
Transmissions:	
Four-speed manual	81.8%
Automatic	18.2
Why the 240Z?	
Styling	74.8%
Economy	23.7
Performance	23.0
Reputation	18.7
Handling	18.7
Specific likes:	
Style	67.6%
Handling	66.2
Economy	47.2
Comfort	40.1
Performance	39.4
Power	21.1
Specific dislikes:	
Poor quality of materials	15.8%
Rattles	12.2
Poor dealer service	10.1

Poor workmanship	10.1
Poor airconditioner	6.5
What changes would you like to see?	
Better materials	20.3%
Different seat shape	9.0
Better suspension	9.0
Better bumper guards	8.3
Bigger trunk	8.3
Had any mechanical troubles?	
No	50.7%
Yes	49.3
What kind of trouble?	
Choke	37.1%
Airconditioner	7.1
Speedometer cable	7.1
Accelerator	5.7
Transmission	5.7
Did you repair it yourself?	
No	91.4%
Yes	8.6
Dealer repairs satisfactory?	
Yes	64.6%
No	35.4

Dealer opinion:	
Excellent to good	62.9%
Average to poor	34.1
Is the 240Z your only car?	
No	52.1%
Yes	47.9
Other cars owned:	
Chevrolet	17.8%
Volkswagen	16.4
Ford	15.1
Pontiac	8.2
Workmanship opinion:	
Excellent to good	80.7%
Average to poor	18.6
Age distribution of owners:	
15-29 years	59.9%
30-49 years	32.2
50-plus	7.8
Would you buy another Datsun 240Z?	
Yes	80.0%
No	20.0

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

Comfort? "Passengers can't believe there's so much legroom in so small a car," says a Texas helicopter pilot. "After driving 26 hours with only short breaks, it was still comfortable."—Colorado student. "Forget rear passengers, but dog loves that area."—West Virginia draftsman. "Bucket seats give good support; passengers like reclining seat feature."—California engineer.

Many owners kept on writing even after they'd answered all our questions. We always invite extra comments, and here are some of the more typical:

A New York hairdresser: "I traded a 1972 T-bird, which cost \$7200, for the Z, and the Z put pleasure back into my driving."

An Ohio RN/interior decorator: "This is the first car I can recommend to friends

and strangers without reservation. I've enjoyed every minute of driving it, and for the first time in my life, I feel I've made a good deal on a car."

And a 19-year-old engineering student at General Motors Institute: "I would like to tell you why I bought the 240Z and not another car. I considered the Fiat 124 Spyder, the Alfa Romeo Spyder and the Porsche 911T. The Porsche's price put it out of the question. For a few hundred dollars more than the Fiat, though, I reasoned I could get a better all-around car: power, handling, comfort, appearance and the safety of an enclosed GT. I can't complain about fuel economy nor the long list of standard equipment. The biggest problem I have is keeping people's fingerprints off the paint and their noseprints off the windows."

ACCESS DOORS flanking hood hide battery on right and master cylinder on left. Dome light (center)

turns on by pressing lens. Chained gas cap (right) would ding fender if it wasn't for the rubber apron



PM OWNERS REPORT: TOYOTA CELICA

ST is for Super and



HIGHLY AMERICANIZED styling catches most buyers' attention initially, and modest price plus good economy, long list of extras move in for the sell. Airscoops look fake but are functional and also help stiffen hood. Despite nominal room for four, it's essentially two-passenger car, with scant legroom in back. Owners report good driving comfort, enjoy long trips, boast plenty of power and good torque for holding speeds going up steep grades



By **MICHAEL LAMM**
West Coast Editor

Photos by Irv Dolin

MEEET TOYOTA'S CELICA, one among a group of several popular, small, imported ponycars. The imports are slick, glossy, economical, well put together and fun-to-drive automobiles. The Celica's competitors now include the Capri, Opel Manta and the Mazda RX-2 coupe. Soon the mini-Mustang will join that growing club.

Who buys a car like the Celica? And why? Young people, mostly. The biggest single age group in our

POPULAR MECHANICS

A nationwide survey based on 1,002, 000 owner-driven miles

Terrific, but dealers—!



1 HARD CORNERING brings out hearty understeer due to 59/41 weight distribution. Heavy engine also makes for the steering stiffness. **2** Celica includes very complete instrumentation, plus radio, tach, clock among standard items. **3** Shoulder harness cuts into neck, so most owners can't use it! This, of course is a problem with many shoulder rigs and their positioning should be given more attention by the car manufacturer. **4** Gas-filler location outfoxes most service station attendants because its hidden behind styled panel. **5** Handy door handles pull out to open; owners say they like them

Celica survey was 20-24. Owners are usually unmarried or newly wed, and since many expect to have families when they're ready to trade for another car, they realize they'll probably need bigger ones next time. That explains why 20.9 percent said they wouldn't buy a Celica again. It *wasn't* because of any inherent dislike of the car. Quite the opposite.

As to why they chose the Celica: "Because I couldn't afford a Datsun 240Z, and I don't like American cars;

the Celica was the next best thing."—Ohio lineman. "Because of its styling and good gas mileage. It's economical to repair as well as to insure."—Hoboken engineer. "Because of its sporty appearance, four seats, good-sized trunk, and low price."—Texas insurance salesman.

By far the biggest beef centered on dealer service. We asked the owners to rate their dealers two ways; first on general courtesy, sales policies and methods. Here owners gave their dealers a fine score: 77.6 percent rated them *good-to-excellent*. But when we asked for their opinions on dealer service alone, only 36.4 percent of the owners said *good-to-excellent*. A full 40.9 percent rated dealer service *poor*.

A Los Angeles inventory planner summed it up this way: "Toyota dealerships are the worst I've come across. The car in general is very good, but it's too bad the dealers can't live up to the standard." Most owners would say "hear, hear" here.

What are owners' specific praises of the Celica? An Ohio therapist says, "The speed is super, handling fantastic, brakes are sure, very comfortable on long trips, good gas mileage, plus lots of standard extras. Who could ask for more?" A Massachusetts electrician credits the "Beautiful interior and sharp exterior. It attracts attention and questions. People love the way it handles turns at high speeds and also the general smoothness of the ride. There's plenty of trunk space, and a handy tool kit comes with the car." And a New York advertising man reports, "I travel a lot. I find the Celica comfortable; the motor is big enough so the car

holds its speed on hills, and it's economical."

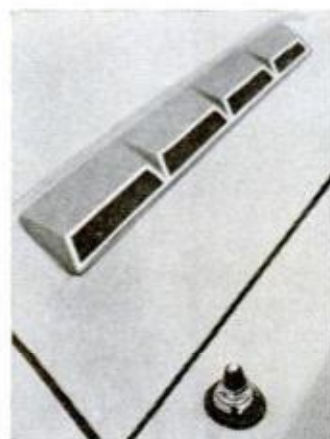
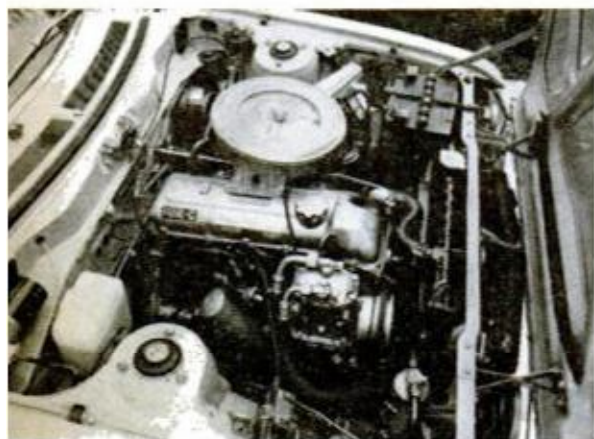
We also asked for specific complaints. Here are some of those. From an Oregon legal secretary: "Steering is hard in parking, and my car has more than its share of rattles and vibrations." An Illinois coal miner complains that it "maneuvers badly in tight corners and brakes squeal on cold mornings." A Chrysler Corp. test driver notes, "High cost of warranty tune-ups, and it could use wider standard tires." A Denver parts manager tells of "hard steering from understeer." And from a Virginia college professor: "The Celica has terrible front/rear weight ratio and awful understeer."

It's true that the Celica is front-heavy, with a weight distribution of 59/41. That's bound to give quite a bit of understeer, and it also accounts for complaints about hard parking. Yet owners were evenly divided in their opinions about handling.

Most people realized when they bought their Celicas that the rear seat was strictly for kids and short hops. One owner suggested remaking of this area for a two-passenger car and using the present rear-seat area to enlarge the trunk. Most others, though, found luggage capacity to be plenty big.

Toyota Celica owners give their cars a high rating on workmanship. Fully 88 percent of them marked workmanship as *good-or-better*, with 34.7 percent checking no less than *excellent*. That's quite a tribute to what is essentially designed as an economy car. It's the sort of mark that was previously reserved for Volkswagen alone.

In the realm of I'd-like-to-see came



TOYOTA'S sohc-Four, with 97 bhp, powers Corona and Mark II as well as Celica. MacPherson-strut front suspension gives plenty of travel, helps soften ride

88

ANTISWAY BAR and standard radial tires compensate to some degree for understeer. Semiautomatic antenna pops up when radio goes on, pushes down by hand

POPULAR MECHANICS

Summary of Toyota Celica Owners Reports*

Total miles driven	1,002,829
Average miles per gallon	
Local driving	24.6
Long trips	29.0
Why the Celica?	
Styling	69.5%
Economy	48.2
Price	16.3
Performance	12.1
Reputation	7.1
Specific likes:	
Economy	60.6%
Style	59.9
Handling	45.1
Comfort	39.4
Performance	24.7
Power	18.3
Ride	16.2
Specific dislikes:	
Poor dealer service	10.6%
Rattles	9.2
Poor quality of materials	7.8
Too light on road	7.0
Brakes squeal	5.6

What changes would you like?	
Bigger engine	13.2%
Better suspension	10.9
Different styling	8.5
Better steering system	7.8

Had any mechanical trouble?	
No	54.6%
Yes	43.4

What kind of trouble?	
Carburetor	14.3%
Speedometer cable	11.1
Dieseling	7.9
Transmission	7.9
Muffler	7.9

Did you repair it yourself?	
No	95.2%
Yes	4.8

Dealer repairs satisfactory?	
Yes	55.9%
No	44.1

Is the Celica your only car?	
No	53.6%
Yes	46.5

Other cars owned:	
Chevrolet	19.7%
Toyota	15.3
Pontiac	11.8
Ford	11.8
Plymouth	10.5

Workmanship opinion:	
Good to excellent	88.1%
Average to poor	11.9

Dealer service opinion:	
Good to excellent	34.4%
Average to poor	63.5

Age distribution of owners:	
15-29 years	72.1%
30-49 years	18.2
50-plus	9.8

Would you buy another Celica?	
Yes	79.1%
No	20.9

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

fairly strong pleas for a six-cylinder engine option to bolster the Four; and a number of the respondents said they'd also like to see Toyota make its five-speed gearbox available in the Celica models.

Other suggestions received included the offering of power steering, improving the design of the shoulder harness; adding removable roof panels in the same way Porsche, Triumph Stag and Corvette do; and using a heavier gauge metal. "I've got to be very careful when I wax the car, ha, ha," says a Texas airman wryly.

But by and large, all complaints concerned with the car itself are trifling. A New Jersey machinist's major gripe, for example, was "... that I didn't buy the car sooner."

Summing up some of the other owners'

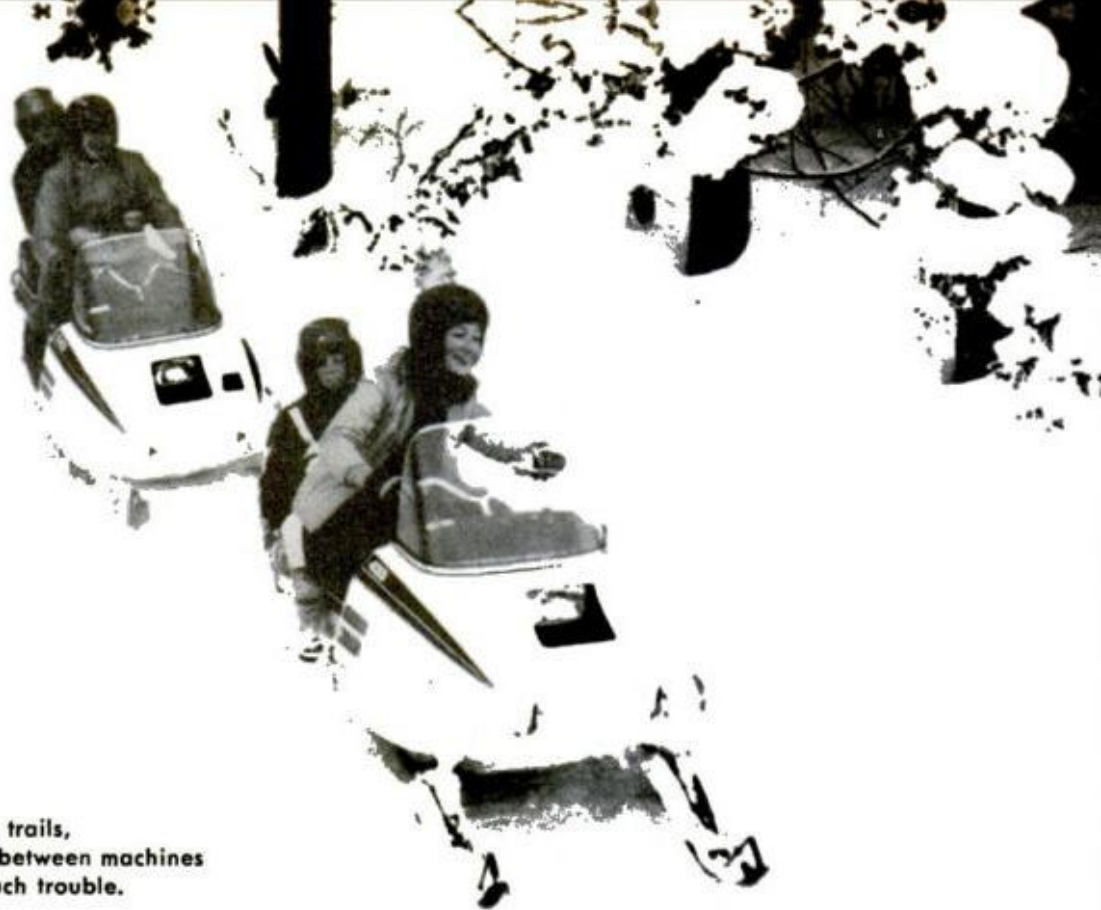
feelings: "Dollar for dollar, I feel it's the best car in its class."—Staten Island correction officer. "That little car just overwhelmed me—love at first sight!"—retired Denver fireman. "Interior is well above the quality of U.S. cars."—North Carolina student. "All that standard equipment makes it nice, like the radio, reclining seats, tach, clock, rear-window defroster, and the good disc brakes. . . ."—California vintner.

And a 23-year-old New Jersey secretary who's thoroughly sold on her Celica states, "I have owned the car four months and 5300 enjoyable miles. It's very sporty, yet has ample room, amazing power on the highway, gas mileage is great, and the equipment they call standard makes me feel that I really got something for nothing." ★ ★ ★



STYLING AND ECONOMY of the Celica is the reason owners say they bought the car. Many owners are enthusiastic drivers and want to see bigger engine
JANUARY 1973

CELICA TRUNK is neat and commodious for small car. Some owners don't need rear seat and indicate a preference for a trunk running through to front seats



ON TRACK along assigned trails, a group—with more space between machines than shown—can avoid much trouble.

Trails—a solution for the snowmobile problem

New specially made paths across snow country may help steer 2-million snowgoers away from accidents, ecology damage—and even some critics

SNOWMOBILES MAY HAVE TURNED a corner this winter, heading out on a happier course across the snowbelt.

Anywhere the weather bureau says there is an average of one inch of snow 100 days a year (and even some places where there isn't), snowmobiles have been flourishing over the last decade—to the delight of their owners and the dismay of many stay-at-home critics. Complaints about the machines have cited noise, needless trespassing, damage of the countryside, drunken driving and drownings.

But now more and more drivers are off on a different track that is proving safer and more fun. It's estimated that this winter there are nearly 40,000 miles of trails set aside just for the snowmobiler. This is a remarkable development record

for a sport so young, but probably 100,000 miles would be more adequate for the number of machines in use.

Unfortunately, many trails are not yet properly maintained. Constant use creates moguls—those exaggerated washboard bumps that give you a roller-coaster rodeo ride at modest speed and pitch driver and machine out into the underbrush if you try to take them too fast. And many snowmo trails are not well marked. After a sprint across open meadows it is often hard to tell where the track re-enters a wall of woods, and long winding stretches don't yet have the recommended "reassurance" signs that tell a driver he hasn't wandered off course.

This year, however, a number of aids are available for the first time to help



MODERN TRAILS can now be graded and smoothed to take the washboard ride out of your snowmobile outing

SNOWDRIFT PICNIC SPOTS are now designed into new trails. Safe night operation is preplanned into layout



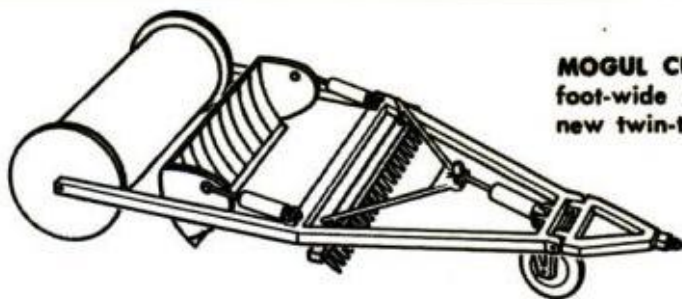
By **BILL McKEOWN**
Outdoors Editor

communities, clubs and even individuals set up excellent local trails. An old logging road or abandoned right-of-way can be converted, or a group can start from scratch. In Douglas County, Wis., in the northwest corner of the state, scenic Cut-A-Way Dam Trail was designed and bulldozed out two years ago for a 15-mile two-way trail at a cost of about \$8000. The money came from snowmobile registration fees paid into State Department of Natural Resources funds. Last winter Halvorsen, Inc., in Duluth, a Ski-Doo distributor, provided a Bombardier Skidozer dual-track machine, designed for grooming the trail. More than 10,000 snowmobilers used Cut-A-Way, and the county forest administrator termed the development a spectacular success. Complaints of snowmobile dis-

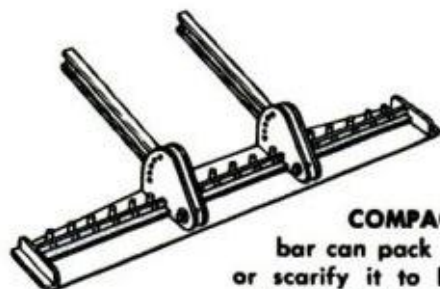
turbance in the county dropped to practically zero, and there was no evidence of snowmobilers leaving the designated trail.

A club operation that snowballed into a success story started at Old Forge, N.Y., in 1966. With the help of a local architect club member, trails were developed along old paths after permission was obtained from local, state and private property owners. Now 500 miles of well-maintained trails fan out from Old Forge along routes that do not conflict with the highways, ski runs or private homes. Local motels are filled on winter weekends, snowmobile rental is booming, and the township government has taken over trail maintenance.

How is a good trail established locally? First you need a snowmobile club so that town fathers know your spokesman repre-



MOGUL CUTTER AND SCRAPER is 8-foot-wide accessory for Bombardier's new twin-track Skidozer to level trails



COMPACTOR bar can pack snow or scarify it to break hard-packed moguls, rough stretches

SEVERE DIP (left) stops snowmo dead, but after Trak-Pak (below) fills ditch the trail is level



SKI AND SNOWMO TRAILS can both be smoothed by Haugen Track Sled towed by snowmo or snowcat for 3-foot-wide trail

sents a responsible group. A booklet, *How to Organize a Local Snowmobile Club*, is available free from the International Snowmobile Industry Assn., 5100 Edina Industrial Blvd., Minneapolis, Minn. 55435. From the same source is *Basic Recommendations for Snowmobile Trails*, an eight-pager. From the SnoPlan Trail Study Manager, Bombardier Ltd., Valcourt, Que., Canada, clubs can get the 24-page *Guide to the Development of Good Snowmobile Trails*, a how-to-do it booklet that also gives illustrated success stories of trails in the United States and Canada. Minnesota, Michigan, Wisconsin, New York, Idaho, Washington, Utah, Wyoming are among 20 states offering snowmobile maps or directories for families that just want to see more of the snow country and groups studying trail development.

In general terms, depending somewhat on typical weather and terrain, a good modern snowmobile trail should be

planned where a minimum of three inches of snow can be expected. It should hopefully be at least 15 miles or more in length, with a minimum of five miles and maximum of 50. Ideally, trails will be one-way, 10 feet or more wide, and with shorter loops that can get a driver back to his starting point. It's estimated that a well-designed trail can handle eight machines per mile twice a day; thus a 50-mile trail could accommodate 800 machines a day. Safety patrols and rest stops should be provided.

Already, new trail-grooming aids that can be towed by snowmobiles or special vehicles are available from such companies as Bombardier, Trak-Pak Snow Grader division of Bullard Products, North Hyde Park, Vt. 05665; the Norwegian-built Track Sled from Haugen Co., 8 Henshaw St., Woburn, Mass. 01801, and others.

Trails will never silence all snowmobiles and their critics, but should keep them on separate sides of the snowdrifts. ★★★

ONCE A TRUCK was simply the replacement for workhorse and wagon. Now light trucks double as everything from pleasure car to backpacking mountain goat. Surveys show most presently will serve more than half their roadway hours as vehicles for fun. Small imports, too, are trying to join a trucking trend to recreation. Today more trucks are making like turtles as they add travel homes—it's an easy way to load a lot of living-on-the-go. ★★★

Trucks for fun

Camping conversions can make a happy switch-hitter out of your cargo carrier



INTERNATIONAL offers a three-way choice with new Travelall (front), Travelette (top), Scout (right)



DODGE calls it the new CB300 Kary Van, and a do-it-yourselfer may rate it ideal for conversions



CHEVY's C-30 pickup with "3+3 cab" is dual-rear-wheeled four-door suited to fifth-wheel trailer tow



FORD SUPER CAMPER SPECIAL F-350 has longer wheel base, higher GVW rating, new tie-downs, sway bars



JEEP COMMANDO, American Motors' old favorite, is available now as wagon (above), pickup or roadster
JANUARY 1973



GMC JIMMY, almost identical to Chevy's Blazer, here mounts Con-Ferr's Baja luggage rack as extra

Pleasure-craft preview '73

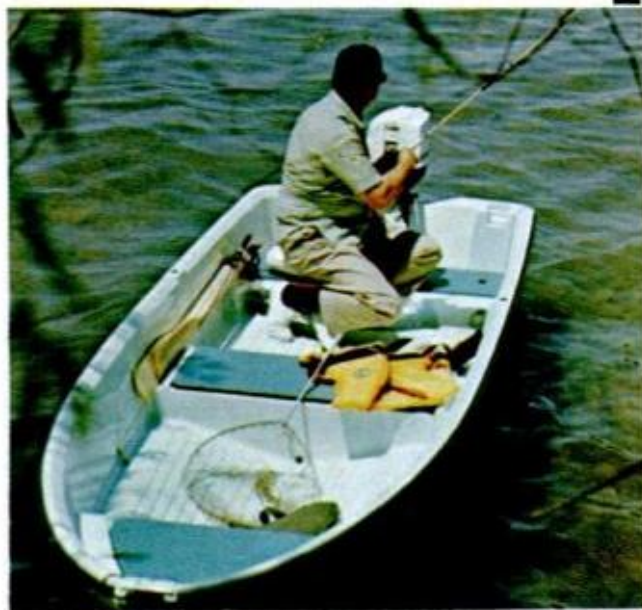
Boat shows are about to display more plastic and plush, power and performance

EACH YEAR, 'NEXT YEAR' comes earlier afloat with more builders announcing new lines ahead of the season. Our pre-boat-show selection here shows trends toward more speed, styling and color, using bigger horsepower in outboard motors, inboard engines, stern drives and increasingly popular water jets. Even electric outboards are getting stronger, and fish are due to get a bottom view of a great many new bass boats designed just for anglers trolling sheltered waters. ★★



1

2



3



4



5



POPULAR MECHANICS



6

1. **MFG RUNABOUTS** add color to line that includes new I/Os, cruisers, sail
2. **SUPER GAMEFISHER**, 12-footer by Sears, will be joined by ABS 14-footer
3. **SLEEKEST AND FASTEST:** Aronow's high-performing Cigarettes from Miami
4. **BOSTON WHALER** newcomer is Bass Boat 16 with pedestal seats standard
5. **STARCRAFT** aluminum cruisers will come in 18, 21 and 24-foot I/O models
6. **GLASTRON'S GT-150**, sporty 15-footer from top outboard, jet, I/O lines
7. **CHRYSLER CONQUEROR SIII** mounts 340-cu.-in. V8 stern-drive or water jet
8. **LARSON 1650 SHARK**, new trihull, carries six with outboard or I/O power



7

8



Little box that can be a work of art

You can convert a throwaway lotion box into one of these handsome chests

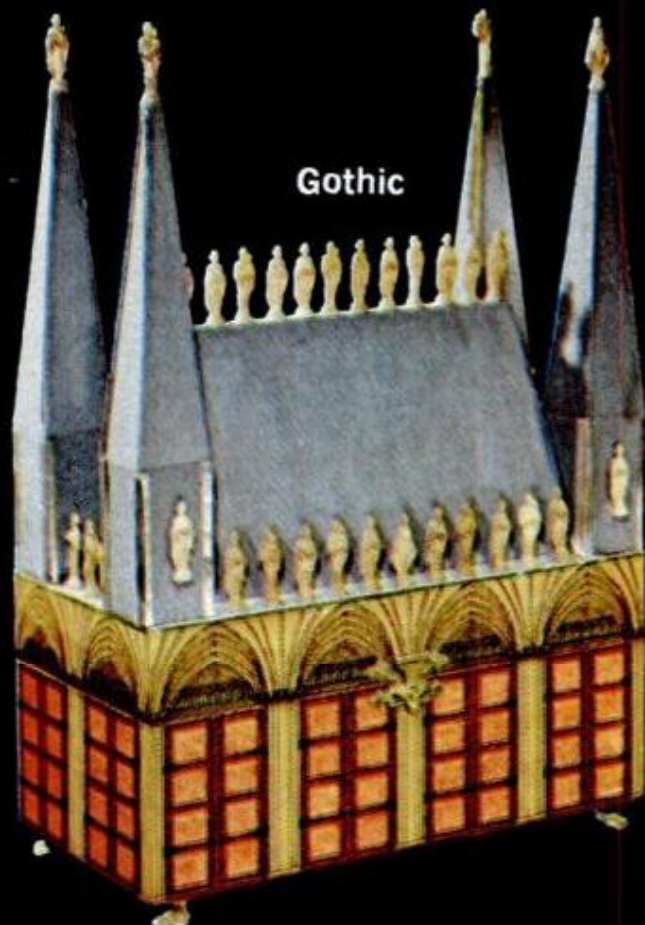
By WAYNE C. LECKEY, Home and Shop Editor



Camelot



Byzantine



Gothic

IT ALL STARTED with a gift from his wife. That's when Al Mesnooh, New York artist and freelance art consultant, began "tinkering around" making these handsome one-of-a-kind trinket chests.

The gift was a bottle of English Leather cologne by Mem which came in such a nicely made wooden box that Al just couldn't throw it away.

Since that first bottle, Al has used a lot of cologne for he has created a lot of chests from the empty boxes. His works of art have been displayed at countless banks, museums and art fairs in and around New York City. Many have brought a handsome price.

Appropriately named Camelot, Byzantine and Gothic, the three chests shown here in color are good examples of how his interest in ancient history and architecture have been put to use.

Asked where he found the tiny plastic figures, he answered: "Here and there, in hobby stores, gift shops and souvenir counters. Finding enough of them is my biggest problem."

An artist, Al decorates most of his boxes with his own exclusive designs, but, as he explained, "You don't have to be an artist to produce a handsome chest. In the case of my Camelot chest I made use of the embossed metallic designs from

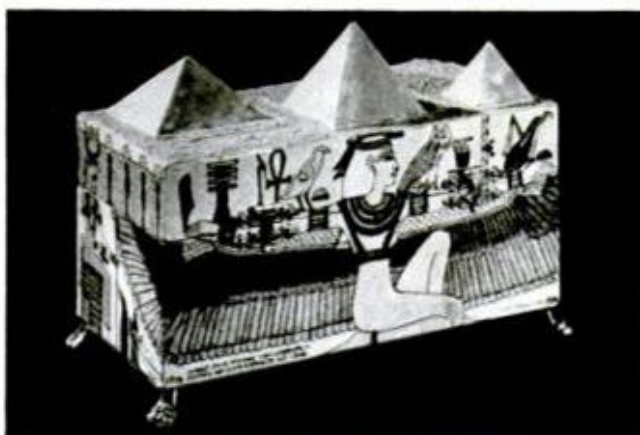
NICELY MADE OF REDWOOD, throwaway after-shave lotion box becomes "work of art" trinket chest when decorated and fitted with brass hardware as at left



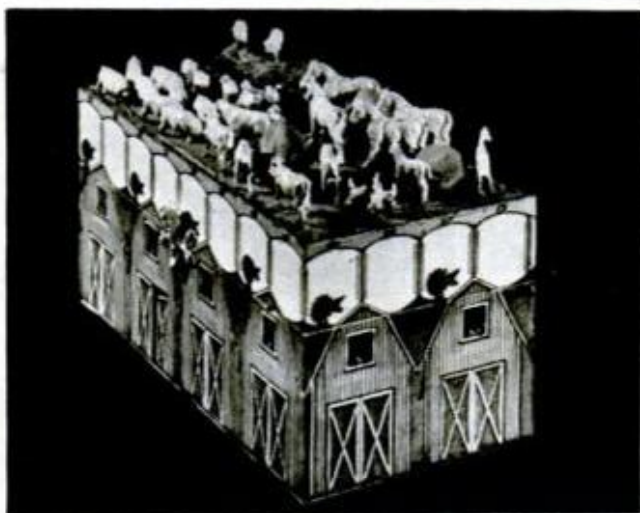
PHOTOS BY ROBERT D. BORST



CALLED BEN HUR, this handsome chest is decorated with stately columns depicting the Colosseum and a chariot race of tiny figures to complete the theme



the carton of a bottle of Chivas Regal Scotch whisky, antiqued them gold and applied them to the sides, ends and top. Magazines are a good source of appropriate pictures; so are cards and gift-wrapping paper. That's the fun part of it all, starting out with a theme and tracking down suitable figures and illustrations. Of course, when you can make your own designs, the fun is ever greater."



COMPLETE WITH PYRAMIDS resting in desert sand, this exotic chest (top photo) is decorated with appropriate pictures to give it an Egyptian motif. A country theme is achieved by adding tiny farm animals to cover of chest and barn illustrations to sides

Actually no specific box is required to start with. Anyone who is handy can make a suitable box from thin wood. Where the corners of the chest are left exposed, the "dovetailed" joints of the cologne box do add to the appearance of the completed chest as you see in Camelot. In cases where the box is to be completely covered, how the box is put together and what wood is used makes little difference as you see in the other examples.

The top of the cologne-bottle box actually becomes the bottom of the chest and the bottom, the lid; the cardboard liner is discarded. The lid is held in position by two tiny brass hinges. The latter, plus the feet and lid clasp, can be purchased from most well-stocked hardware stores. ★★



SPEED AND DISTANCE are shown on meters in RCA's experimental system. Reflector under plate of car ahead sends back radar signal at double frequency

Relax, let radar do the braking

There are several radar systems in operation right now, but the questions are: When will they become mandatory safety equipment? And which system will go into production at what cost?

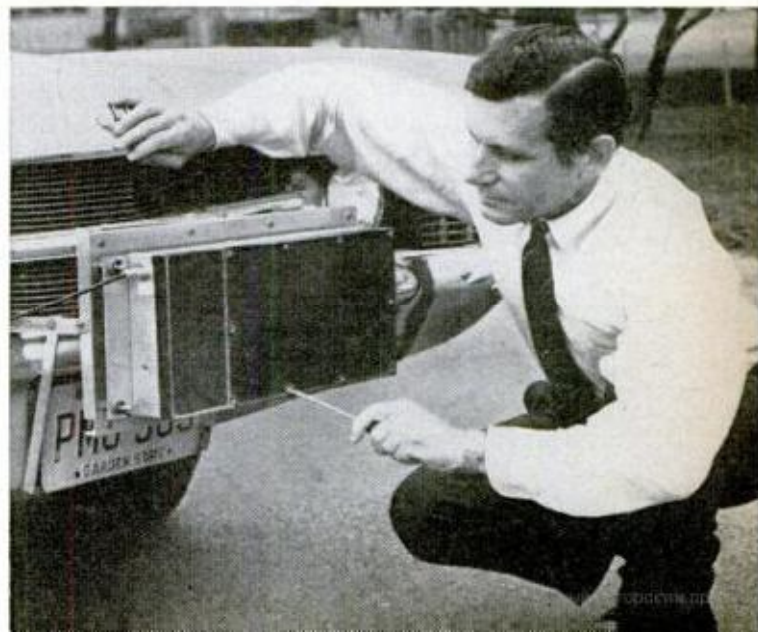
By **ROBERT LUND**, Detroit Auto Editor

IF YOU'RE INVOLVED in an automobile accident this year, the chances are one in four it will be a rear-ender. You'll be hit from behind or you'll plow into the back of another car. Those odds are going to get better over the next few years. Auto manufacturers have two projects in the works to cut down, or even eliminate, bash-'em-from-behind accidents.

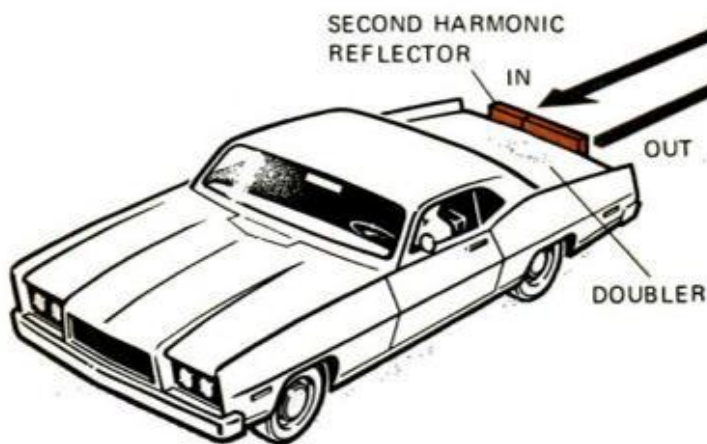
These devices are: 1) Radar brakes. 2) Headway controls that automatically maintain a safe distance between a lead car and following vehicles.

Radar brakes are about two years away;

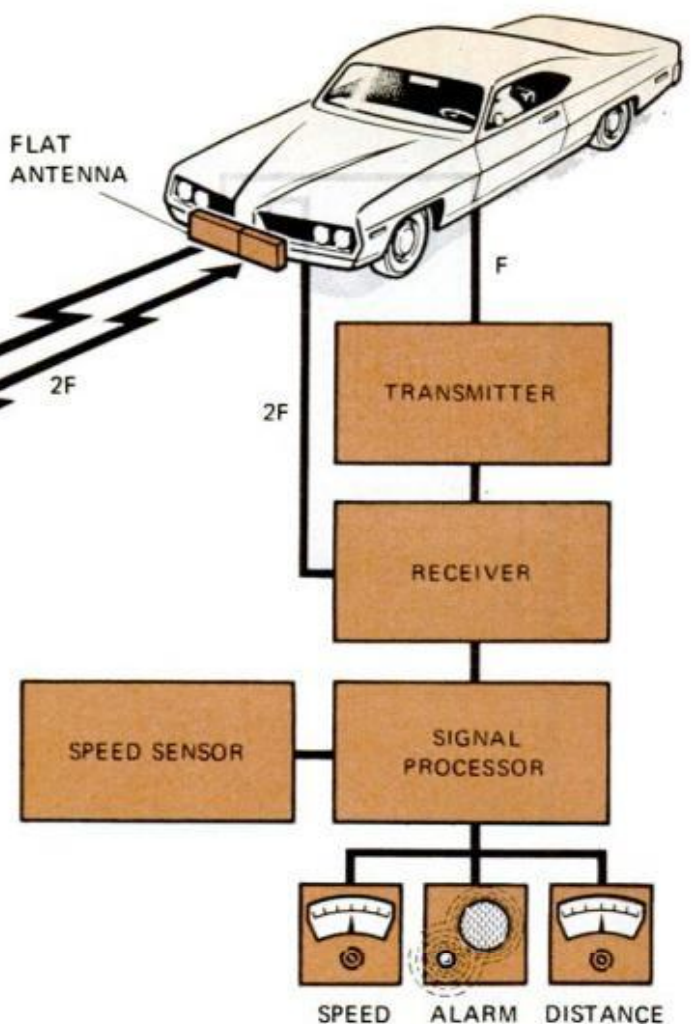
TRANSMITTER of experimental system is adjusted by RCA engineer. System is explained on the next page



IN RCA SYSTEM, following car transmits a signal (F) which is reflected back at twice the frequency (2F) by a special reflector on the rear of the car ahead. The radar then calculates the distance between the two cars and sounds a buzzer and flashes a light if the separation distance is too small. The technique of doubling the frequency eliminates false targets created by signals bouncing off signs, bridges and other objects. It also prevents two radar-equipped cars traveling in the opposite directions from blinding one another as they pass



FLOW DIAGRAM OF HARMONIC COLLISION-AVOIDANCE RADAR SYSTEM



Technical Art by Peter Trojan

they'll come on the '75 or '76 models. The National Highway Safety Administration is now writing a standard that will make the use of radar brakes mandatory by mid-decade.

Headway control won't come until sometime later. As a guess, probably on the '77 or '78 cars. But the auto companies could be pressured into moving sooner.

Radar brakes are ready now. It's a matter of deciding which version to use and then putting the item in production.

Two types of radar brakes are under consideration. One version sounds a warning when a car gets dangerously close to the car ahead. The signal is in the form of a light or a buzzer or a light-and-buzzer combination. Radar measures the distance between cars based on speed and alerts the driver to back off when he gets too close to the lead car.

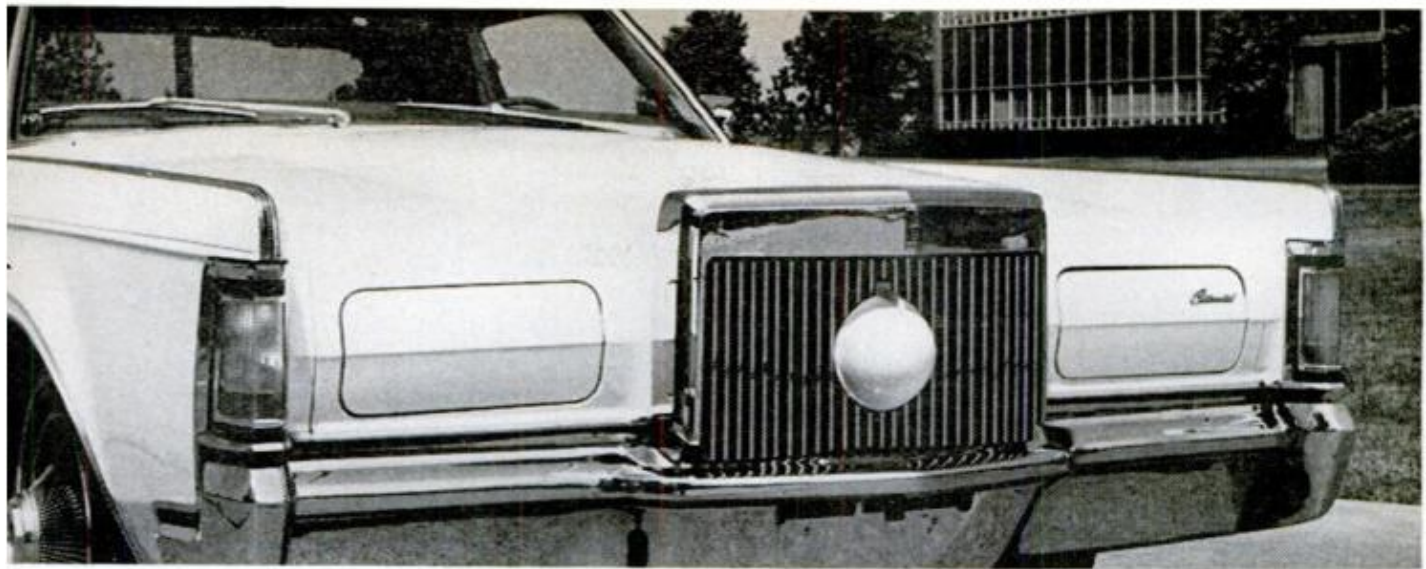
The second version of the radar brake is more sophisticated and performs a robot function. It alerts the driver of impending danger, eases up on the throttle and applies the brake. Automatically, without human intervention.

GM, Ford, RCA and several auto in-

dustry suppliers have working versions of both types of brakes, and the race is on to see which of the various systems will be adopted by the auto companies.

The only contender that has given a public demonstration of its system is RCA. In its version, both cars must be equipped with receivers and senders. The trailing car transmits a continuous signal which is received by a reflector on the rear of the vehicle ahead. The reflector doubles the frequency of the transmitted signal and relays it back to the radar. The radar measures the time required for the signal to make the round trip between the two cars. It then calculates the distance between cars and triggers a light buzzer warning if the separation distance falls below one car length for each 10 mph of speed between the vehicles. Range of the radar is a hundred yards.

The RCA unit corrects disadvantages inherent in earlier efforts to use radar on automobiles. It can distinguish between cars and such false targets as highway signs, bridges, trees and oncoming cars in the opposite lane of traffic. This is achieved because the radar is responsive



IN BENDIX SYSTEM brakes are applied automatically. Radar dome would be behind grille in production cars

only to signals produced by the reflector at double the transmitted frequency. But the RCA version could be used to detect bridges, trees and other objects simply by placing small reflectors on obstacles to be avoided.

RCA estimates its warning system radar—without the automatic braking feature—could be installed on a car for \$50 to \$100. The cost of producing only the reflector—that is, the receiving unit without the sending device—for installation on older cars would be less than \$10. RCA doesn't have a figure on what it would cost to include the automatic braking feature, but a long-time supplier to the auto companies estimates that linking the radar up to throttle and brakes would push the price up to \$200, give or take.

The auto companies are extremely cost-price conscious and will obviously opt for the less expensive version—a radar warning system without automatic braking—in the early stages. That's providing the government doesn't step in and order automakers to use the more expensive, safer unit incorporating both warning device and robot braking.

Car producers are already looking ahead to what comes after radar brakes. Next up: automatic headway control. When: probably not before 1978, according to Bendix, pioneer and leader in development of headway controls. How much: at today's prices, about what you'd pay for a factory-installed airconditioner. Say around \$400.

Headway control offers two advantages over a radar brake with automatic braking. With headway control, it's impossible

to tailgate another car without doing so intentionally. You can't get close enough to the car ahead to cause the brakes to slam on. The second advantage is that headway control operates independently of other vehicles. The car ahead doesn't require any kind of receiving device to maintain a safe distance between the two vehicles.

Two companies, Bendix in this country and Joseph Lucas, Ltd. in England, have built working versions of a headway control system.

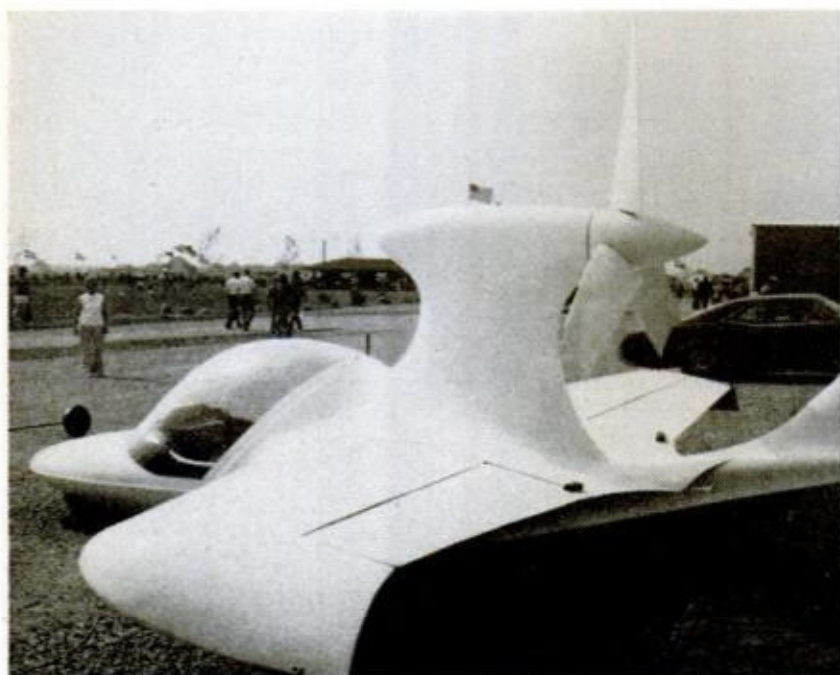
The Lucas system uses two four-inch radar "horns" mounted on the grille; one for transmitting, another for receiving. Computers on the car continuously calculate the distance between the lead car and the trailing vehicle. Brakes and throttle adjust automatically to maintain a safe distance between cars. But the driver can override the system at any time by going to manual operation of brake or accelerator.

Bendix has been working on headway control since 1957, longer than any other automaker or supplier. The company's current test car with a headway control installation is a 1969 Continental Mark III. (The car will soon be retired, because Bendix wants to install the system in a smaller, less expensive automobile and incorporate changes it has made in the radar hardware since 1969.)

Bendix calls its system adaptive speed control. It uses a radar sensor to measure headway or range and closing velocity of the controlled car to the lead vehicle. A signal processor analyzes this information

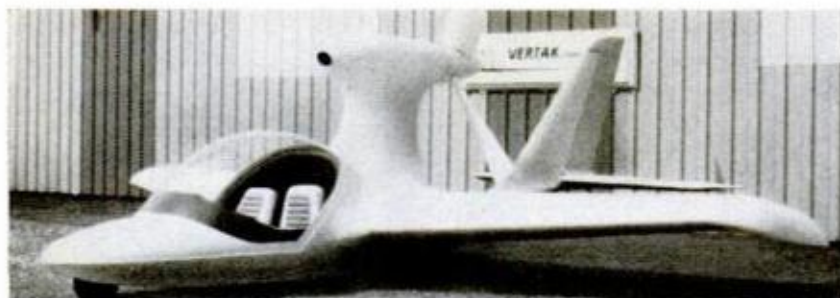
(Please turn to page 186)

IT'S NEW NOW



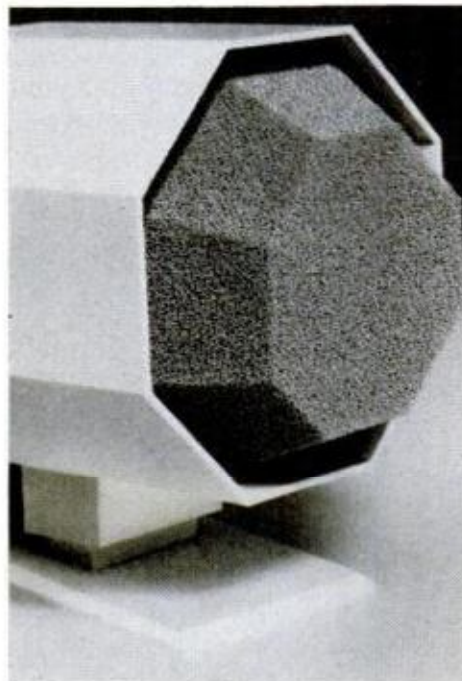
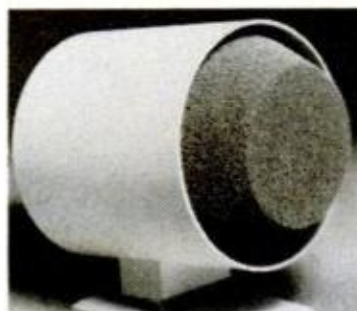
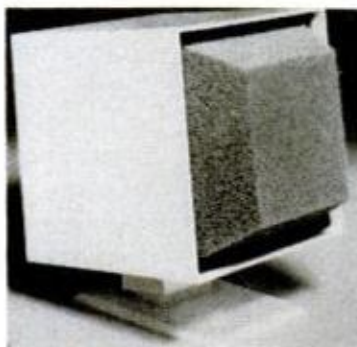
Kit-built plastic plane designed to take off in less than 100 feet

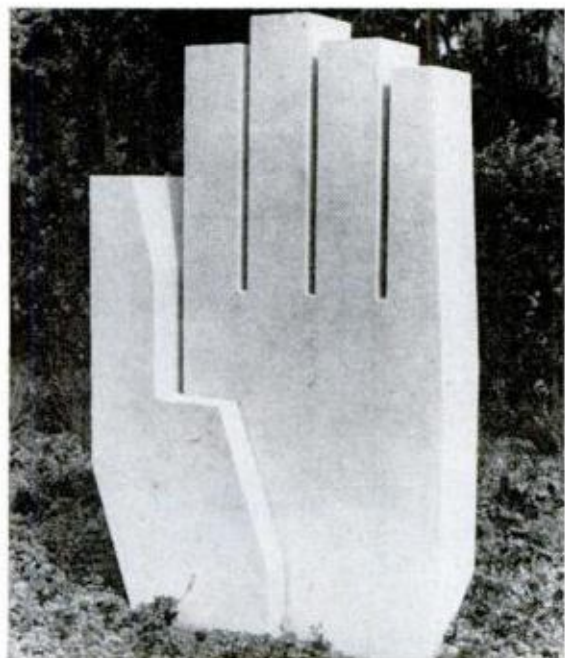
This futuristic-looking two-seater by Vertak was recently unveiled in full-scale mock-up. The S-221, expected to be the first in a series of certified and kit-built craft, has claimed takeoff capabilities under 100 feet. The plane is built mainly of plastics, for lower costs and greater strength. It sits low to the ground to allow a simpler landing-gear retraction system and to take advantage of ground effect on takeoff. The plane can be powered by a 130-hp Curtiss-Wright Wankel or a 210-hp Continental in two-seat configuration, or by twin Wankels as a four-seater. Powered by the 210-hp Continental, it is said to have a 273-mph top speed, and an 1120-mile range at 40 percent power (200 mph), with 32.5 mpg fuel consumption. Weight is 950 pounds; wingspan 24 feet. Kit price is expected to be as low as \$4500; certified model under \$5900. Vertak Corp., Box 658, Troy, Ohio 45373.



New shapes and colors for indoor-outdoor speakers

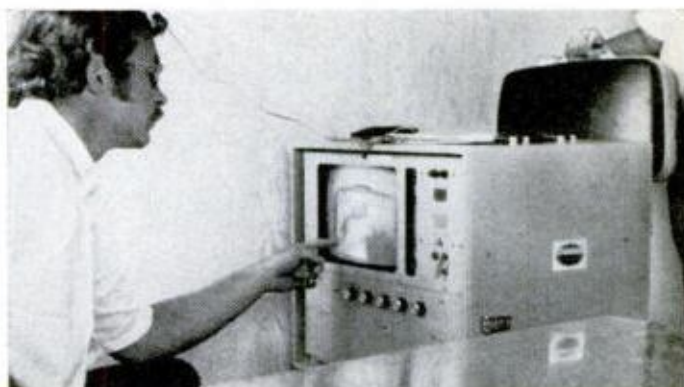
You have a choice of square, round and octagon shapes in a new group of loudspeakers offered by Sound West. In addition, the removable, weather-resistant grilles come in a color selection that includes rust, blue, gold, black and white. Housed in a tough white ABS-plastic enclosure, each speaker weighs only two pounds and can be located anywhere in your house or yard. Speaker dimensions are: 6 inches wide, 7½ inches high and 7 inches long. Retail price is \$14.95. The manufacturer is Sound West, Inc., 14201 Bessemer, Van Nuys, Calif. 91401.





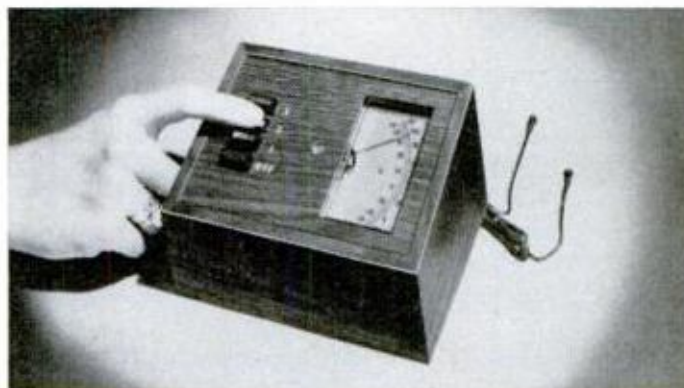
Futuristic headstones enliven Dutch cemetery

Modern headstones break the uniform solemnity of the Crooswijk graveyard in Rotterdam, Holland. To help bereaved families and others recognize the cemetery as "a vibrant, living place—a pleasant place for a stroll," Crooswijk allows the use of tasteful, futuristic headstones such as those shown above. Many of the stones (top) are based on the traditional oblong slab, but with their sides and faces rounded or carved for a more pleasing appearance; others are ultramodern. Representational art has its place, too, as with the gigantic hand (lower photo) which seems to some observers to point the way above, and seems to others a call for the respectful attention of the passer-by.



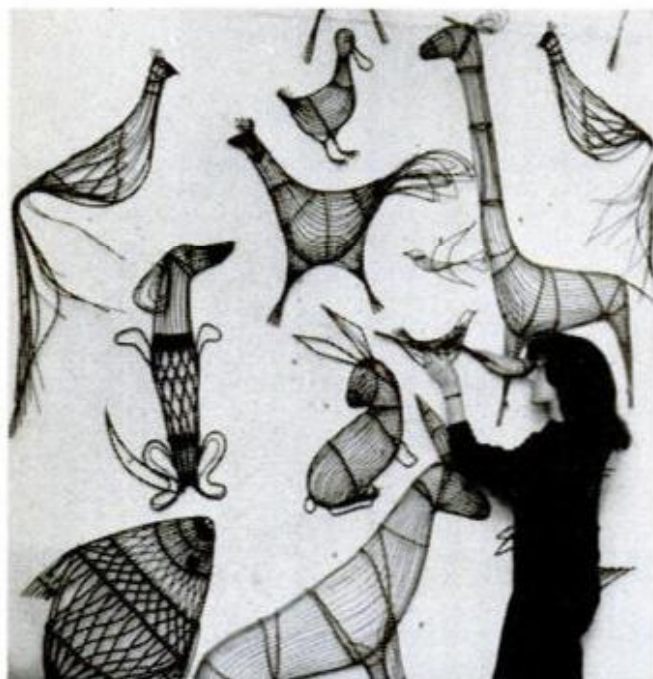
X-ray skyjack spotter

That's a gun in that innocent-looking suitcase, easily visible on the screen of the Norelco Saferay Detection System. A high-speed pulse lasting only 50 billionths of a second X-rays the bag and stores an image of its contents on the TV tube. The pulse is too short to be dangerous (small fraction of average daily dose of natural radiation) or to fog film. But commercial installations, now beginning, will X-ray bags as they pass down a conveyor, so passengers won't be exposed. Norelco, 100 East 42 St., New York, N.Y. 10017.



Electronic thermometer reads remote temperatures

This new, electronic thermometer reads the temperature at any of three different locations up to a thousand feet away. It covers temperatures from -20° to 122° F., and its "D" battery lasts a year. Two plug-in temperature probes with extendable, weatherproof cords are provided, and there is a socket for a third probe. Model 8600, \$39.95. James Electronics, Inc., 4050 North Rockwell St., Chicago, Ill. 60618.



Parisian artist works in wicker

To most people, wicker is just the hard, stinky material from which porch furniture is made. But to Sylvia Meyer, a Swiss artist now in Paris, it's a new art medium. Visitors to her studio discover animals, people, wall decorations and vehicles all made of wicker—and her wicker display mannequins have been used by Fath, Dior, Balmain and others.



Spray-on repairs for fiberglass motor homes

Scratches and scrapes on fiberglass motor homes can now be repaired with an aerosol spray kit. Thirteen different colors are available in the new Valspar Armor-Spray Gel-Coat Repair Kit, which can be stored for a year. Half-pint kit covers 16 sq. ft., costs \$7.50 at marine stores.

POPULAR MECHANICS



From suitcase to sailboat

There's a Stowaway sailboat in those two duffel bags (far left). Unpack the 95-pound boat (that weight includes both sails and oars), assemble it, and in 45 minutes you can be out on the water, sailing or rowing happily. Airbags beneath the bow deck and stern seat, and foam in the aluminum ribs keep the boat unsinkable. \$695. Sport Skiff, Cedar Hill Ave., Nyack, N.Y. 10960.



Water-ski grips grip you back

Soft, but tough, rollers of Dow Ethafoam in these new EZ-Grip handles press against the back of a water skier's hands to help him (or her) keep a firm grasp without fatigue. When the rope goes slack or line is released, the roller pressure relaxes, so the skier can let go easily. Under \$14; Aqua Ski, Sacramento, Calif.



Turned-on heater cools it safely

Quick-lighting new propane catalytic heaters for sportsmen start without flare-up, and now Coleman's Model 5445-708 has an automatic safety shutoff for fuel if the flame goes out. Heat is adjustable from 2000 to 5000 B.T.U., and \$50 unit can use refillable tanks.



Next spring the riders will be out in force

If you have a big lawn, your next mower could be a rider. For '73 there's a wide choice of the "take-it-easy" machines. The 7-hp, rear-engine Toro shown is a good example of what some new models offer: adjustable steering post, parking brake, key starting. Price: \$499.95. Other Toro riders start at \$329.95.



At last: a museum for useless things

Need a tandem bicycle that faces two ways at once, for people who disagree on the direction they want to ride? A faucet that feeds back into itself, so that it positively can't drip? A snowshoe-tired bicycle (when it doesn't snow, you can play tennis)? You'll find them all—and anything else you've never dreamed of looking for—at the Museum of Useless Things. It's in Paris, now, but coming soon to Dallas. The table? Its for Ping-Pong players who don't level with each other.

World's fastest fire truck is race driver's best friend

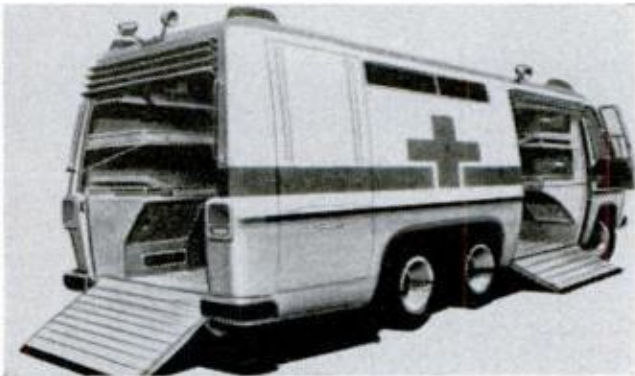
This fire engine gets around race-courses in true sports-car time—because it is a true sports car, a 335-hp Maserati Ghibli, with two foam fire-extinguisher cannons on top. The outfit was demonstrated recently at the Hockenheim racing circuit in West Germany. So far it's just an experiment. But the 168-mph Ghibli is available, without extinguishers, for \$22,500.



Rolo goes boinggg! And your cassettes sit neatly on your shelf



Cassettes are the last word in musical convenience—until you try to store them neatly. Stack them, and you wind up with an untidy pile. Buy a cabinet for them, and the cabinet wastes space until it's full. So a British inventor came up with Rolo. It's a coiled ribbon that attaches to a shelf. Take out one cassette—or several—and it rolls back snugly, keeping the remaining cassettes in place. Made from a combination of acrylic and stainless steels, Rolo is available in two designs, to hold 17 cassettes or 12 cartridges. They sell in Britain for about \$3.60 and \$4.25, respectively. Top Secret, Ltd., Quest House Horley, Surrey, England.



New GM motor home lends chassis to bus, ambulance

The small transit bus, emergency rescue vehicle and motor home above are all based on the same new GMC chassis. The new design has front-wheel drive, a low, wide frame, tandem rear wheels with independent air suspension, and bodies of aluminum and molded fiberglass; the motor home will be available this year. GM is thinking of a van version.



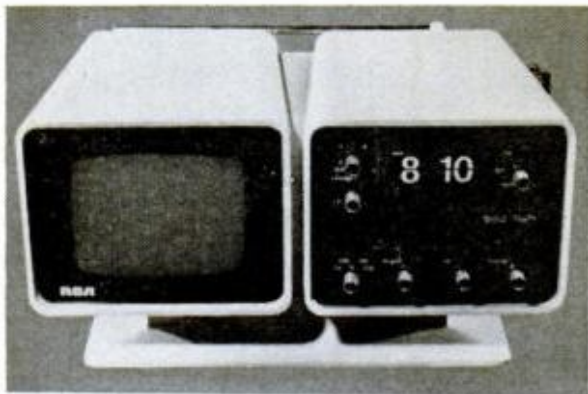
Using hands as fingerprints

Place your hand on the machine above, insert any identification card, and the machine will compare your hand measurements to data magnetically recorded on the card, to tell if you're really you or not. Users range from banks, to methadone clinics, to the Air Force. Lower photo shows the principle: hand points are plotted on a radial grid. Cost: about \$3000 to \$5000. System was developed by Identification Marketing, 408 Paulding Ave., Northvale, N.J. 07647.

Wristwatch strap carries medical emergency information



Pull the "SOS" medallion off this wrist-strap, and out comes a tale of medical woe: a complete list of the wearer's diseases, allergies, medication, shots, blood group—everything a doctor would need to know in an emergency. Cost is about \$5 to \$15, in Germany.



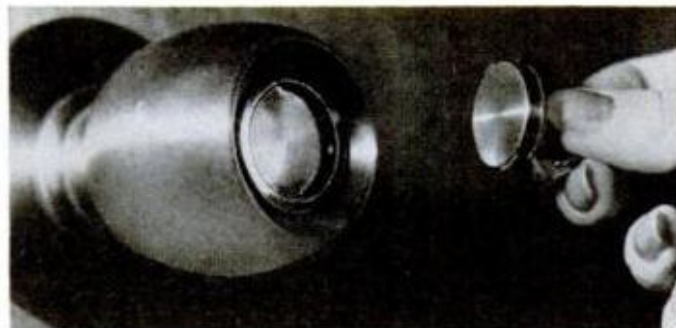
New styles in home electronics

RCA's new Lunar I (top) combines a solid-state, 5-inch TV receiver, FM/AM radio, and a digital clock in two matching pods; about \$160. Electrohome's 19-inch "Contour" color TV has equally unique styling: \$579.95. Also from Electrohome, the new "720" stereo holds 40-watt AM/FM-stereo receiver, and turntable under a plexiglass bubble. \$249.95. For information, write RCA, 600 N. Sherman, Indianapolis, Ind. 46201; Electrohome, Kitchener, Ont.



For your wall: a plastic gallery of wooden ships

Cutty Sark (above), the U.S.S. *Constitution* and a Spanish galleon are the first of Revell's new Olde Ships Gallery of wall-mounting models. Each ship rests against an "antique" map reflecting its history. \$6 each, at romance-minded model and hobby shops.



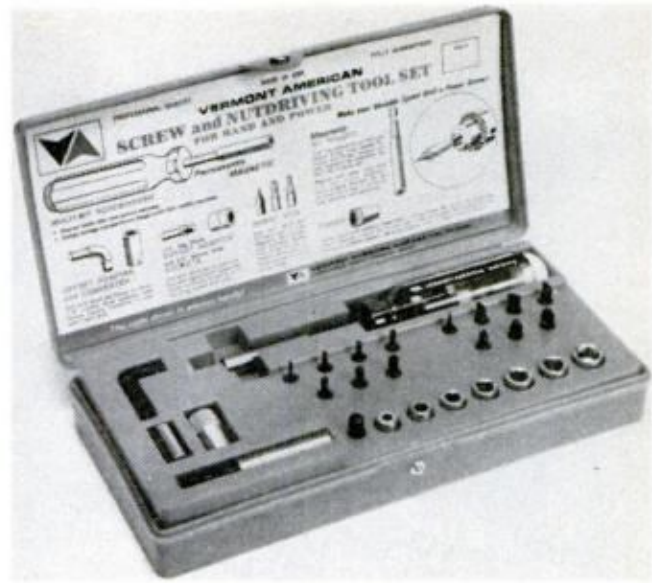
Lock without a keyhole

Dirt, dust, water and would-be lockpickers can't find the keyhole of the new Maglock now available in England. The key is a $\frac{3}{4}$ -inch disc whose magnetic pattern aligns tiny magnets within the lock. Only if the magnetic "combination" is right will the lock open.



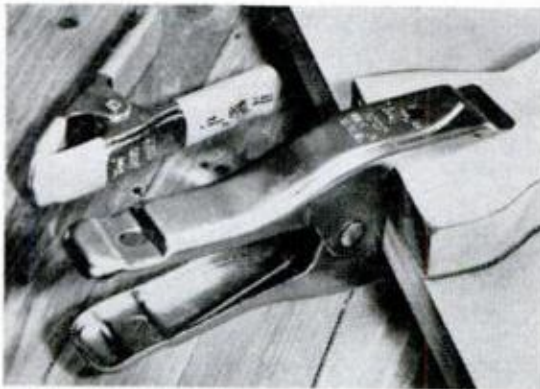
Handsome knife for your desk or workbench

Well-made workbench or desk knife boasts a comfortable handle and a $1\frac{7}{8}$ -in.-long, high-carbon, manganese-alloy steel blade which takes and holds a razor-sharp edge. It's a good tool for whittlers, patternmakers and modelers. Specify catalog No. D-1527.1 Bench Knife. \$1.75 plus 70 cents postage from Brookstone Co., Dept. C-PM, 11 Brookstone Building, Peterborough, N.H.



Tool set makes you a superdriver

This set offered by Vermont American, Box 340, Lincolnton, N.C. 28092, includes multi-bit magnetic hand screwdriver, magnetic bit holder, adapters, 14 insert bits and seven $\frac{1}{4}$ -in.-sq. drive sockets for driving 21 different sizes of Phillips, Allen and hexhead nuts and screws by hand. A 90° adapter included in set permits driving screws in hard-to-reach places; permanent magnets makes bit-changing fast and easy. About \$19.99.



Better gripping spring clamps

When the jaws of these clamps are opened to full capacity they are parallel—rather than beyond parallel—and thus won't slip off work. The new-design Pony spring clamps come in four sizes, 1 to 4-in. jaw capacities, sell for 50 cents to \$3. Adjustable Clamp Co., Chicago, Ill. 60622.



Pedestrian cloverleaf crosses intersection

Pedestrians at this busy London intersection never need to wait for the light to change. Instead, an unusual pattern of four elevated walkways provides full-time access from any of the four corners to each of the others.

NOW



Binoculars you can hide in a cigaret pack

These 8x20 binoculars have 16-element optics, eyepiece focusing, rubber eyecups that fold away for eyeglass wearers. Only 5¼ ounces, they fold to 2½ x 1¾ inches (smaller than a 100-mm-cigarette pack). Konica Pocket Binocular, \$99.95. For information, write to Berkey, 25-20 Brooklyn-Queens Expressway West, Woodside, N.Y. 11377.



A warm massage that straps on

This belt has both heating elements and a vibrating massage unit. Fastened by adjustable Velcro strips, it can be strapped on almost anywhere. S1 belt, \$39.95; smaller S2 for arms and legs, \$34.95. Available from Florin, 28 Woodside Dr., Penfield, N.Y. 14256.



Detecting plaque on your teeth is easy with special light

Plaque is the gummy, colorless mass of bacteria manufactured in the mouth that's the cause of much gum infection and tooth decay. You can spot plaque—and thus know where to brush and use dental floss—with a Plak-Lite "disclosing" kit. You swish around in your mouth a water-soluble fluorescein solution that adheres to plaque. Then you beam white, filtered light on your pearls and view them with a special mirror. The plaque areas to be cleaned are all aglow! Plak-Lite kits are available at drugstores at a price of \$24.95.



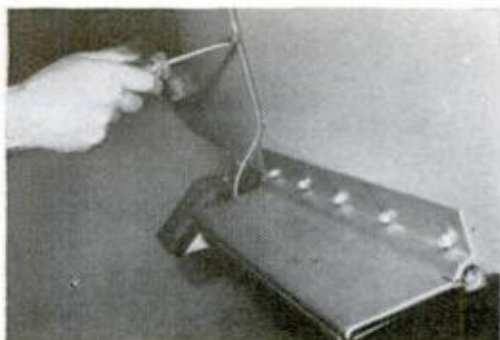
Four channels from your car stereo

Add the Realistic Auto Quatravox to your car's stereo tape player or stereo FM radio, and you add a four-channel effect—rear-channel "concert-hall" ambience. \$9.95 from Radio Shack, 2725 West 7th St., Fort Worth, Tex. 76107.



Small tape, big counter

"Magically" changing tape counter on transparent lid of Panasonic's experimental RQ-4000S cassette recorder is easy to read. When off, the liquid crystal numbers are transparent, too.



D-I-Y trim tabs

Porpoising prevention, quick planing and better balance for a boat are among advantages claimed by ICM Marine Products Ltd., 322 South Michigan Ave., Chicago, Ill., for its Insumatic Total-trims. Designed for owner installation, dash-controlled trim tabs are \$149 for 20-footers, \$300 for up to 35 feet.



Wristband totes tape

Trying to wrap a package with one hand, hold the tape dispenser with another, and pull off the tape with your remaining hand? Strap Tape Toter to your wrist and you can do it. \$1.29 plus 20 cents shipping from Alpine Valley Enterprises, 138 Maple St., Wilmington, Del. 19808.



Hop rod— world's first self-powered pogo stick

The world's simplest gasoline engine powers this one-cylinder pogo stick. Jumping on the footbar compresses the fuel/air mixture in the cylinder; when it fires, it adds extra boost to your rebound. Since the motion is linear, no crankshaft or connecting rods are needed. The four-ounce fuel tank holds gasoline and oil enough for nearly 600 hops, or 30 minutes of running time, even with a 280-pound rider. As a safety feature, the engine automatically stops when the rider dismounts. Priced under \$70. From Auto World, Inc., 701 North Keyser Ave., Scranton, Pa. 18508.



New enlargers have snappy features

Those L-shaped magnets on the new Paterson enlarger's baseboard (top) hold paper flat against the metal board for borderless enlargements up to 12.5X, from 35-mm or 126 negatives. \$89.95. Write: Braun, 55 Cambridge Pkwy., Cambridge, Mass. 02142. Durst's newest M601 model (bottom) has a movable head and negative-masking blades for easier cropping, head and lensboard tilts for perspective corrections, goes to 14X from 35-mm or 126 with 50-mm lens; to 9X on 2¼-square negatives, with 75-mm lens. \$199.50. EPOI, 623 Stewart Ave., Garden City, N.Y. 11530.

NOW

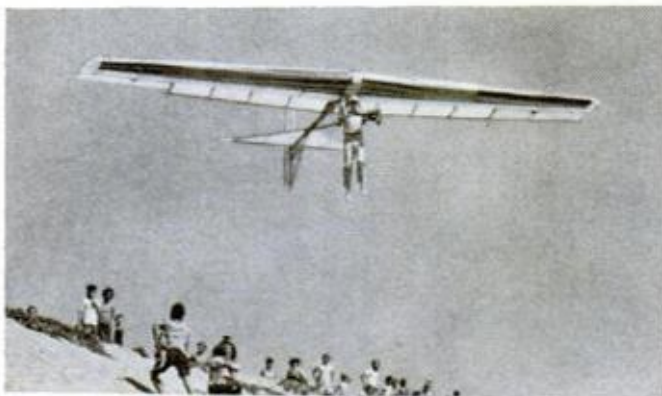
Handful of tests for car tune-ups

This new, hand-held engine tester from Micronta checks ignition dwell angle, engine speed and the condition of the points on U.S. or imported cars or trucks with four, six, or eight cylinders. It's \$17.95 from Radio Shack, 2725 West 7th St., Fort Worth, Tex. 76107.



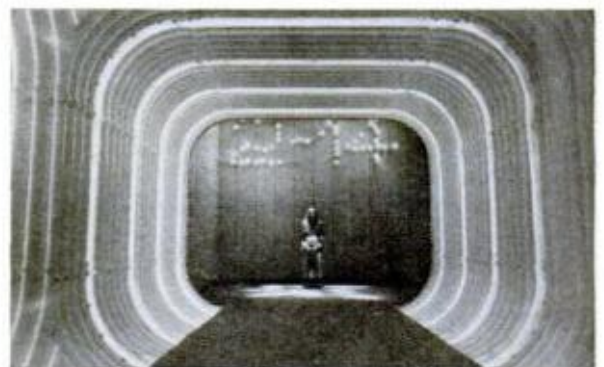
Bobsled: A gravity-driven "snowmobile"

Now you can hit snowmobile speeds without the noise of snowmobiles—just find a steep snow-covered hill to whizz down on this new Gladding-Hedlund bobsled. The sled has a rugged steel frame and hood and hardwood slats and skis. Like the racing models, it has 40° steering and hand brakes. The 5-foot-long bobsled seats two adults or three to four children. About \$60. It's made by Gladding Corp., Box 250, South Paris, Me. 04281.



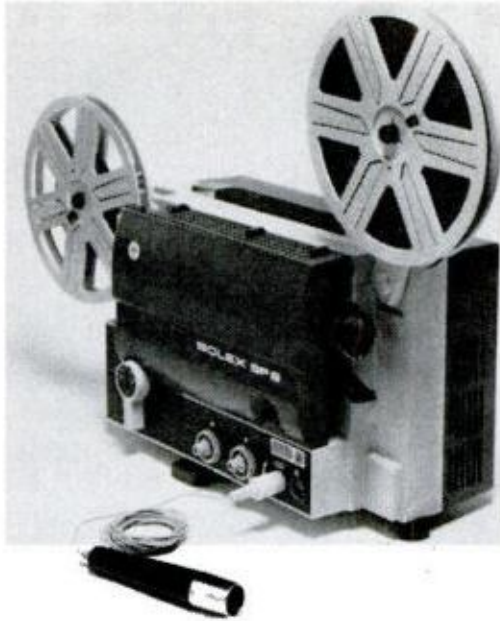
An advanced hang glider that even has controls

This sophisticated hang glider—the Jensen-Culver Swingwing VJ-23—has a cantilever wing and is guided by means of controls. It can make soaring flights in 15-mph breezes and has set records for altitude, distance and duration. It weighs 100 pounds, has a wingspan of 32 feet and is 15 feet long. The wheels flanking the pilot are handy for pushing the glider back to its launching spot. Plans are available. For an information kit, write: Volmer Aircraft, 104 East Providencia, Burbank, Calif. 91502.



Tunnel into office

Welcome to the twilight zone? No, this plushly carpeted 58-foot tunnel, with its white fluted steel walls ringed with blue-glowing neon tubes, leads directly from the sidewalk into an office building in New York's financial district. The tunnel has no door, to ease lobby congestion. Elevators are to the right and left of the receptionist. "After New York's hard sidewalks, entering the tunnel is like entering a dream," said one visitor.



Blinking sound projector

Blinking lights show the sound level when you add soundtracks to home movies with this new Bolex SP8 Super-8 and 8-mm projector. Recording level is automatically or manually controlled. \$299.50. Information from Paillard, Inc., 1900 Lower Rd., Linden, N.J. 07036.



New garden tractor: Big on work but low on noise

You can cut noise pollution (while you're cutting the grass) with quieter garden equipment. One such machine is the new Bolens QT-16 tractor, equipped with a 16-hp, twin-cylinder opposed engine. Tests by an independent lab revealed a noise level of 69 decibels, below the limit of 70 decibels that will be the law in Chicago by 1975. In addition to a quieter engine, noise is reduced by the use of compound curves in the metal to diminish resonance, a big muffler, noise-damping materials under hood.



Better battery booster

Designed for 12-v. storage batteries, the 3-amp. Model BC-3 charger can also be used on 6 and 9-v. rechargeable batteries. Intended to restore batteries at lowest possible cost, it's \$7.95 postpaid from the maker, American Consumer Products Corp., 555 John Downey Dr., New Britain, Conn. 06051.



Long trip for tractor that never left test stand

Some manufacturers go to great lengths to test a product. This New Holland S-8 tractor was mounted on a dynamometer and run continuously for 425 hours. That's equal to a straight-line run of 1800 miles, say engineers. No problems were reported.

It's hard to rob a bank when you can't even get in

By SHELDON M. GALLAGER

NEEED MONEY? Well, you just walk up to a "money machine," identify yourself by inserting a magnetically coded card in a slot, dial the amount you want and out pops the cash. You can have the money any time, day or night, and you don't even have to go into a bank to get it.

Such sidewalk money dispensers are only one of many electronic banking aids that are making things easier for the customer and tougher for the potential thief. You can't rob a bank that isn't there. Not only are the machines burglarproof, but they can even detect identification cards that have been lost, stolen or canceled. If anyone tries to use such a card, the mechanical teller automatically "swallows" it. Among many banks already using the devices are Chemical Bank in New York and Marine Midland in Buffalo.

Another device to foil thieves is the TV teller. You never get to meet her in person. You watch a pretty face on a TV screen, and the face relays instructions over a microphone. Checks, cash, deposit slips, savings-account books and other papers are all passed back and forth be-

tween you and the teller through a pneumatic tube system. Meanwhile, the pretty face is safely protected behind locked doors several floors away, completely isolated from the public. It's hard to threaten a TV screen with a knife or gun. One of the most automated banks using such a "remote-control" money-exchange system is Surety National in Los Angeles.

In addition to money dispensers, there are also mechanical depositors. You feed your check and deposit slip into a machine and the amount is automatically added to the balance in your account without your having to wait in a long line for a teller.

Computers are also playing a new role in modern banking. In major cities, they enable banks to furnish customers with one comprehensive monthly statement listing savings and checking balances, installment loan and mortgage figures. Chicago's Beverly Bank even lists checks in the exact sequence they were written.

These are just a few of the modern banking methods being promoted by the Foundation for Full Service Banks with its 14,000 full-service members. ★★★



CUSTOMERS STAND (left) at two of the six "telestations" in Surety National Bank's new automated branch in Los Angeles. They conduct their banking via closed-circuit TV, pneumatic tubes and voice

transmissions with a pretty teller who's located several floors away (right-hand photo). The center photo shows what the customer sees, including a telephone handset for privacy. Mosler makes the system

POPULAR MECHANICS



24-HOUR CASH SERVICE is offered by Chemical Bank's money machine in New York. Customer inserts her magnetic card, punches personal identification on keyboard, presses button for \$25 or \$50—then scoops cash from drawer. Machine confiscates cards listed as stolen, canceled or lost

ELECTRONIC SCOREBOARD on far wall directs customers at Equitable Trust in Baltimore to open teller windows. Customers take a numbered check, wait in single master line or in a comfortable lounge area until their number blinks on the board. Elsewhere, banks have reduced teller-line congestion by installing automatic check depositors, signal systems and computerized teller systems

How fast your boat really goes

Try this miniature timing trap, plus shortcut calculations, for a quick measure of performance



CARRYING A STANDARD LOAD, including ice and beverages, boat approaches first marker (foreground) of timing trap

By JIM MARTENHOFF

HERE'S A SPEEDY boat-speed trick that works on any lake, bay, river or stream. You set up your own speed trap, and do it in a way that makes the arithmetic extra easy. You can check out your speedometer or get quick miles-per-hour without one, determine boat performance and calibrate a tachometer to read your boat speeds as well.

We'll be talking statute miles exclusively (most small-craft owners do since it makes their rigs seem faster than nautical-mile speeds do), but instead of calling a mile 5280 feet long we'll call it 3600 seconds, the number of seconds in an hour.

Run a measured mile. Time your boat in seconds. Divide seconds run into 3600 and the answer is your speed. If you run the mile in 100 seconds, you're going 36 miles an hour. It's that simple and a lot less work than any of the time-speed-

distance formulae that can be found in textbooks.

If a mile is 3600 seconds, then a half-mile is 1800, a quarter mile is 900 and so on. Measure off a distance of 440 feet which equals 300 seconds, run the trap, and if your time is 10 seconds your speed is 30 mph.

Your trap is measured along any handy beach or stretch of shoreline where you can run parallel to it, within easy sight of your markers. Make sure there are no shoals or rocks. Any respectable distance between easy-to-spot trees, boulders or other landmarks will work. If they don't stand out enough, a dab of paint can mark them. Stakes at right angles between them and the water can provide "ranges" for sighting.

A 100-foot tape measure will make trap measuring easy, but you can also use a measured length of 50 or 100 feet of an-

A SIMPLE 'SPEEDOMETER' DISTANCE ON SHORE



FOR SOLO SPEED TIMING, plant flags or markers ashore, one behind another at each end for a "range," and time a 440-foot stretch, for example. Divide seconds into 300. Ten would equal 30 mph

chor or ski-tow line plus a short tape. Laying out your trap makes a good boat club project. It must be accurate and parallel to the water, but it's a chore that has to be done only once.

When you have your trap length measured in feet, you convert it to "seconds" to simplify that math. To do this, multiply your trap length by .682, (a conversion factor derived by dividing 5280 into 3600). A seven-place answer is .6818181, but rounded off to three is plenty. Again, you only multiply trap length times .682 once. Then you can forget the foot-length of your trap and just remember the length in terms of time.

Suppose you measure between two trees and find they are 565 feet apart. Multiplying by .682 gives 385.33 which you

can round off to 385. Run your distance and time it. You'll need a stopwatch. You can round off long distances but you can't round off running times. Suppose you ran that 385-trap in 13.3 seconds. Divide 385 by 13.3 and your speed comes out to 28.9 statute miles per hour. To cancel out any wind or currents, run your trap both ways and average the speeds.

Don't worry about timing-lag errors as you punch the stopwatch. They tend to cancel out after several runs. To improve accuracy, sight across a windshield brace, seatback or even the top of the motor. Start and stop the watch when your range ashore lines up with your sighting line fixture aboard. Carrying an observer aboard to do this makes driving easier, and to determine useful speeds you



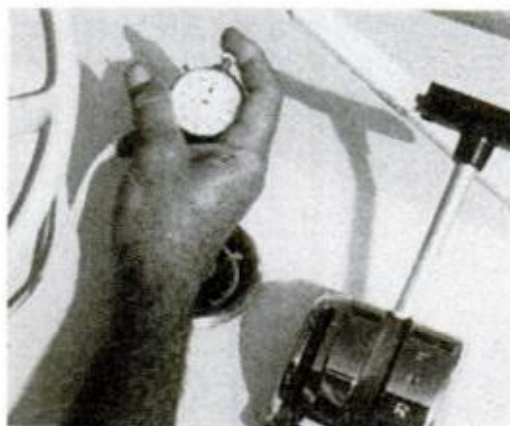
LINING UP BOAT windshield with in-line dockside landmarks provides accurate start and finish points for speed trap. Boat clubs can also station timers ashore at each end of measured course to clock and record up and downwind passes by member drivers

TAPE-MEASURE CHECK of distance between the trap markers is a tedious job, but once completed, can provide a permanent course for boating speed checks
JANUARY 1973

should load up first with the passengers and even the ice, drinks, gas and gear that you normally carry.

For determining true speeds at a variety of throttle settings, the simple division calculations can be made with pencil and paper, even though this is admittedly tedious.

For an easier way to do this, just buy or borrow one of the popular new little pocket-sized electronic calculators. Or try a dime-store substitute—a plastic slide rule. Use the "C" and "D" scales along the bottom. As shown in our illustration, we had a trap 440 feet long which con-



CALCULATIONS must be based on stopwatch timing (seconds cannot be rounded off), but a slide rule, shown here indicating 25 mph for a 440-foot range, makes figuring quick and easy. The speeds resulting can be pasted around tach to make it a speedometer

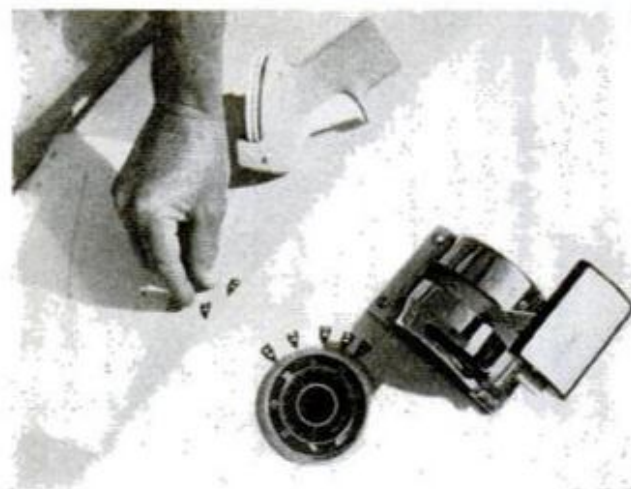
verts to 300 seconds. Running time was 12 seconds, and the mark for 12 on the "D" scale was placed directly under the 3 on the "C" scale, which stands for 300 seconds. (The only knack to using a slide rule is learning to insert your own zeros and decimals.) You read the answer directly above the 1 on the "D" scale—in this case, 25 miles per hour.

Slide rules come with simple directions, and as you can see, it takes only a few moments to compute speeds and it doesn't matter if your time is in fifths or tenths of a second.

Once you know your top speed, what next? Make at least two more runs, one at bare planing speed and another at moderate cruising speed. If you think you'll ever need it, make timed runs with the boat off plane at speeds such as you might use in nasty going during poor weather. Write down these speeds while noting the readings on the tachometer, which most

speedy outboards and stern drives have. On dime-store graph paper, write the rpm down the left side in units of 100 or 200, and write speeds across the bottom the same way. Plot your timed speeds on the graph opposite your recorded rpm numbers and connect your marks into a curve.

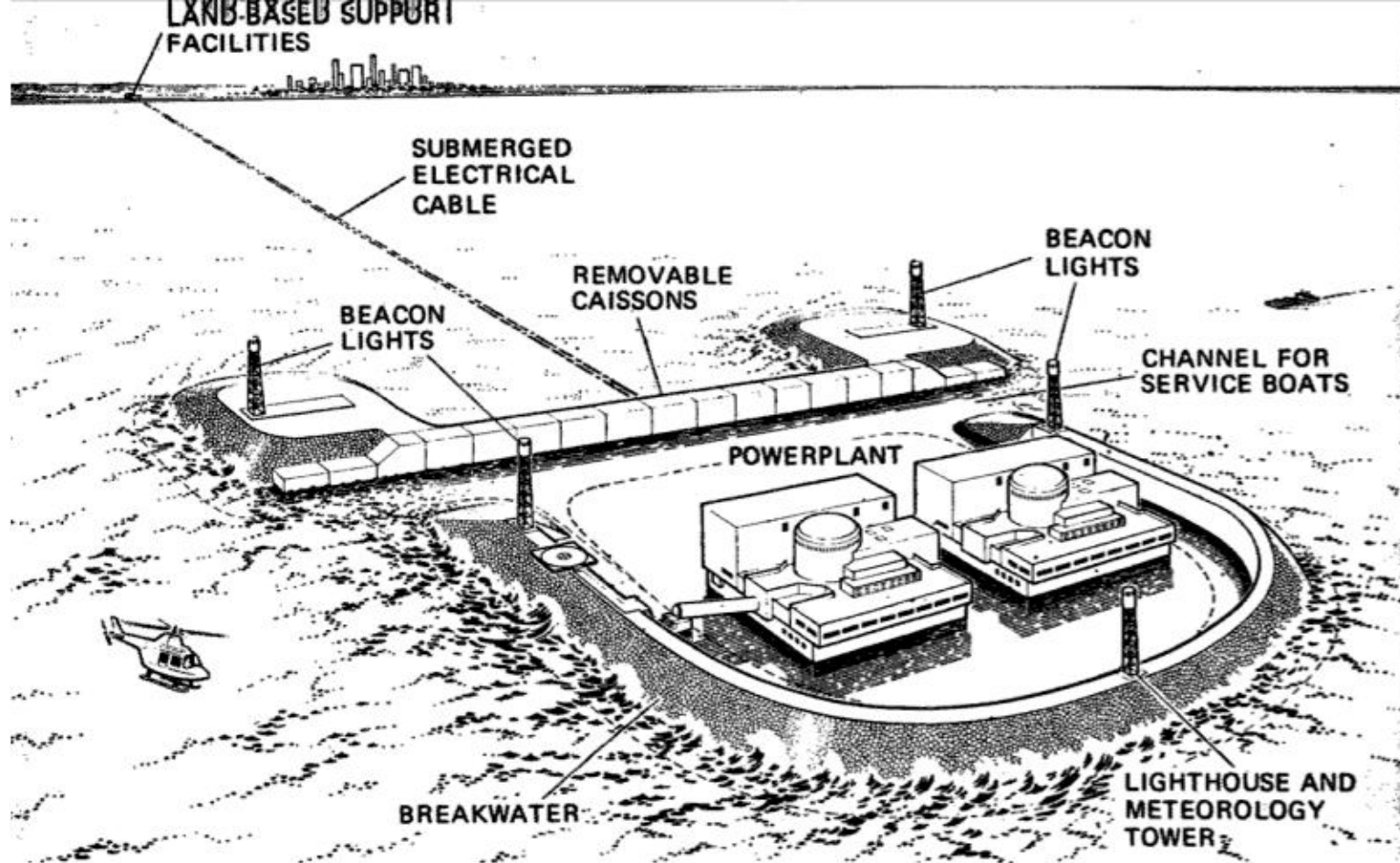
Now you have a table of speeds for various rpm settings. Yachtsmen might carry this around in a log book, which can be a pain in the neck in a small boat. Instead, use this trick. Pick suitable speeds for slow cruise, fast cruise, ski speed perhaps, and wide open. With a labelmaker,



print these speeds, cut them with an arrow-point and paste them at proper rpm spots around the rim of your tach to make it into a speedometer. It will prove to be accurate enough for small-boat open-water navigation.

When using charts and nautical miles, multiply statute speeds by .8689 and they become knots—which are nautical miles per hour.

Sounds like a lot of work? Not really. You only measure your speed trap once, and many of your calculations, once figured, are good forever. ★★★



Coming: Offshore nuclear powerplants

By **JOHN F. PEARSON**, Science Editor
Technical illustrations by Peter Trojan

AN UNUSUAL CEREMONY took place last September aboard a yacht off the New Jersey coast. In the main salon, before several dozen witnesses, two men signed their names to a contract. One man represented the Public Service Electric and Gas Co. of New Jersey, the other, Offshore Power Systems—and the contract called for an outlay of \$750 million for the world's first floating, offshore nuclear powerplant.

The seaborne ceremony was held in the vicinity of the proposed site, a point in the Atlantic just under three miles east of the coast and 12 miles northeast of Atlantic City. (By keeping the plant within New Jersey's three-mile limit, legal aspects of the project are simplified.) At the site, in 40 feet of water, engineers will build a breakwater to shelter the two floating units—each capable of generating 1.15 million kilowatts—that will make up the powerplant. Power will be transmitted to shore via underwater cable.

Environmental problems on land have caused nuclear-power developers to look to the oceans. Plants sited on rivers and estuaries tend to cause ecological upheavals with the release of huge amounts of heated water. The same water supposedly would not cause much of a stir in the ocean. In addition, a plant located miles from the nearest shore would pose less of a threat in the event of a nuclear accident.

The project represents advanced thinking in more ways than

one. Offshore Power Systems—a joint venture of Westinghouse Electric Corp. and Tenneco, Inc.—will build the 140,000-ton PMNPs (Platform Mounted Nuclear Powerplants) on an assembly line.

Preliminary work on the manufacturing facility has already begun on a 900-acre site in Jacksonville, Fla. A major feature will be a broad slip leading to a nearby waterway. Honeycomb platforms—about 400 feet on a side—will be fabricated at the start of the slip. They will then be moved down the slip and stopped at assembly stations where 650-ton gantry cranes will load on board various components, some weighing as much as 600 tons.

A completed PMNP will be floated out at the end of the slip and into the waterway for mooring at a testing area. After it's checked out, it will be towed seven miles to the Atlantic and then to its final destination. The first such tow—to the New Jersey site—is planned for 1979. According to present schedules, PMNP production (at a rate of two units a year) will start in mid-1975.

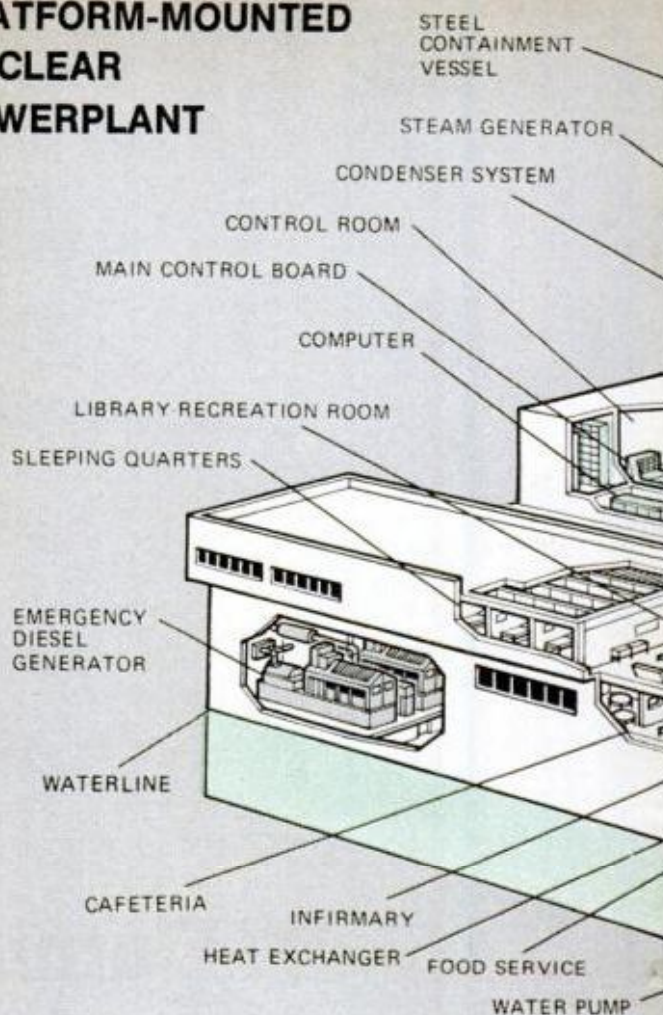
Work on the breakwater will begin in 1976. The U-shaped section, which will face the ocean, will be built first. Then after the two PMNPs are moored, the straight section facing land will be installed.

Some 3 million tons of concrete and other material will go into the building of the breakwater. It will measure 30 feet across at the top and 300 feet at the bottom, and will have enough heft to withstand hurricane-force winds and 43-foot waves—those that occur once in 100 years. The powerplant should be able to continue operating even during such a storm.

The breakwater will also provide solid protection for the PMNPs in the event of a ship collision. Impact studies indicate that a 190,000-ton tanker would do relatively little damage to the breakwater. Ships larger than that would have too deep a draft to even get close. In addition, the facility is located away from the normal shipping lanes.

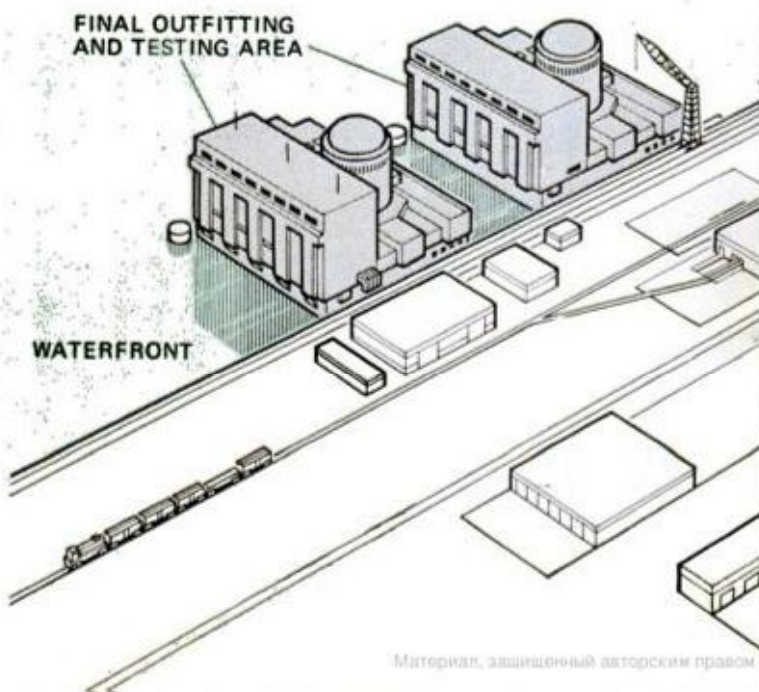
The cost of the breakwater—\$250 million—will shoot the total price tag to \$1 billion. But this outlay, according to Public Service officials, will help insure an adequate power supply for New Jersey in the 1980s. ★★★

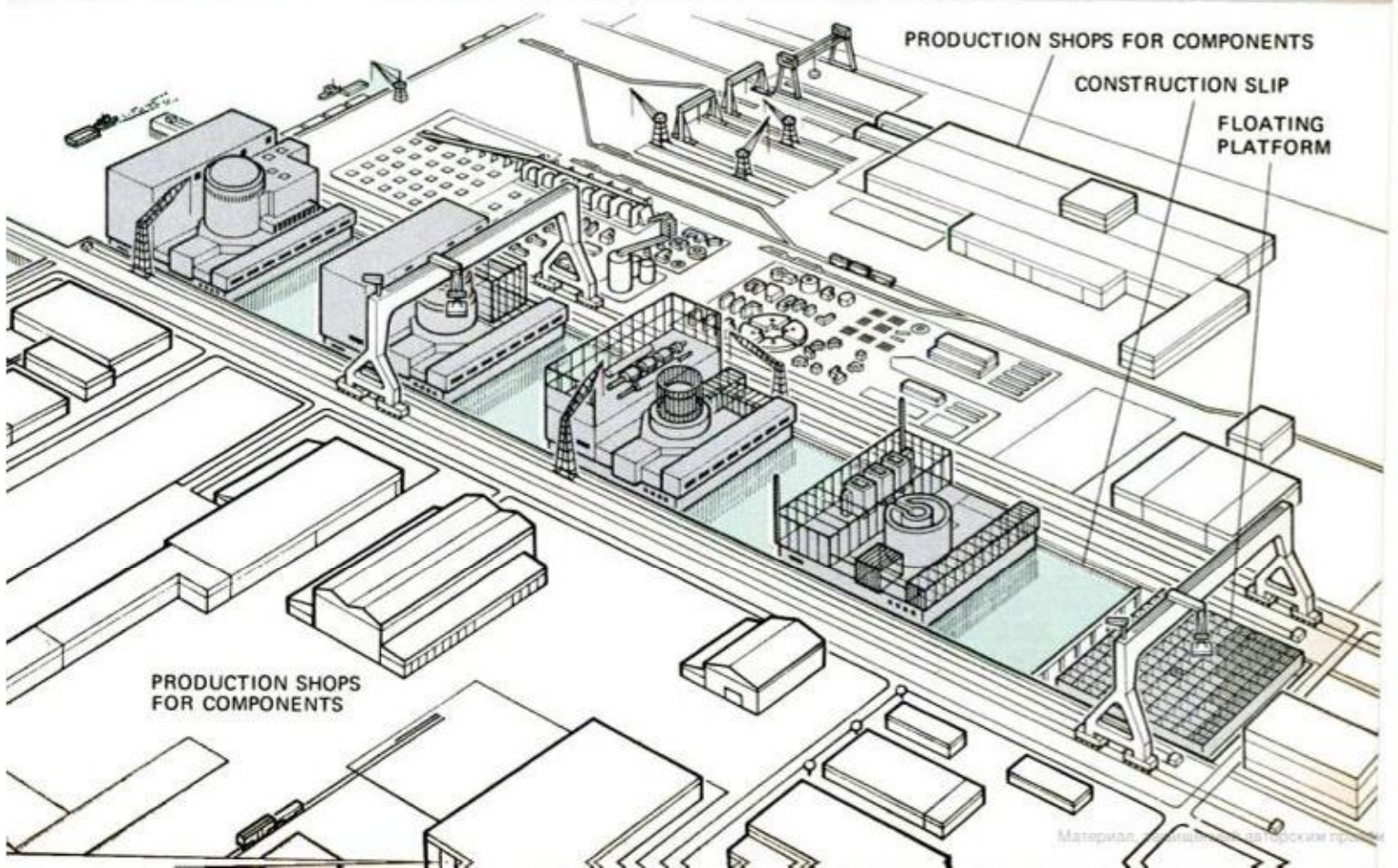
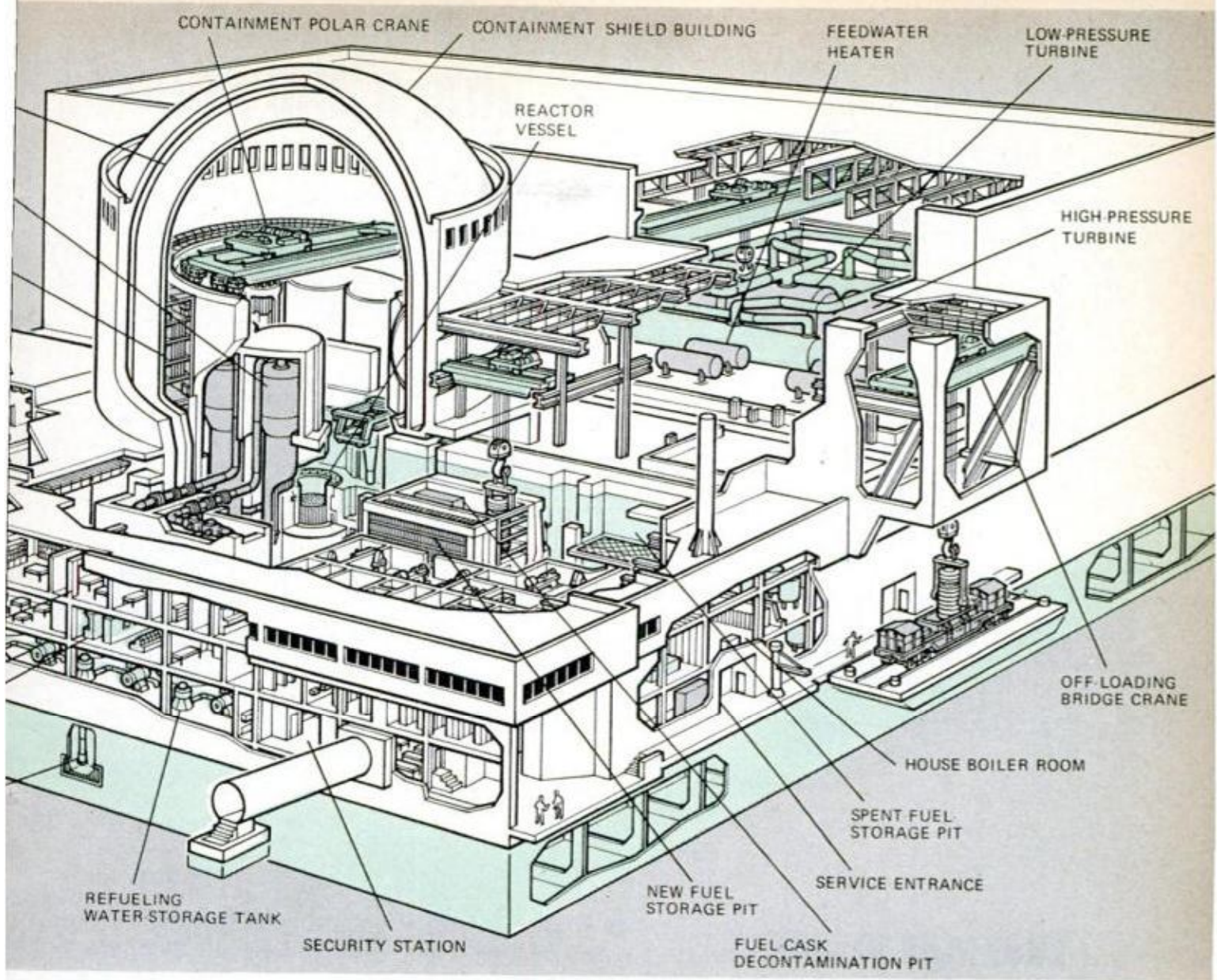
PLATFORM-MOUNTED NUCLEAR POWERPLANT



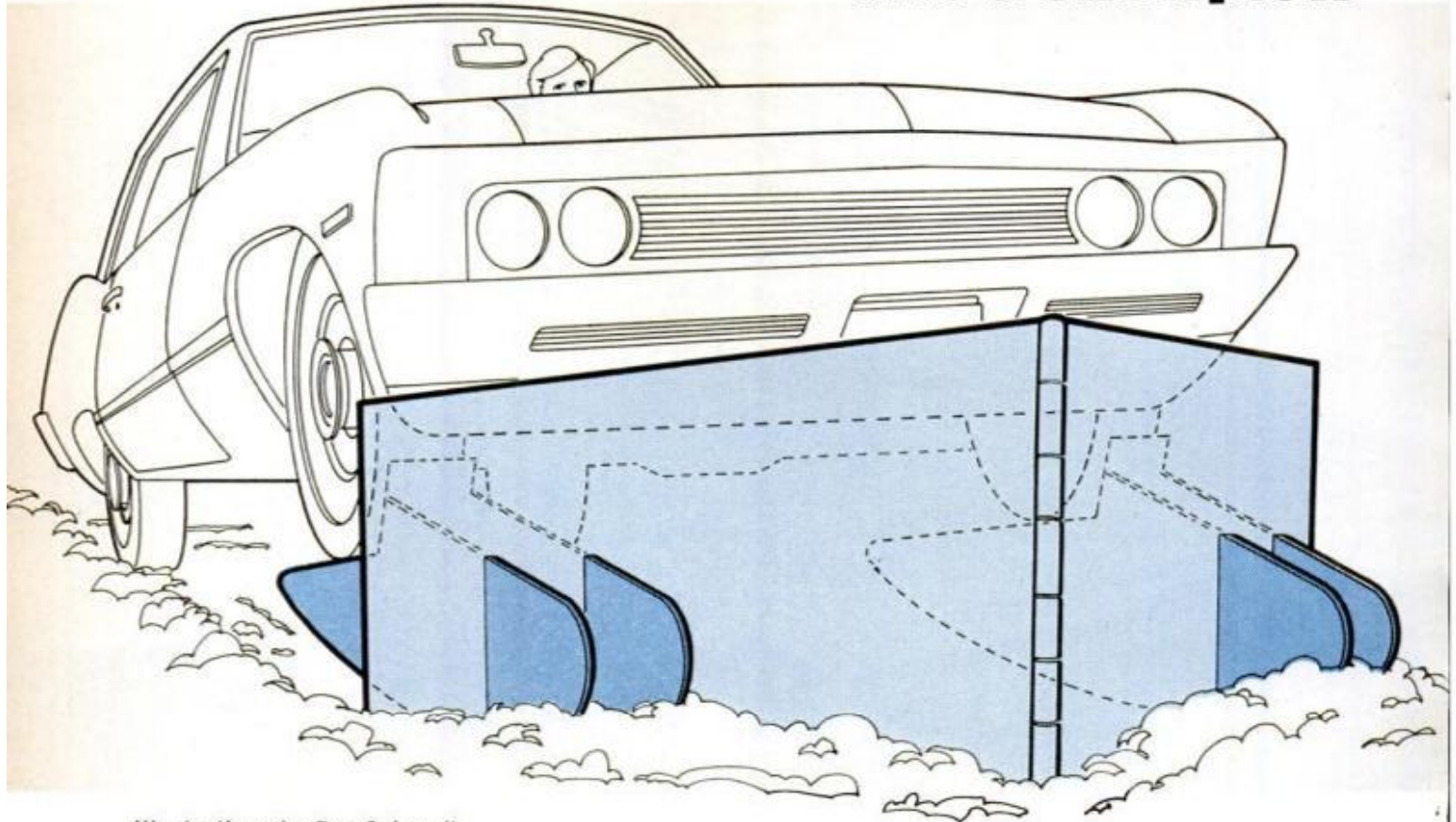
THE FLOATING PLANT'S equipment, facilities, safety systems and general layout are very similar to those of a conventional, land-based nuclear generating station. The supporting platform measures 400 feet long, 378 feet wide and 40 deep

SUPERSIZE ASSEMBLY FACILITY will be built in Jacksonville, Fla. Floating platforms will be fabricated at beginning of the slip. Then, at assembly stops, massive components will be swung aboard and positioned. At the start, production schedule calls for two finished units per year



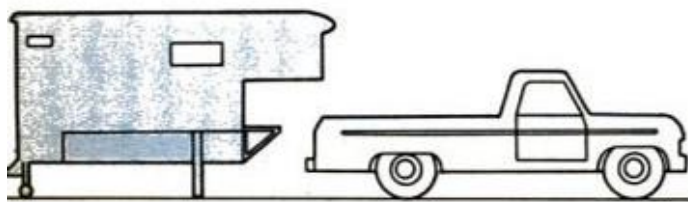


Now: Turn your car into a snowplow

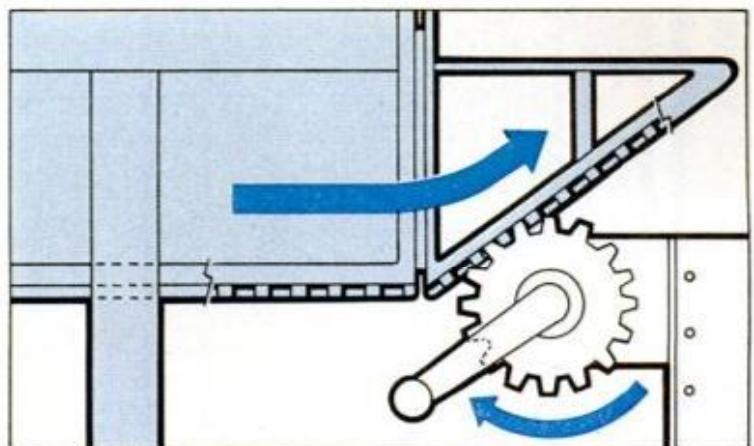
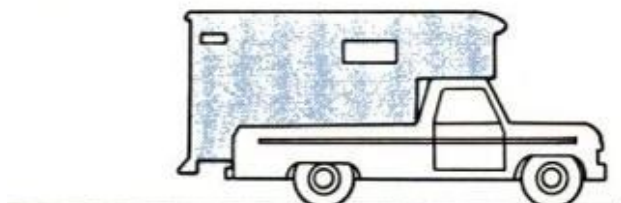
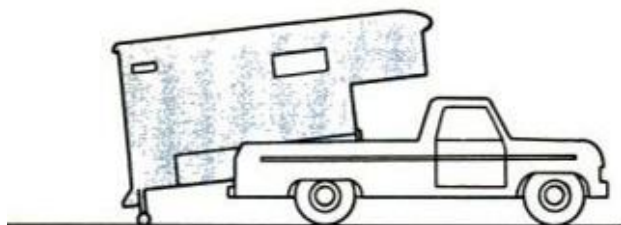


Illustrations by Roy Grinnell

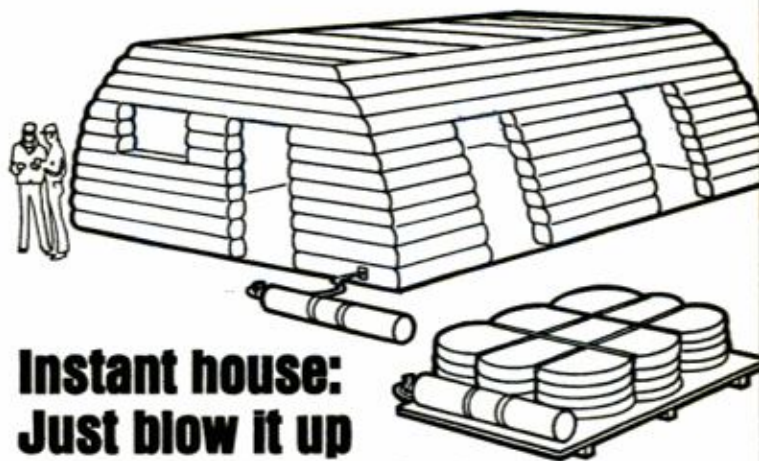
Easy way to pick up a pickup camper: Just roll it on



Sliding this camper aboard a pickup truck is a bit like running a cogwheel railway. In this case, though, the "rail" is mounted on the bottom of the camper and the toothed wheel is on an axle mounted over the rear bumper of the truck. By cranking a handle, the operator turns the toothed wheel to pull the camper aboard. A triangular bracket at the front end of the camper lifts the front to the level of the truck bed. The bracket folds to one side when the camper is in place, and the camper legs retract. The system was invented by H. V. Talbot, 301 South 98th St., Mesa, Ariz.

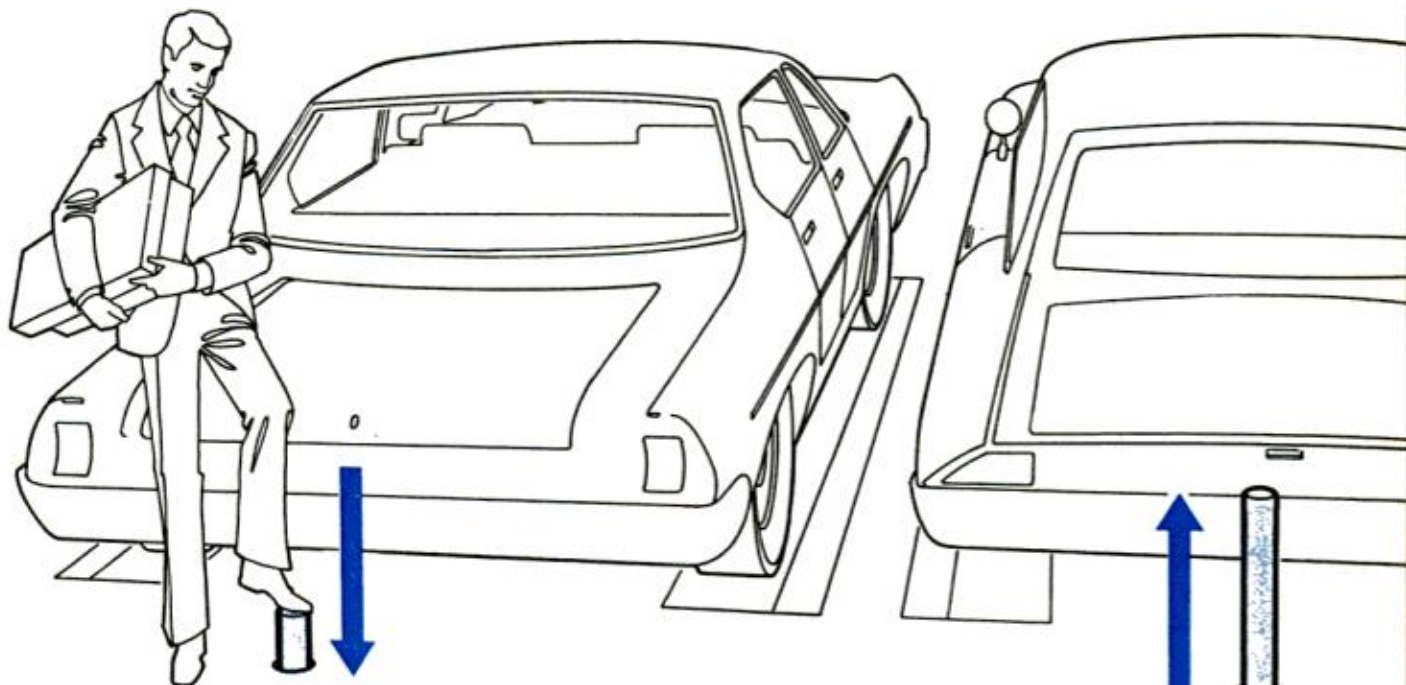
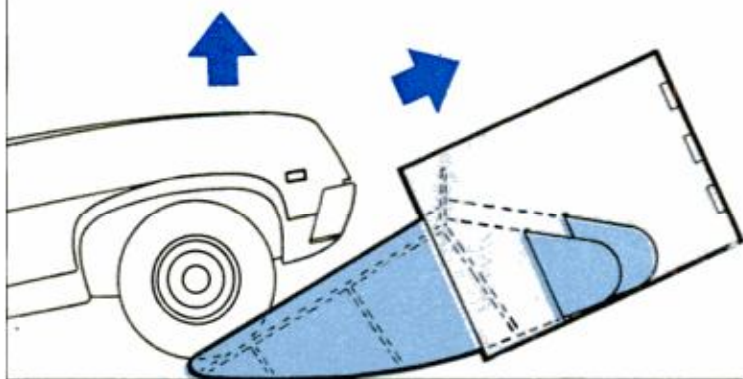


IF THERE'S A CHANCE of snow during the night, the only preparation the owner of this snowplow need take is to park his car so it can be driven forward out of his garage. Then if it snows, he merely sets up the foldaway snowplow in front of the car and drives the vehicle's front wheels up built-in ramps onto twin sleds (drawing below). The front wheels rest against stops, and the weight of the car causes the sleds to rock forward, lowering the V-shaped snowplow to driveway level. The plow is then pushed forward by the car's rear wheels, clearing a path slightly more than the width of the car. Since the plow is hinged in the middle and has slots that fit over the sleds to hold it in position, it's easy to take apart and store again. Inventor is Emerson B. Carlton, 942 Elliott Drive, Lewiston, N.Y.



Instant house: Just blow it up with compressed air

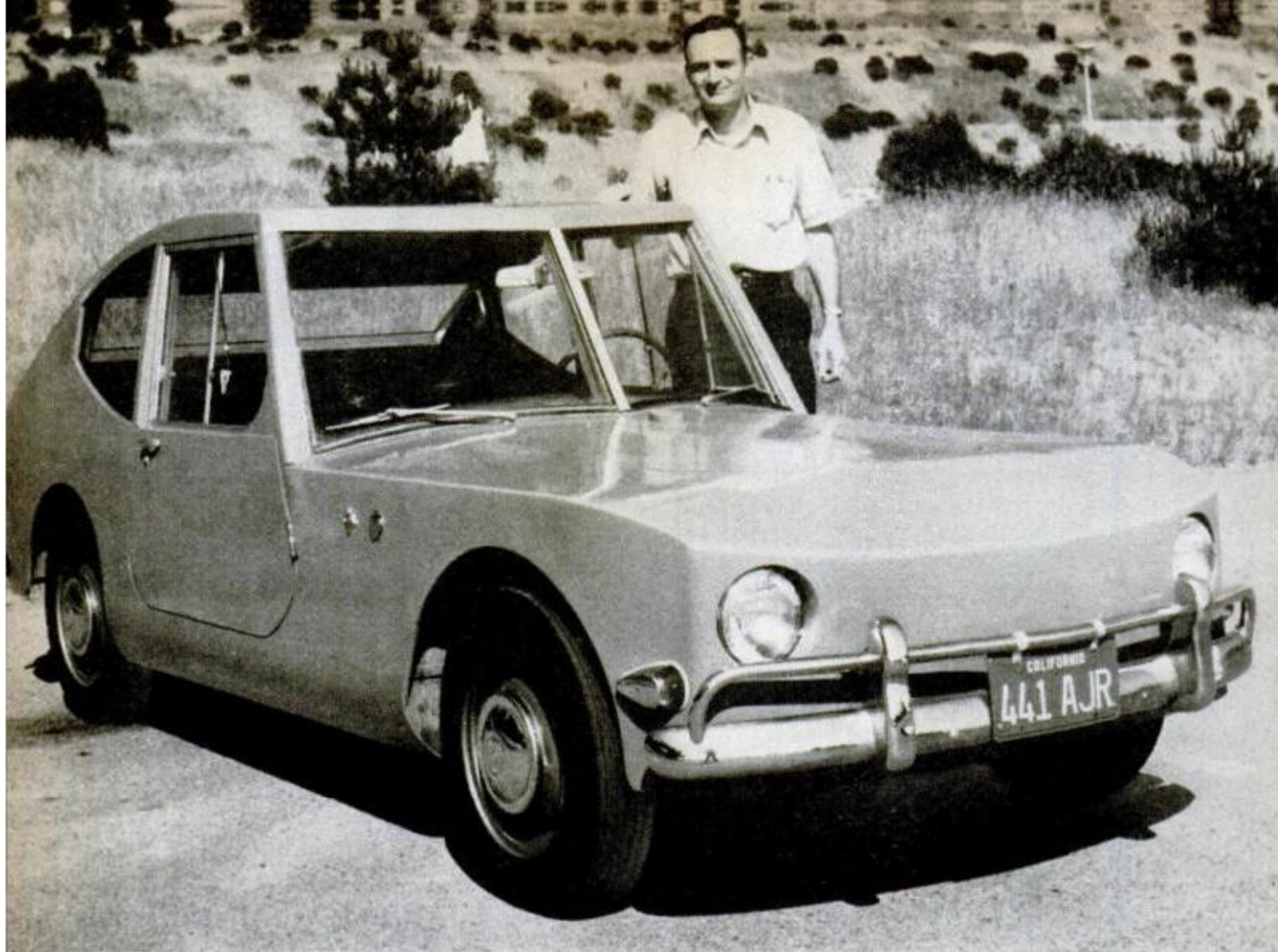
Need a house in a hurry? You can have one in the length of time it takes to blow up the Perma-Flate Structure with compressed air. Once erected, the structure quickly hardens, becomes permanent and can be put into immediate use. Its surfaces are fiberglass-reinforced resin—the same material as boats are made from. Other uses envisaged for the inflatable structures include petroleum-storage tanks, mine-tunnel liners, emergency housing, field hospitals and even life-support structures on the moon. The Perma-Flate Structure is the invention of Arthur A. Turner, 4510 S.W. 112 Place, Miami, Fla.



Pop-up post saves both your car and parking place

A metal post that pops up from ground level enables a motorist to reserve his parking space while using his car as well as keep his car from being stolen while it's parked. Post locks in its up and down

positions and must be unlocked with a key. Foot pressure lowers it; another push by foot causes it to return to up position. Inventor is Clark Kappelman, 1140 Colorado Blvd., Denver, Colo. ★★★



A FINE EYE FOR DESIGN: Door-hinge angle was selected so that the doors of the car would be self-closing

Rollin Armer's wooden wonder

By JOSEPH ZMUDA

Handcrafted from the ground up, this unique car is designed around an electric motor for clean and quiet running

ECOLOGY and the environment are truly electrifying issues for Rollin Armer of Kensington, Calif. Not content merely to pay lip-service to our problems with automotive smog and the growing energy crisis, this 42-year-old mechanical designer at the Lawrence-Berkeley Laboratory built a unique battery-operated car that:

- Carries two passengers up to 60 miles on a single charge and can hit top speeds in excess of 50 mph.
- Measures 12 feet 8 inches long by 53 inches high and weighs only 1600 pounds including 600 pounds of batteries.

- Costs \$1300 to handcraft in 18 months of spare time.

- Pollutes much less than a gasoline car, even after computing environmental damages produced at the generating station.

That last item might require elaboration for anyone as skeptical as I was. "First of all," says Rollin, "the small battery capacity of electric cars as well as their low speed and limited size understandably reduce power requirements. The less power you use, the less you pollute."

"But more important, electric generating plants are driven by low-pollution steam engines with an overall efficiency un-

known to any small thermal engine, about 45 percent. This means less wasted fuel to cause smog.”

The car was designed from the ground up to be battery-operated. Running gear (wheels, brakes, rear axle, torsion bars) were scavenged from a Morris Minor and the chassis and streamlined “ecology green” body made all of wood.

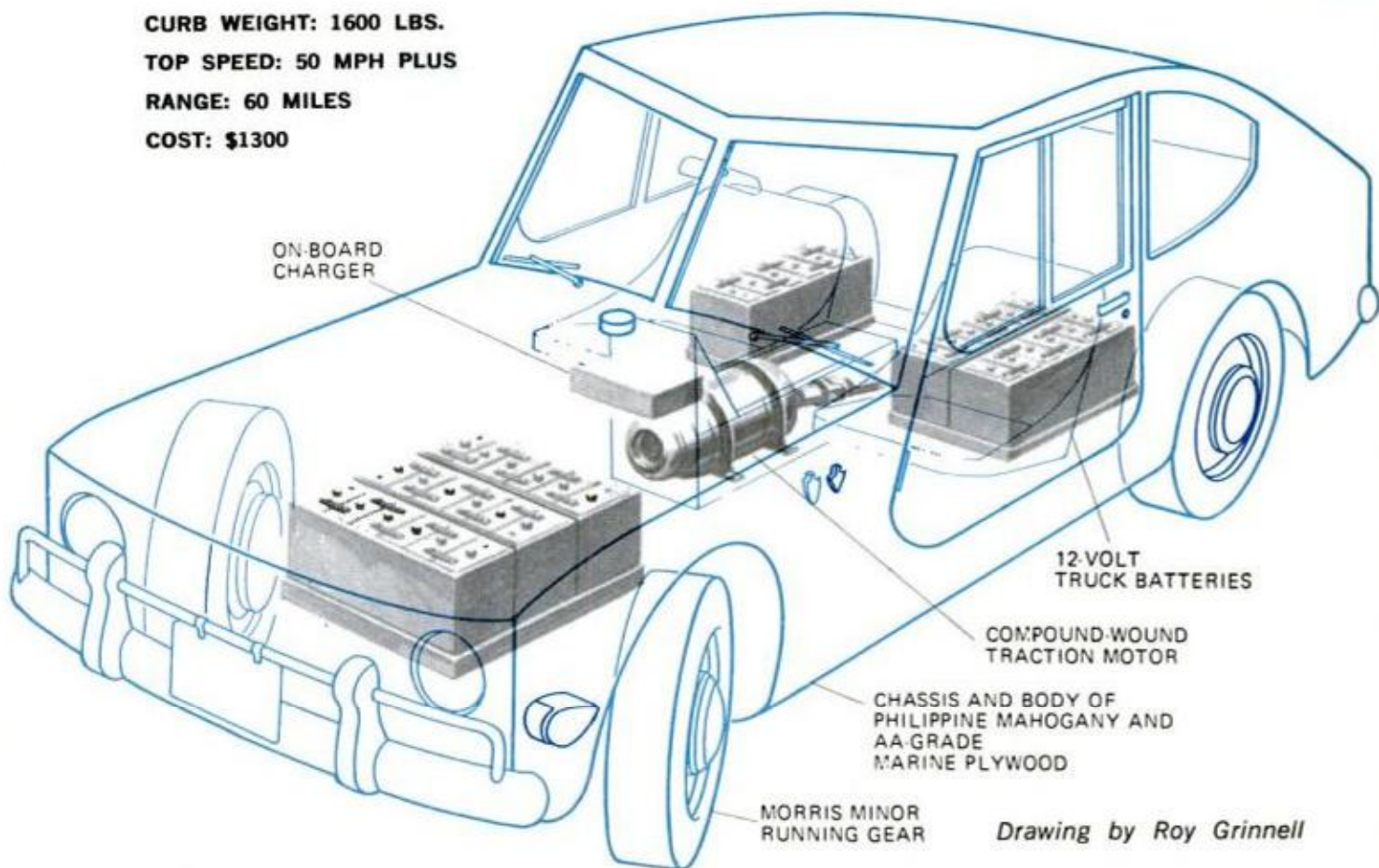
The compound-wound traction motor, built up on the carcass of an old bus generator, fits snugly into a small compartment between the front bucket seats. Directly coupled to the rear wheels, it is rated nominally at 15 hp but can supply up to 30 hp for short periods.

Power comes from six large, 12-volt truck batteries placed strategically to give the vehicle a low center of gravity and a 48-52 percent front-to-rear weight distribution (including driver). Three 96-pound batteries are nestled under the hood with an inboard charger that delivers 12-16 amperes from household line current. The

THE CLEAN GREEN MACHINE is right at home on curves and twisty roads, and, even in California, where strange cars proliferate, the car attracts the curious. Cutaway drawing below shows placement of batteries for good weight distribution and low cg



CURB WEIGHT: 1600 LBS.
TOP SPEED: 50 MPH PLUS
RANGE: 60 MILES
COST: \$1300



Drawing by Roy Grinnell

others are in back, out of sight. The batteries cost \$230 and last two years.

The controls are simple. The dash contains a voltmeter, ammeter, speedometer and two auxiliary ammeters for the charger. A key activates the system, starting a fan that draws air through the motor compartment. A toggle switch selects vehicle direction: Reverse is limited to half the forward speed at full torque.

The accelerator pedal is attached to a cam that operates microswitches connected to Cutler-Hammer power relays. The relays give different combinations of battery voltage and field current to change both the torque and motor speed.

The motor starts on 36 volts from both battery sets in parallel through a stainless-steel wire resistor that prevents excessive loads. A moment later the resistor is removed and further pressing of the accelerator varies the amount of shunt-field current. At zero field, the batteries are reconnected in series along with the wire resistor. With resistor removed, the shunt-field again varies from full current. At zero, the motor will run its fastest.

The cooling fan comes on with a slight whine. The sound of the motor reminded me of an electric bus, but this noise was acceptable considering that my left arm was actually resting on the uninsulated motor compartment. From outside, you hear only the wheels against pavement.

We sped down street with an occasional clack of power relays. A torque curve inverse to that of an i-c engine gives unbelievably fast and silent acceleration.

Our first 90° turn without slowing down flipped my camera case upside down; the next one righted it. When I commented on the car's cornering ability, Rollin gave a dramatic demonstration on a downhill horseshoe curve at 42 mph with only slight drift at the bottom. But I was too white around the gills to really notice.

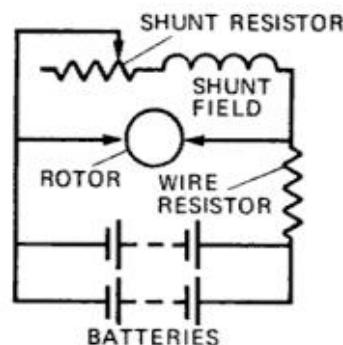
Regenerative braking is a big feature. When you stop or go downhill, the shunt-field can be increased by easing the accelerator. When back electromotive force exceeds battery voltage, the motor acts as a generator, recharging batteries up to 100 amps. This increases vehicle range and saves the mechanical brakes for panic situations or full stops.

Recharging takes two to four hours after connecting an extension power cord to a jack on the right outside. A new charger

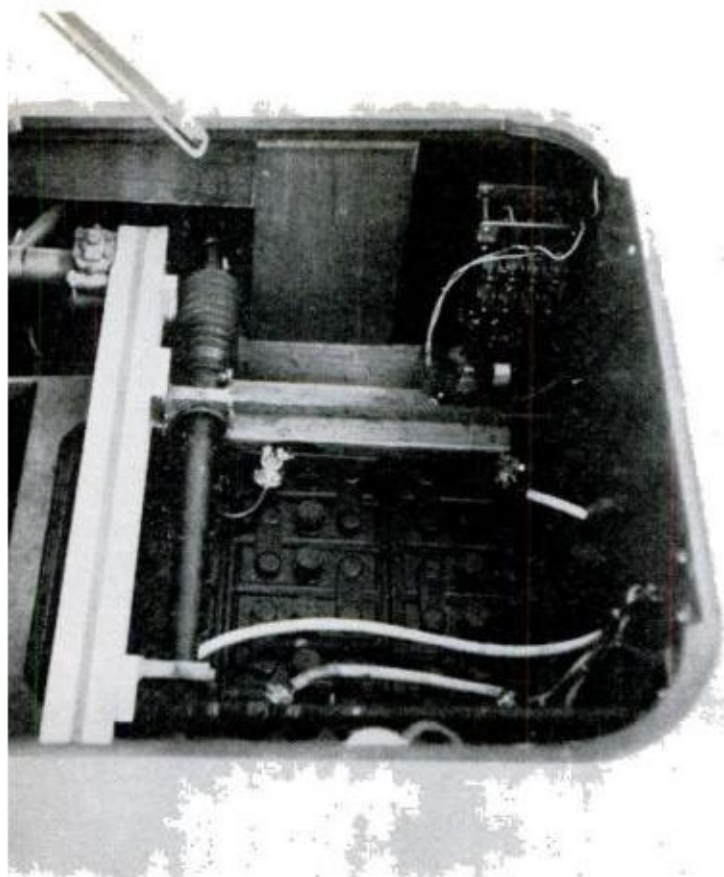
Rollin designed can now do the job in half the time. But he downplays any thought of doing it faster because of wear on the batteries and line-current limitations.

Driving range between charges can vary from 20 miles, with excessive starts and high speeds, to 60 miles and more—if you know what you're doing. An optimum cruising speed of 28 mph on a level road produces an 87-percent motor efficiency; and regard for motor efficiency is the conservative way to drive any electric. Upgrades should be taken slowly unless you can count on momentum from a prior downhill run to carry you up and over.

Although the Armer electric is a beauty to ride and behold, Rollin also gets a charge out of driving battery-operated motorcycles. His first was built frame and all for \$400 in four months. He drove it 9000 miles without a hitch, then sold it for \$375. His present cycle uses a Honda CB100 frame and required only two months to complete. A copyrighted do-it-yourself Electric Motorcycle Builder's Manual—and permission to build one vehicle—can be obtained for \$8.50 postpaid from Rollin Armer, 277 Purdue, Berkeley, Calif. 94708. ★★★



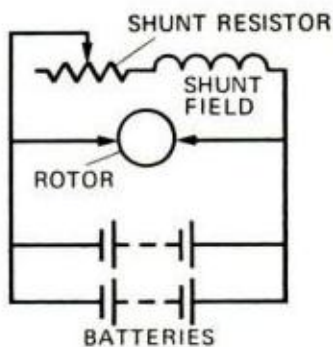
Pressing the accelerator pedal starts the rotor turning, with current coming from both battery sets in parallel through a wire resistor that prevents excessive loads.



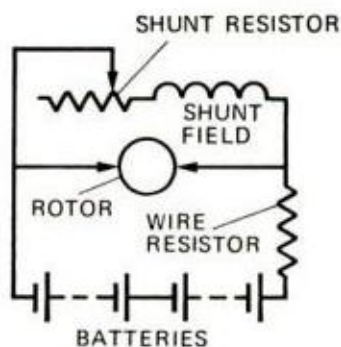
FRONT COMPARTMENT houses three of six batteries that power the vehicle. The on-board charger is mounted above them on the firewall. Steering linkage is visible as is part of the front wheel A arm

CONSOLE BETWEEN BUCKET SEATS is actually motor housing with a hatch for access. The 15-hp motor is coupled to rear wheels without transmission. Instruments are mounted in beautiful mahogany panel

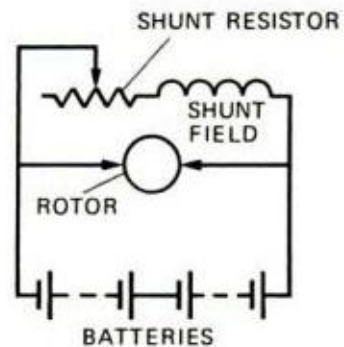
HOW THE ARMER ELECTRIC OPERATES



A moment later the resistor is removed from the circuit and further pressing of the accelerator varies the amount of the shunt-field current through the shunt resistor.



At zero field, the batteries are reconnected in series along with the wire resistor. (This diagram is a simplified approximation of what occurs. The actual circuitry has a patent pending.)



Further pressing of the accelerator removes the wire resistor and again varies the shunt-field current from full to zero. At zero shunt field, the motor will run its fastest.

A durable economy plane

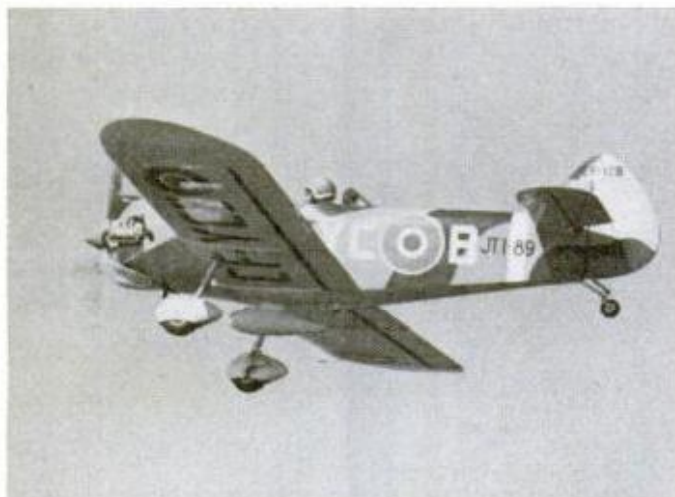


THE PLANE THAT STARTED IT ALL—the original *Monoplane*—is shown with John Taylor at the controls. It has a wooden frame that's covered with plywood, a fixed main landing gear and a modified VW engine



LANDING GEAR MOUNTED on fuselage wing stubs and blunted wingtips were major modifications made by Canadian Geoffrey Broadwood. Plane cost \$1000 to build

UNDERBELLY POD on Ivan Bougie's version carries a small amount of luggage. A jazzy paint job creates an RAF look. This homebuilt was constructed in two years



By **JOHN F. PEARSON** and **HOWARD LEVY**

Photos by Howard Levy

WHEN HE DREW UP plans for his *Monoplane*, John Taylor kept a major design limitation in mind: All components had to be of a size that could be accommodated within the confines of his 16 by 11 shop.

When assembled after 14 months' work, the single-seater had a wingspan of 21 feet and was 15 feet long. It was

ANNUAL MODIFICATIONS by Robert Ladd include blown canopy, retractable landing gear and handcarved, four-blade prop. Plane cost \$2000



from Britain

powered by a 38-hp engine that produced a top speed of 105 mph and a climb rate of 950 feet per minute. It weighed 410 pounds empty, had a gross weight of 620 pounds and a range of 230 miles. Its stall speed, with flaps down, was 38 mph.

The *Monoplane* was a no-frills, sturdy homebuilt that in time gained a reputation far beyond the boundaries of Essex, England, where Taylor made his home. Working with Taylor's plans, amateur builders in the United States, Canada, New Zealand, South Africa, Australia and Finland produced modified versions.

The simple design seems to invite modification, as is shown on these pages. A recently completed version (not shown), by a Long Island, N.Y., builder, reflects a radical change in the design. It is an all-metal job, and Taylor's prototype was constructed entirely of wood.

The first American version to get into the air, in 1964, was built by Hugh Beckham of Wichita, Kans. Beckham changed the wing structure and installed a converted VW engine.

A Canadian welder, Ivan Bougie, spent two years and \$1500 in putting together his *Miss Valleyfield*. It, too, is VW-powered.

Another sharp-looking version is the work of Robert W. Ladd, a 43-year-old Milwaukee engineer. He has made yearly modifications on his *Chihuahua* since completing it in 1967. A 50-hp VW engine gives him a maximum speed of 135 mph.

Shop foreman Jim Kerley of Redondo Beach, Calif., took 15 months to build his Taylor plane at a reported cost of only \$958. Jerry Higginson, a paving contractor from Clear Lake, Iowa, reports that his plane cost him about \$1500.

The man who started it all did not live to see the full flowering of his basic design. John Taylor died in an accident while flying a midget racer. But detailed plans for his *Monoplane* are still available at a price of \$25. Write to Mrs. J.F. Taylor, 25 Chesterfield Crescent, Leigh-on-Sea, Essex, England. ★★

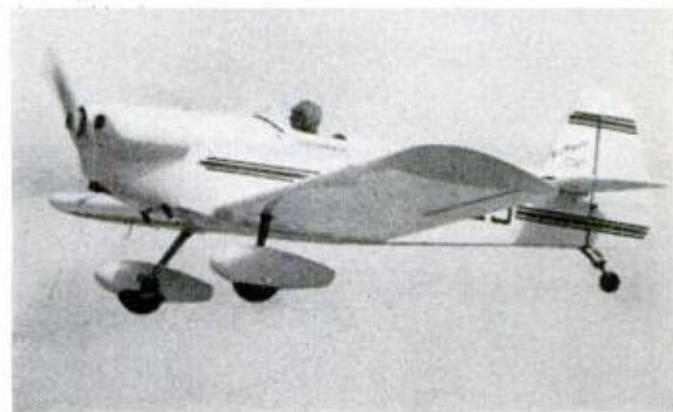
JANUARY 1973



CESSNA SPRING GEAR and hydraulic brakes are among modifications made by Jim Kerley. His 25-hp engine eats only two gallons of fuel per hour. Range is 270 miles



WHEN HUGH BECKHAM finished his *Monoplane* in 1964, it had an open cockpit. Bubble canopy was added later. This was the first Taylor homebuilt made in America



JERRY HIGGINSON put a 65-hp Lycoming in his plane, increased size of rudder and cut wingspan by a foot. Plane needs 500 feet for takeoff, has top speed of 130

129

The simple way to...

Adjust Vega carburetor and emission-control system

THIS PROCEDURE is condensed from a booklet in a new series offered by *PM*. The booklet shows how to do major maintenance jobs on a Vega. To order, send \$1.99 to Popular Mechanics, Dept. XYZ, Box 1014, Radio City, N.Y. 10019; include

your address and specify "Vega."

Other available booklets: VW Beetles 1966 through 1971 (\$1.99 each); a large booklet for all VW Beetles 1965 through 1971 (\$2.95); Toyota Corona (8R-C engine) booklet (\$1.99).

EMISSION CONTROL AND AIR CLEANER

This section shows how to remove and install the air cleaner and service the emission-control system. The air cleaner is of one-piece construction and cannot be cleaned. It should be replaced as a unit at 50,000-mile intervals under normal driving conditions. If vehicle is operated in dusty areas for prolonged periods, air cleaner should be replaced at more frequent intervals.

The emission-control system consists of a positive crankcase ventilation system and a vapor emission control system.

Crankcase ventilation system uses intake manifold vacuum to draw crankcase fumes and vapors through a regulating valve into the cylinders to be burned. The ventilation system draws clean air from the carburetor air cleaner and has a nonvented oil filler cap, thus forming a "closed system."

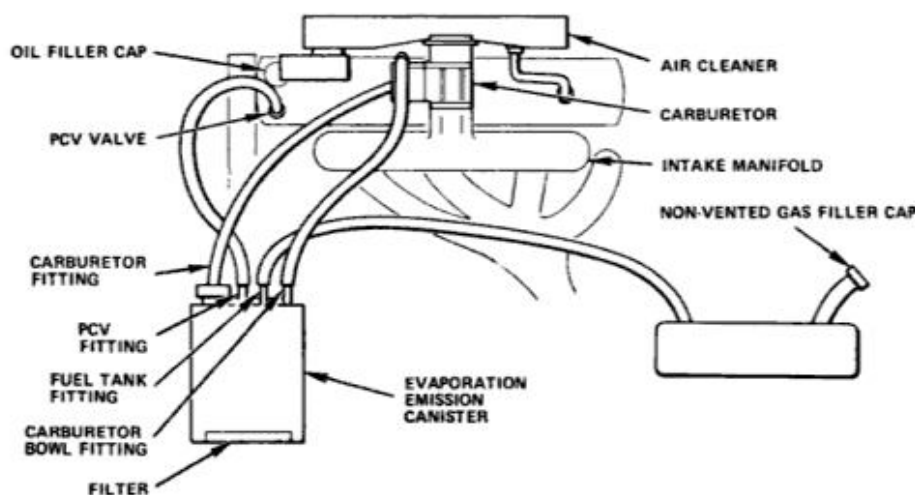
Since the crankcase ventilation system affects every part of the engine, it is important that the system be properly serviced.

The Positive Crankcase Ventilation (PCV) valve should be replaced at 24,000-mile intervals.

The vapor emission control system is designed to reduce fuel vapor emissions that are normally vented to the atmosphere from the fuel tank and carburetor fuel bowl.

The fuel evaporation vapors are stored in the evaporation emission canister and drawn from the canister into the cylinders to be burned.

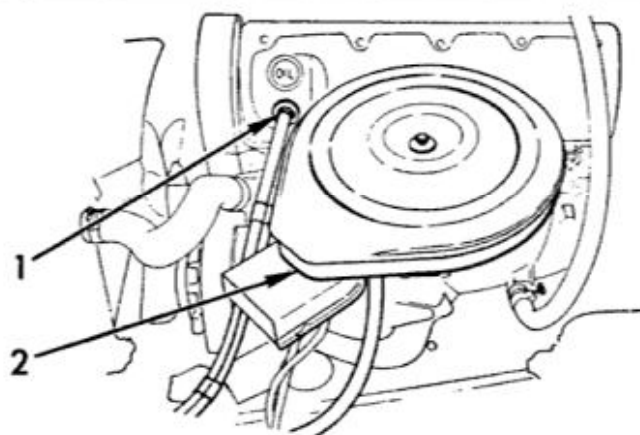
The filter mounted on the bottom of the canister should be replaced at 12,000-mile intervals.



PART 1

Tools and Parts:

- 3/16-inch wrench
- Pliers
- PCV valve, AC type CV-758c (1)
- Air cleaner, AC type A-375c (2)
- Evaporation control canister filter



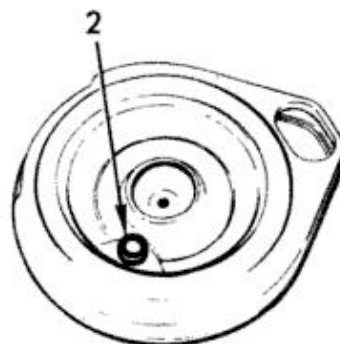
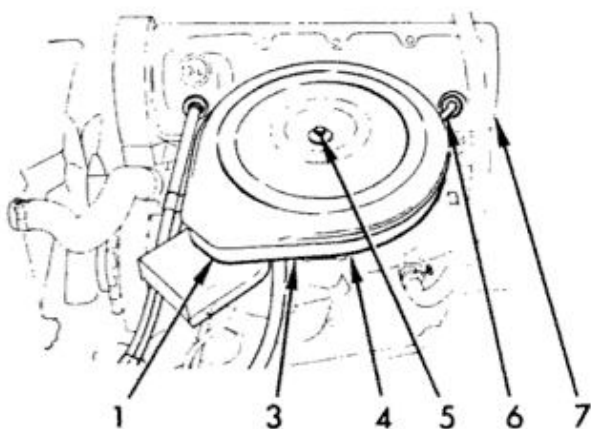
PART 2**Remove Air Cleaner**

1. Remove $\frac{7}{16}$ -inch bolt (5) and washers.
2. Lift end (1) of air cleaner (3) up and turn clockwise until crankcase vent pipe (6) is clear of valve cover (7).
3. Remove air cleaner (3).

If not replacing air cleaner (3), REMOVE ENDS HERE.

4. Remove vent pipe (6). Remove grommet (2). Dispose of air cleaner (3).

REMOVE ENDS HERE

**Install Air Cleaner**

If not installing new air cleaner (4), go to Step 2.

1. Install grommet (2). Install vent pipe (6) in new air cleaner (4).
2. Place air cleaner (4) on carburetor (3). Turn end

(1) of air cleaner counterclockwise until vent pipe (6) can be installed in valve cover (7).

3. Install vent pipe (6).
4. Install washers and $\frac{7}{16}$ -inch bolt (5).

INSTALL ENDS HERE

PART 3**Replace PCV Valve**

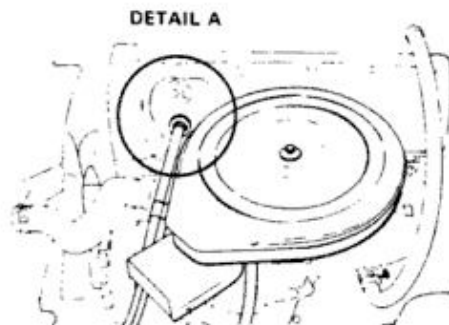
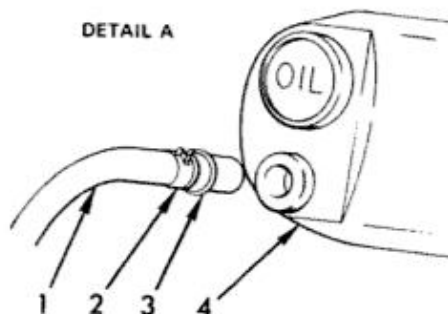
1. Pull PCV valve (3) from valve cover (4).
2. Remove valve (3) by loosening retaining clamp (2). Dispose of valve.

3. Check that hose (1) is not cracked or deteriorated.

4. Install new valve (3). Tighten clamp (2).

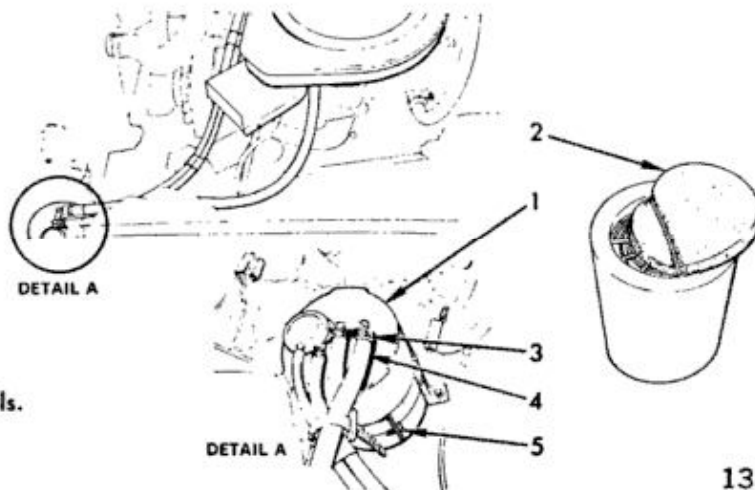
5. Press valve (3) into valve cover (4).

REPLACE ENDS HERE

**PART 4****Replace Evaporation-control Canister Filter**

1. Label and disconnect four hoses (4) from canister (1) by loosening clamps (3).
2. Loosen $\frac{3}{8}$ -inch bolt (5). Remove canister (3) by pulling up.
3. Remove old filter (2) from bottom of canister (1). Place new filter at installed position.
4. Place canister (1) at installed position. Tighten $\frac{3}{8}$ -inch bolt (5).
5. Connect four hoses (4) to canister (1) by loosening clamps (3). Remove labels.

REPLACE ENDS HERE



CARBURETOR AND FUEL FILTER

Instructions in this section show how to adjust the carburetor and replace the fuel filter.

Before performing instructions in this section, it is essential that the ignition system be properly timed.

The carburetor is a device which measures the volume of air being drawn into the engine and meters the proper amount of fuel that will mix with the air to form a combustible mixture.

The fuel/air mixture has been adjusted at the factory and should not be altered. If mixture adjustment is required, take car to a reputable service shop.

A throttle-closing solenoid is used on all Vega carburetor applications. The solenoid is electrically controlled through the ignition switch.

When the ignition switch is turned off, the solenoid is de-energized, allowing the throttle to close further than idle position, preventing engine from running after ignition has been turned off.

The fuel filter is mounted in the carburetor at the fuel inlet to give maximum filtration of incoming fuel. The fuel filter is a disposable type and should be replaced at 12,000-mile intervals.

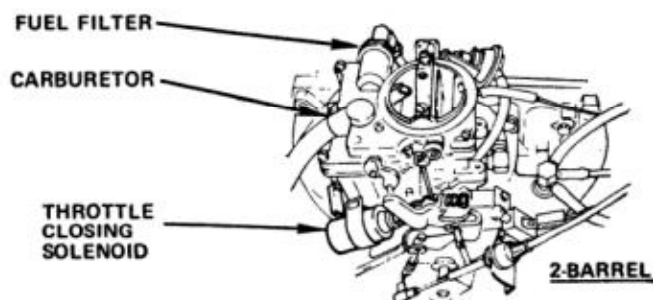
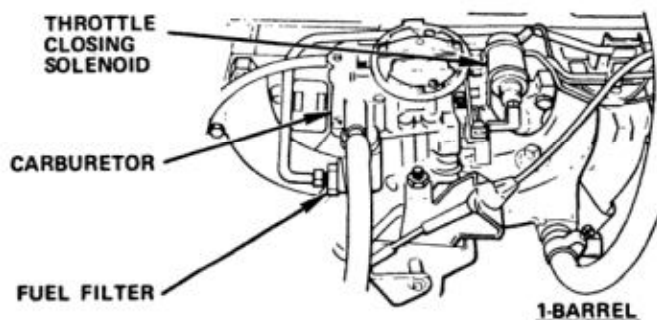
PART 5

WARNING: Be sure to keep area well ventilated when working with fuel. Do not smoke or work with fuel near garage water heaters or electric heaters.

Be sure to keep hands and equipment clear of fan and drive belts when engine is running.

Emergency brake must be on.

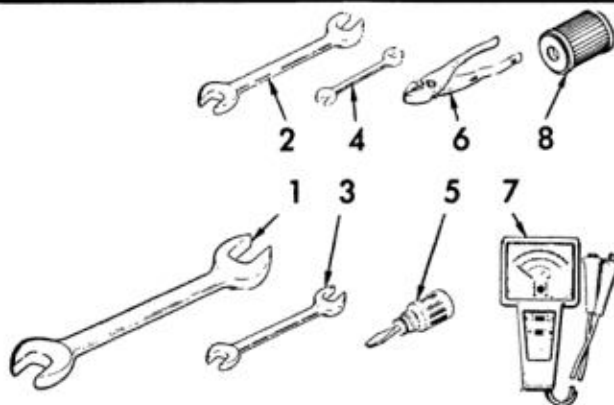
All Vega engines have the same cubic-inch displacement; however, two types of carburetors are used. The two types of carburetors used are one-barrel and two-barrel.



PART 6

Tools and Parts:

- 1-inch wrench (1)
- 1/2-inch wrench (2)
- 3/8-inch wrench (3)
- 1/4-inch wrench (4)
- 3-inch common screwdriver (5)
- Pliers (6)
- Tachometer (7)
- Fuel filter (8)

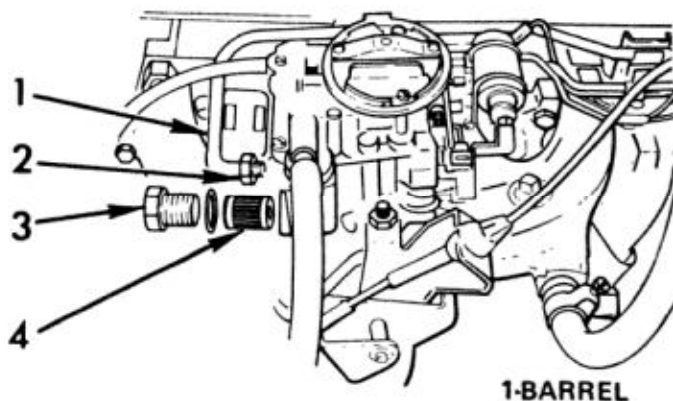


PART 7

Replace Fuel Filter

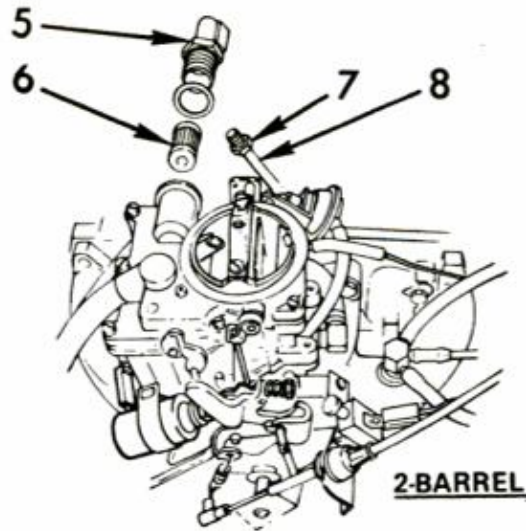
1. Remove air cleaner. See Part 2.
2. Using a 1-inch wrench to hold fuel filter nut (3, 5), loosen 1/2-inch fitting (2, 7). Disconnect fuel line (1, 8).
3. Remove 1-inch fuel filter nut (3, 5) and gasket. Remove fuel filter (4, 6).

(Part 7 continues top of following page)



- Gasket end of filter (4, 6) faces 1-inch nut (3, 5).
4. Install new filter (4, 6). Install gasket and nut (3, 5).
 5. Connect fuel line (1, 8). Tighten fitting (2, 7).
 6. Install air cleaner. Part 2.

REPLACE ENDS HERE



PART 8

Adjust Carburetor

See operator's manual supplied with tachometer for instructions on use of meter.

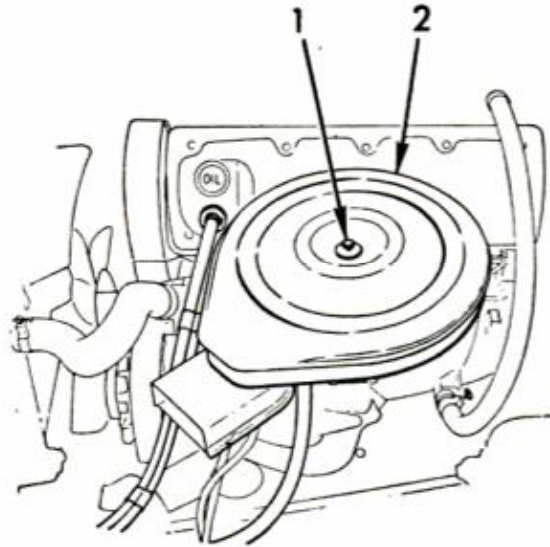
1. Connect meter to engine.
 2. Remove $\frac{7}{16}$ -inch bolt (1) and washer.
- Engine adjustments can be made with air cleaner (2) raised, but not removed, for access to adjusting screws.

After adjustment is made, air cleaner (2) must be lowered to make accurate readings on tachometer.

WARNING: Be sure area is well ventilated before starting engine.

Be sure to keep hands and equipment clear of fan and drive belts when engine is running.

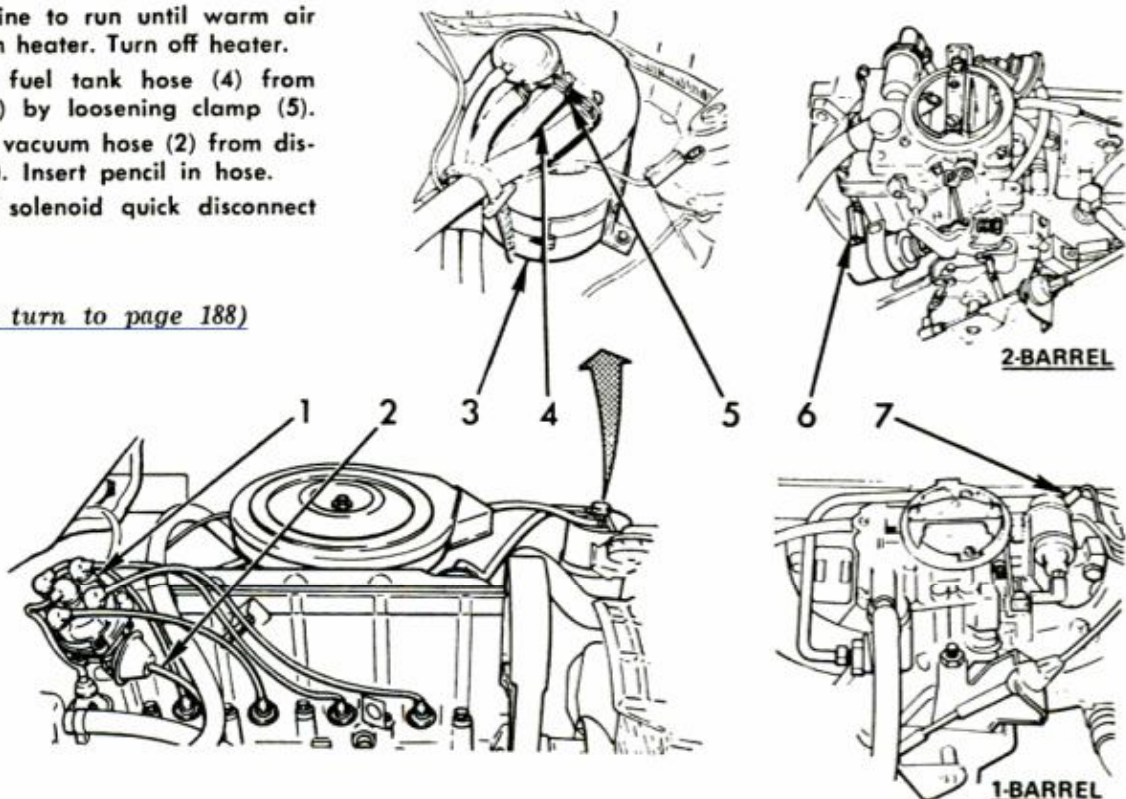
3. Start engine. Turn on heater.



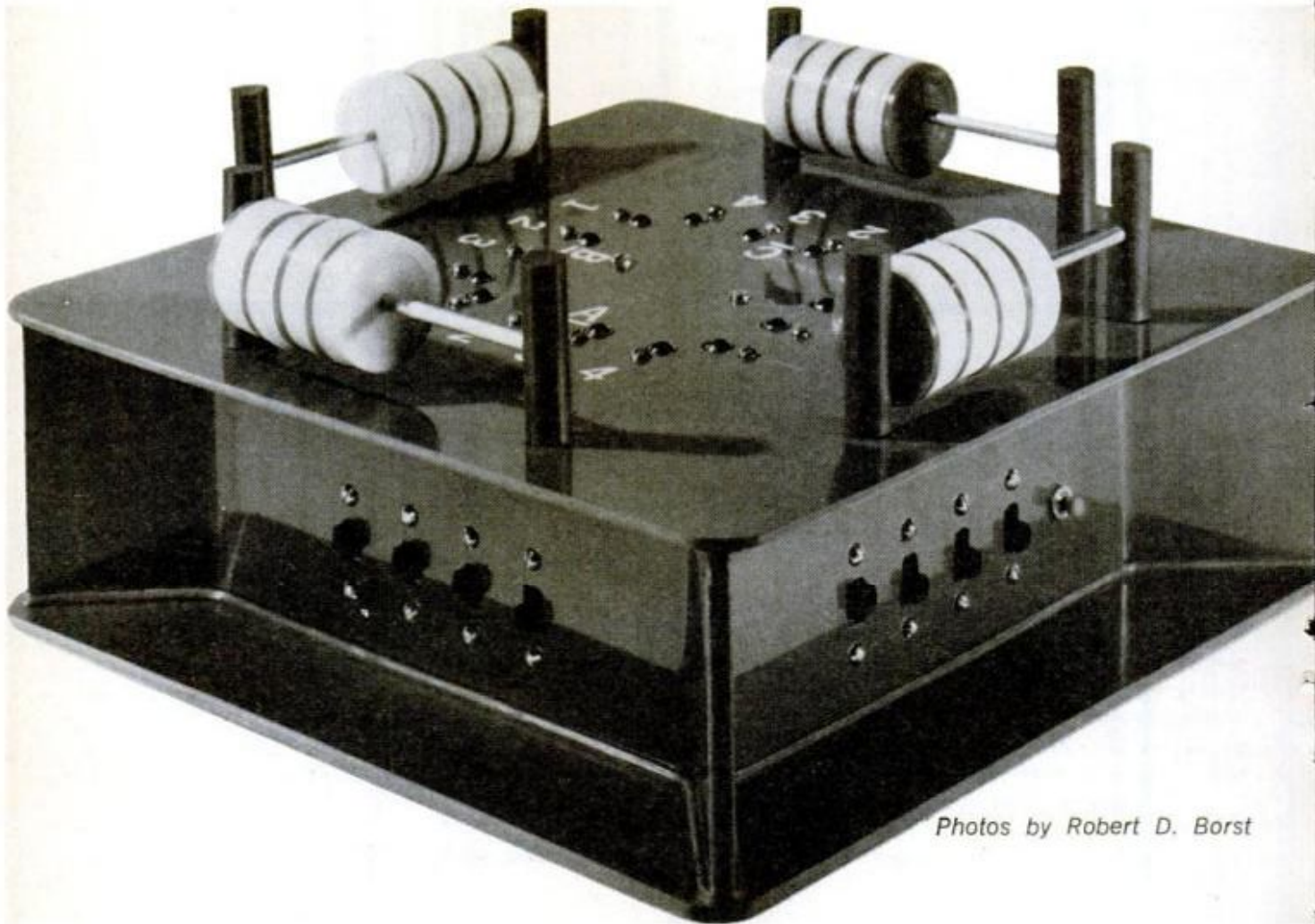
PART 9

1. Allow engine to run until warm air comes from heater. Turn off heater.
2. Disconnect fuel tank hose (4) from canister (3) by loosening clamp (5).
3. Disconnect vacuum hose (2) from distributor (1). Insert pencil in hose.
4. Disconnect solenoid quick disconnect (6, 7).

(Please turn to page 188)

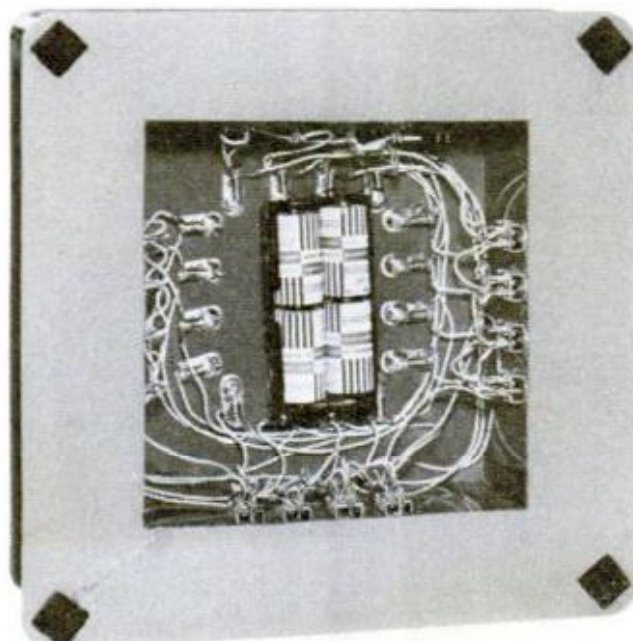


Number-guessing game



Photos by Robert D. Borst

OPENING IN BOTTOM of game provides access to batteries and bulbs when they need to be replaced



By **J. W. CALLENDER**

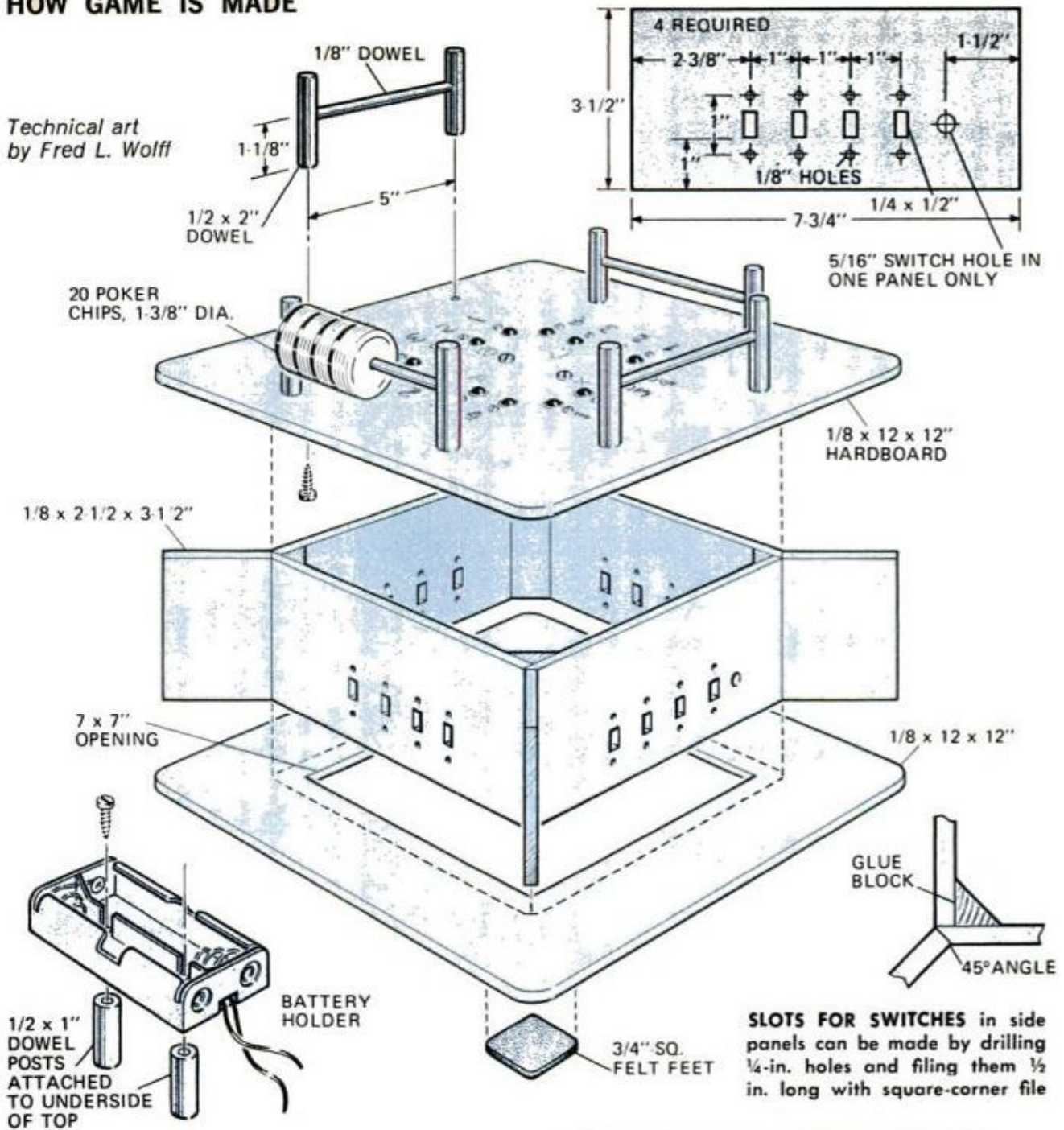
HERE'S A GAME that really keeps you guessing. It's a modern version of the old fingers game in which the "dealer" (in this case player X) tries to outguess his opponents. It can be played by two, three or four players, and each player has a turn at being player X.

The game is played as follows: Player X, who has the option of pressing either one or two of the four toggle switches in front of him, begins. Then players A, B and C do likewise, trying to guess the number or numbers player X picked. Now player X presses the pushbutton which lights the green and red bulbs on the top of the game to see if an opponent may have matched him. Individual scores are kept by moving discs left to right.

Let's suppose player X presses switch

HOW GAME IS MADE

Technical art
by Fred L. Wolff

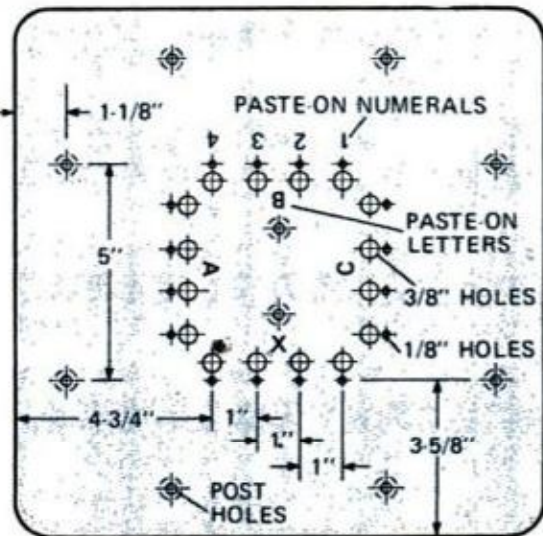


4, and player A presses 1 and 2, player B presses 2 and 3 and player C presses 3 and 4. Here No. 4 will light for player C only, allowing him to score one point.

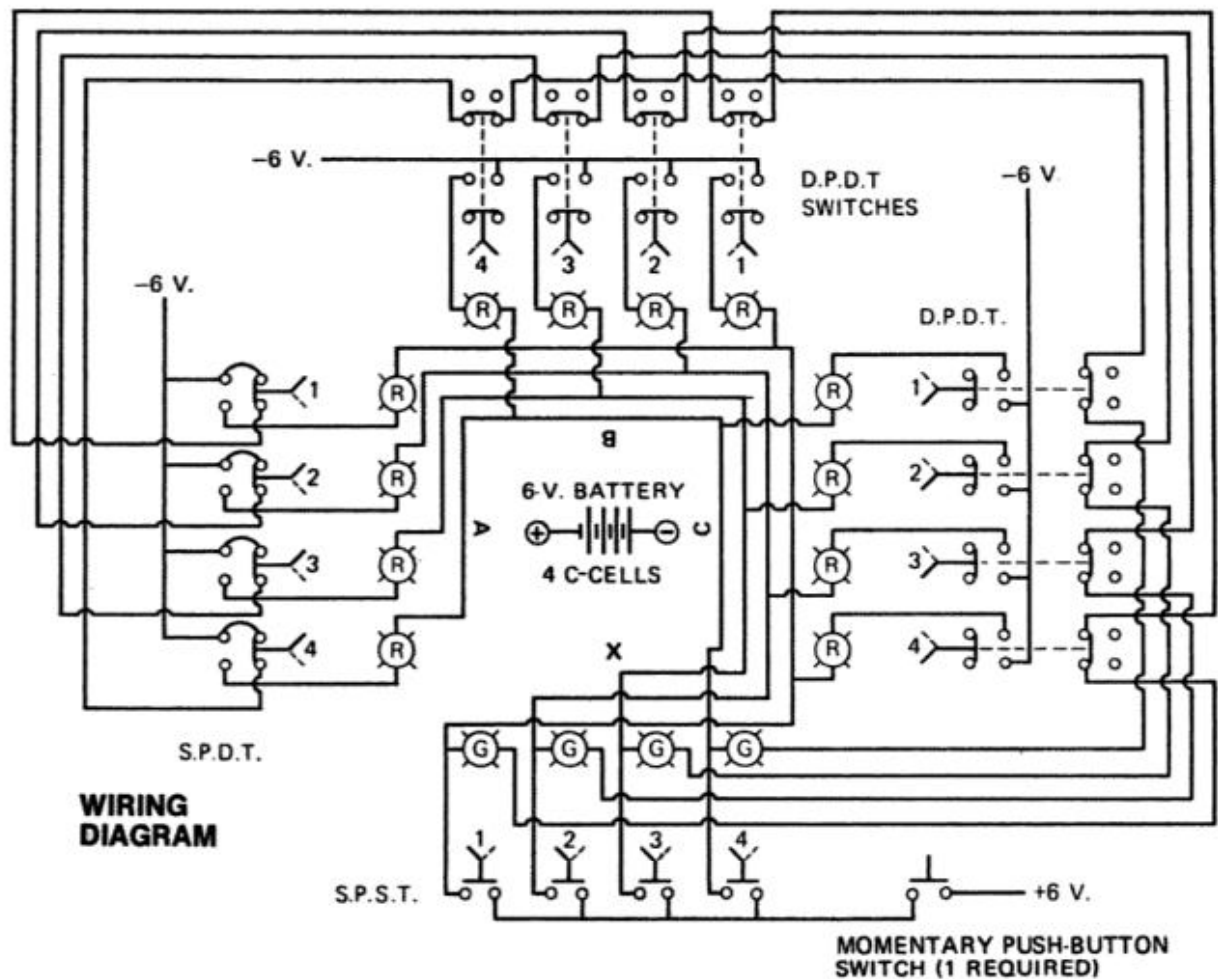
If player A chose 1 and 4, player B, 2 and 4 and player C, 2 and 3, then players A and B would match player X and each score a point.

However, if players A, B and C had all pressed switches 1 and 2, player X would collect a total of three points.

The first player to score 5, 10, 15 or 20 points, whatever number agreed on, wins. All switches are turned off after each guess. Player X has the right to check each player's guess, if he so desires, before he presses the button to turn on the

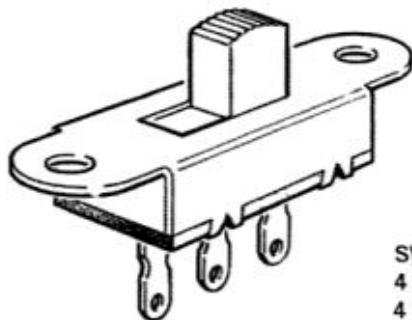
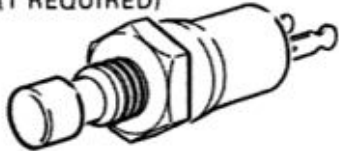


TOP PATTERN shows location of holes used for the lamps, poker-chip racks and battery-holder posts. Each row of holes is numbered

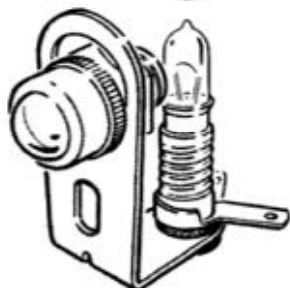


SWITCHES AND LAMPS REQUIRED

MOMENTARY PUSH-BUTTON SWITCH (1 REQUIRED)



SWITCHES
4 S.P.S.T.
4 S.P.D.T.
8 D.P.D.T.



LAMP WITH PILOT
12 RED PILOTS
4 GREEN PILOTS

lights. Any combination of numbers may be used by all players.

The scoring discs are 20 poker chips with holes through their centers. Each fifth chip is a different color to make counting easier. All discs are moved to the left before the game begins.

The game can be made of 1/8-in. hard-board and painted, or of colored sheet plastic. Cut four panels 3 1/2 x 7 3/4 in. and drill and slot them following the pattern. Then bevel one end 45° on the face side. Notice that only one panel is drilled for a pushbutton switch. Glue panels together at the corners to form a box 7 7/8 in. square and back up each corner on the inside with a triangular glue block. Finally, glue the 2 1/2 x 3 1/2 in. wings at the four corners.

Now lay out the 12-in.-sq. top panel and drill the 3/8-in. holes for the 16 lamps which fit flush with the surface. The holes in each row are numbered 1, 2, 3 and 4 with paste-on letters, and each row is identified with letters A, B, C and X. Holes are also made in the top for the

(Please turn to page 190)

Now: a 'cut-anything' bandsaw blade

SAW BLADES edge-coated with tiny particles of tungsten carbide make it easy to cut a variety of "unsawable" materials, and Remington Arms Co. of Bridgeport, Conn., has been making them to fit your sabre saw, circular saw and hacksaw. Now Remington has one for your bandsaw.

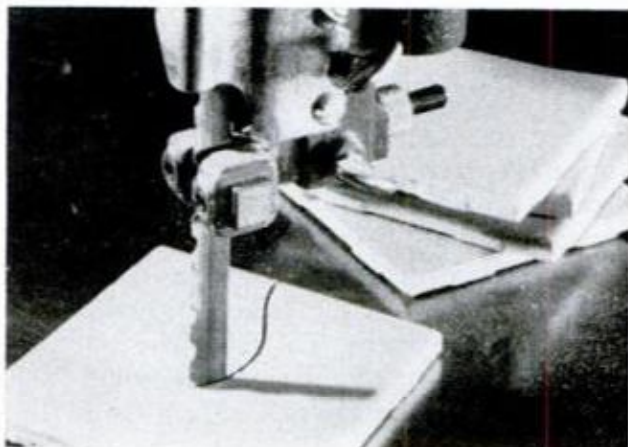
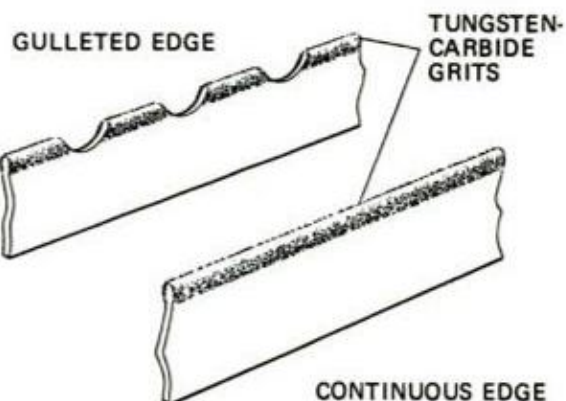
Such extremely hard materials as tile, slate, hardened steel, glass and asbestos-cement saw almost as easily as hardwood. The endless, smooth-running blade will walk through glazed ceramic tile and snaggy wire grille, and a bandsaw lets you cut thick materials.

These new Grit-Edge bandsaw blades have a gulletted cutting edge for general use or a continuous edge for cutting very thin materials where chipping might occur. They come in $\frac{3}{8}$ and $\frac{1}{2}$ -in. widths for 12 and 14-in. home-workshop saws and up to $1\frac{1}{4}$ in. for bigger machines. Write Remington for prices.



Specifications • Nominal Kerf in Inches and Index Number

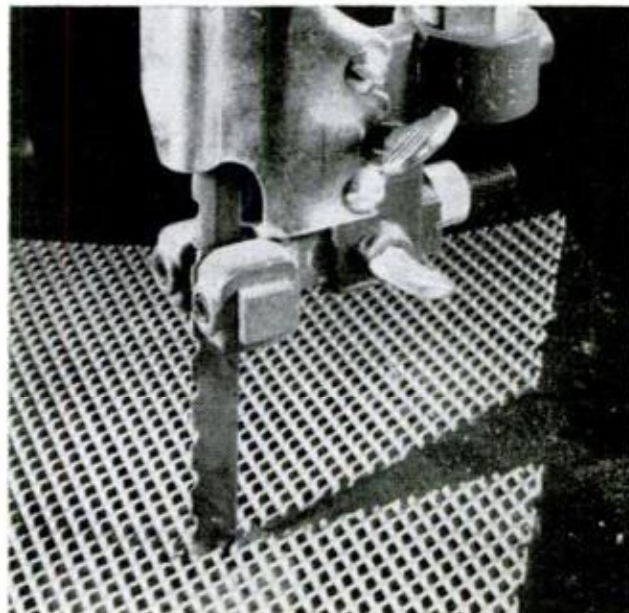
Width	Type Blade	Thickness in Inches	Fine -70 +100	Medium -50 +70	Med. Coarse -40 +50	Coarse -30 +40
3/8"	Gulletted	.025		.047 BS3-2M	.056 BS3-2MC	
	Continuous	.025	.039 BS3-1F	.047 BS3-1M		
1/2"	Gulletted	.025		.047 BS4-2M	.056 BS4-2MC	
	Continuous	.025	.039 BS4-1F	.047 BS4-1M		
3/4"	Gulletted	.032		.054 BS6-2M	.063 BS6-2MC	.076 BS6-2C
	Continuous	.032		.054 BS6-1M		
1"	Gulletted	.035			.066 BS8-2MC	.079 BS8-2C
	Continuous	.035			.066 BS8-1MC	
1-1/4"	Gulletted	.035				.079 BS10-D2C

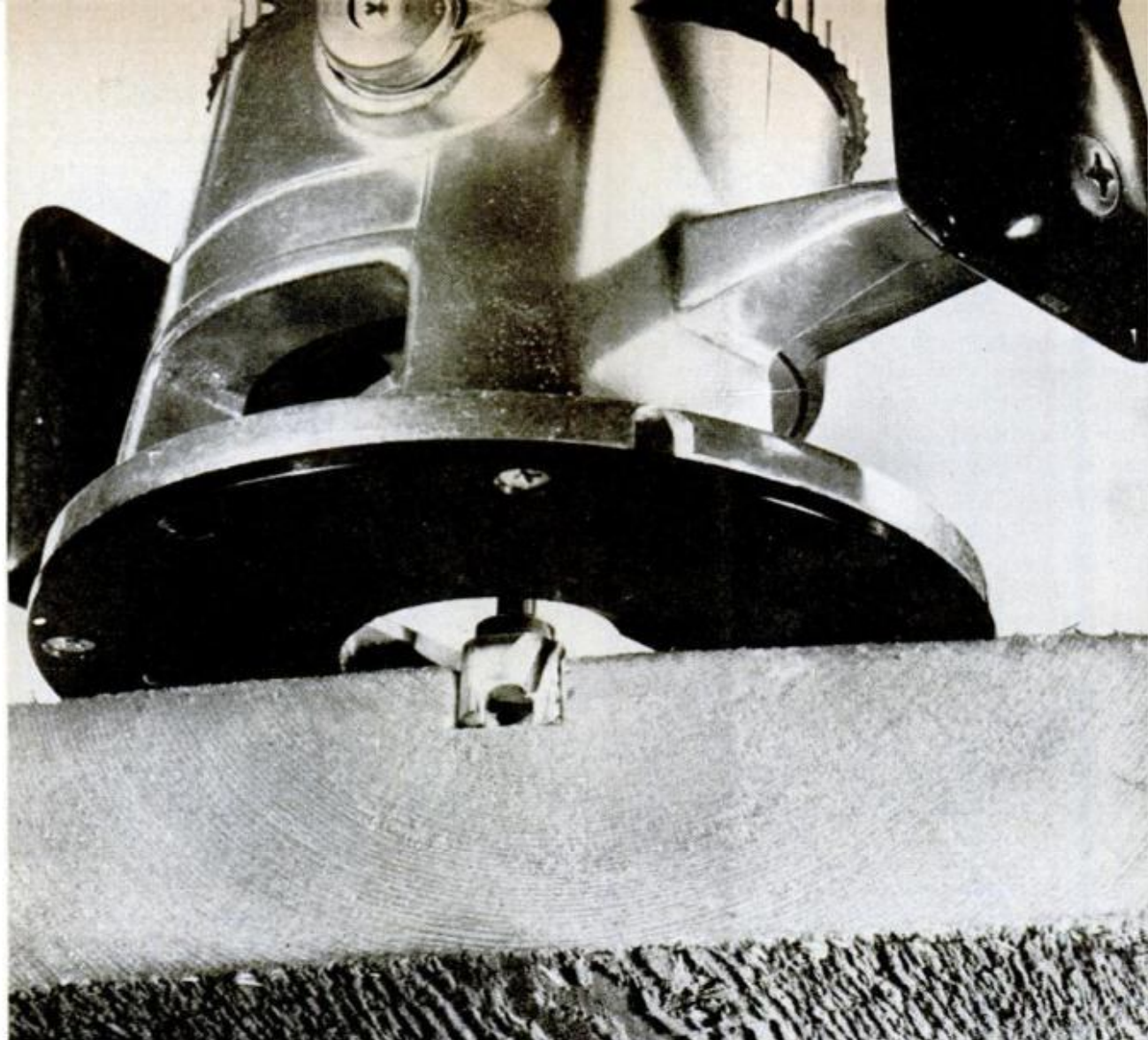


CERAMIC TILE cuts like butter with the tungsten-carbide blade, following a straight or irregular line

CARBIDE BLADE zips through a stamped metal grille with greatest of ease and without normal snagging

JANUARY 1973





Router know-how

PART 2

How to get decorative edges, create circular work, handle plastic laminates, make dovetail joints and more

By **HARRY WICKS**, Workshop Editor

Photos by Robert D. Borst

CHANCES ARE you have wasted no time familiarizing yourself with your new router by making test grooves and dados. Now you're looking forward to some great workshop moments with this versatile tool.

The simplest and most common cutting done with a router (right behind the two cuts mentioned above) is decorative edging. It's about the quickest, surest way to add a professional touch to any project.

Decorative edging

A shaped edge, whether Roman ogee,

beaded or simply rounded-over (quarter round), improves the looks of just about any cabinet door, tabletop or drawer front. Actually, doing these edges goes so effortlessly that it is easy to give in to the temptation to put an edge on just about everything in sight. To avoid the mistake of *over-routing*, decide *which* edges will receive *what* treatment—and stick to the plan.

Direction of feed is as described last month in Part 1 (page 156); bit versatility can be increased by simply raising or lowering the cutter. You can put decora-

tive edges on circular workpieces, too. To do it, use the circle-cutting guide (shown in Part 1) and counterclockwise feed.

When in doubt, feed the router extra slowly. As you gain experience, you'll find that many woods have a tendency to splinter off large pieces ahead of the cutter. A slow feed rate and sharp cutter usually prevent this happening, but if it still happens, you should make the decorative edge with several passes. Lower the bit for each succeeding pass until the desired shape (depth) is achieved.

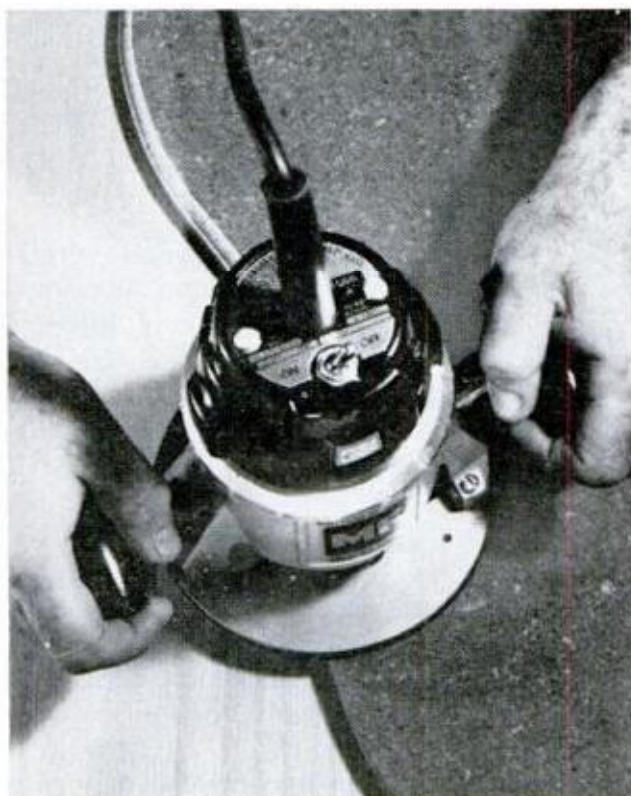
A lipped door is easily made using the

rounding-over and rabbet-cutter bits. But sequence is important: Make the rounded edge first, then the rabbet. Since the rabbet cutter's pilot will not have a surface to bear against, affix a guide for the router sub-base (shoe) when cutting the rabbets.

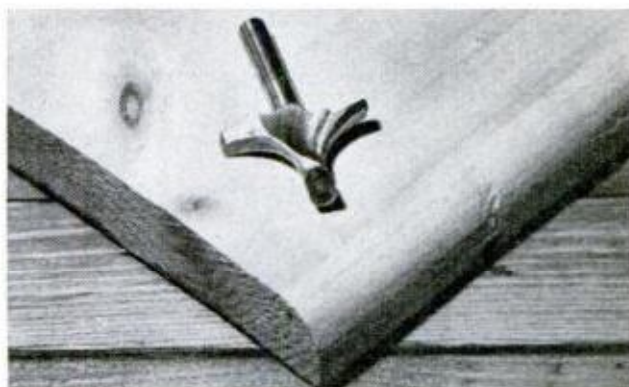
Circular work

Circles cut with a router will be absolutely accurate, as can be seen in the pair of photos at top of page 140. The first is a perfect circle being cut from plywood using a trammel point and panel-type bit; the other is a decorative plaque

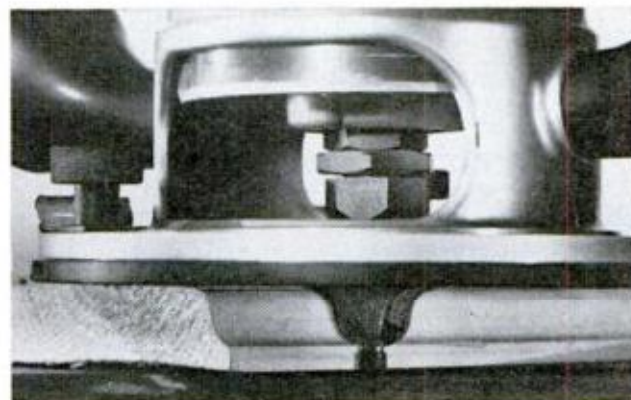
How to cut decorative edges that improve your projects



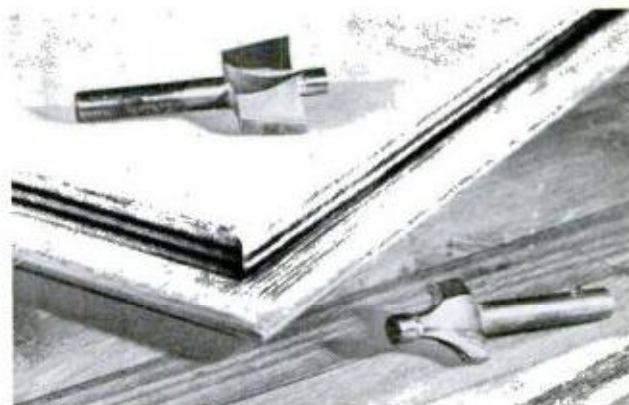
PILOT BIT (here, a beading cutter) can be used around edge of either square or free-form workpiece



TYPICAL EDGES SHAPED using a pilot-type bit: rounded-over (quarter round) at top and beading

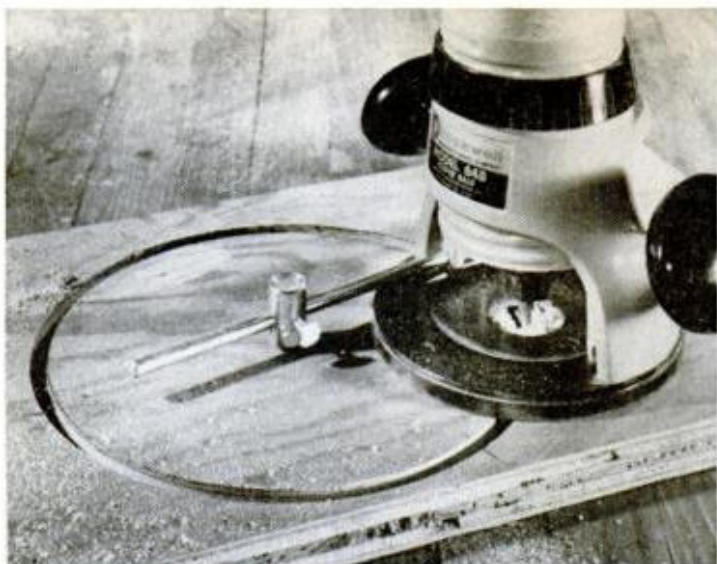


ROMAN OGEE illustrates how flutes do the cutting as the pilot at bottom ridges against the work edge
JANUARY 1973

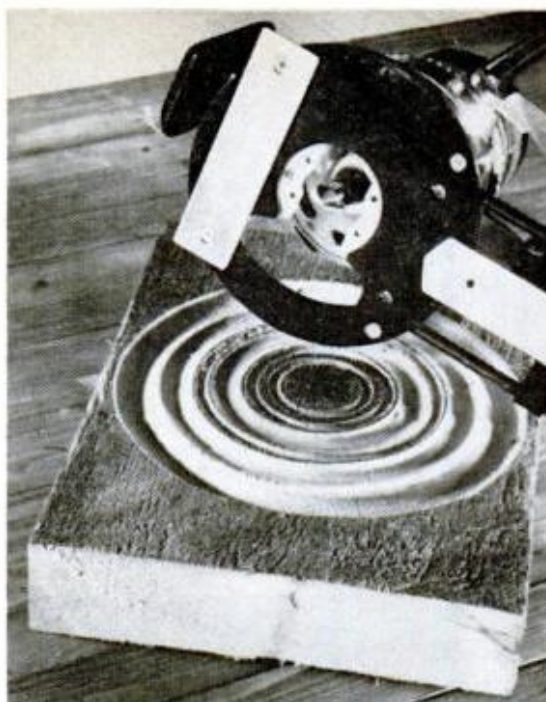


LIPPED DOOR is formed using rounding-over bit on the outside edges and $\frac{3}{8}$ -in. rabbet cutter on inside

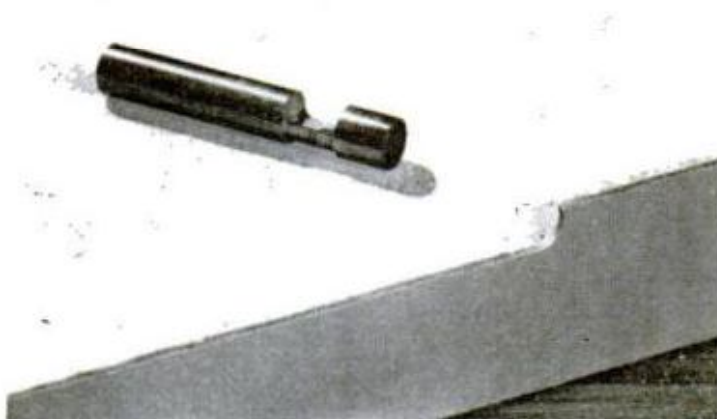
How to handle circular work with no chance of error



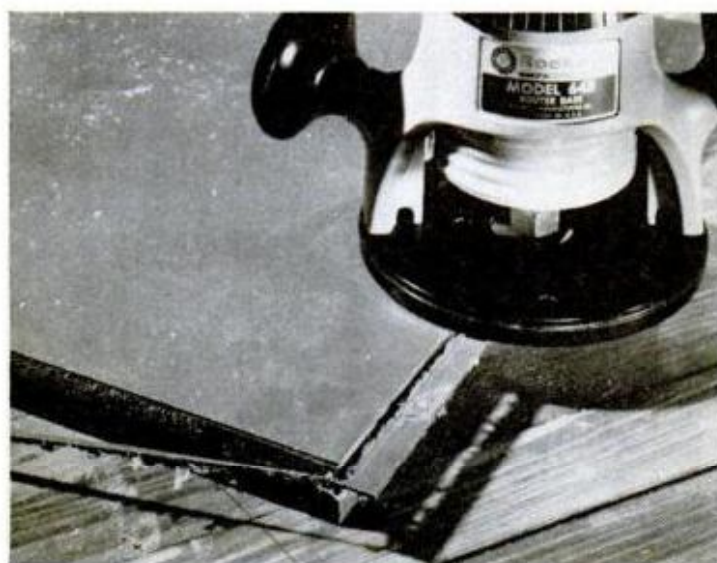
TRAMMEL POINT is affixed at the desired radius on guide bar secured in router shoe; straight bit does the cutting. The decorative plaque (right) was created with a core-box bit set at various depths for the concentric circles



Working with plastic laminates



1. **SELF-EDGE** is applied to the top and trimmed with a straight carbide bit. Type shown is solid, one-piece trimmer



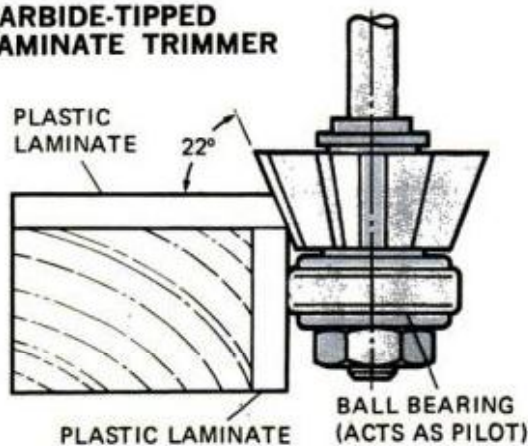
2. **LAMINATE TOP** is placed and trimmed, using the same cutter. See text for ways to prevent cutter burn marks
140

created by routing concentric circles with trammel point and core-box bits of various radii set at a different depth for each circle. Variations on this type of design are almost unlimited; each bit at a different cutting depth will provide a visual difference.

Plastic laminates

Because of looks and durability, plastic laminates are now commonly used by do-it-yourselfers. But plastic-laminate fabrication requires precise workmanship. Since plastic laminates are not cheap, it makes good sense to practice on scrap be-

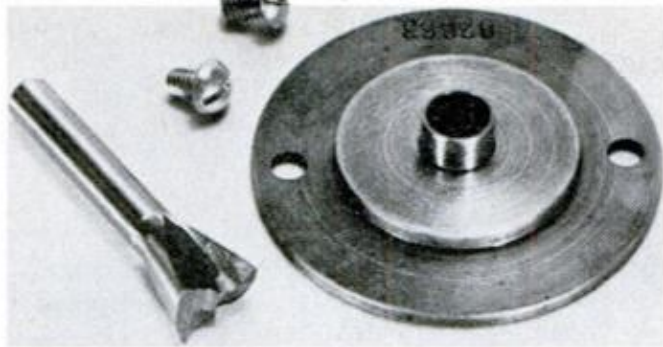
CARBIDE-TIPPED LAMINATE TRIMMER



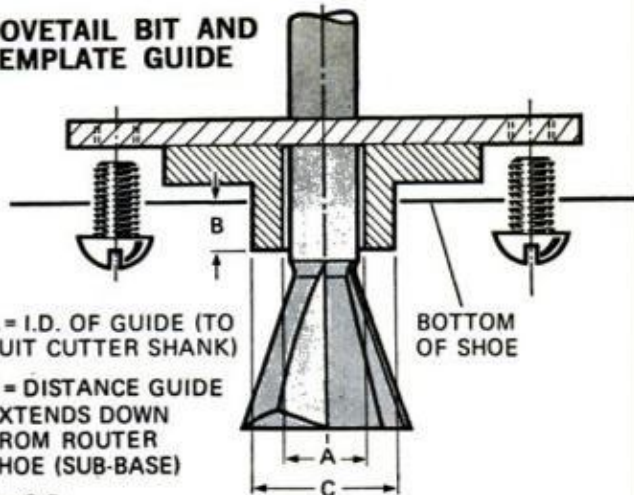
3. **EDGE** is finish-dressed with a bevel. Ball-bearing-type bit is also carbide-tipped

POPULAR MECHANICS

Dovetailing the easy way—with power



DOVETAIL BIT AND TEMPLATE GUIDE

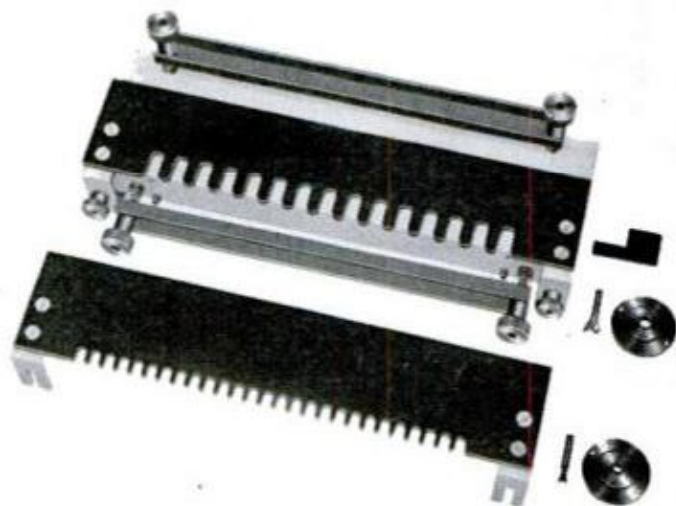


A = I.D. OF GUIDE (TO SUIT CUTTER SHANK)
 B = DISTANCE GUIDE EXTENDS DOWN FROM ROUTER SHOE (SUB-BASE)
 C = O.D.

BOTTOM OF SHOE

TO CUT DOVETAILS, you need a dovetail bit and template guide in router shoe and the dovetail template (below)

TEMPLATE GUIDE must be securely fastened to shoe and bit set at precise cutting depth

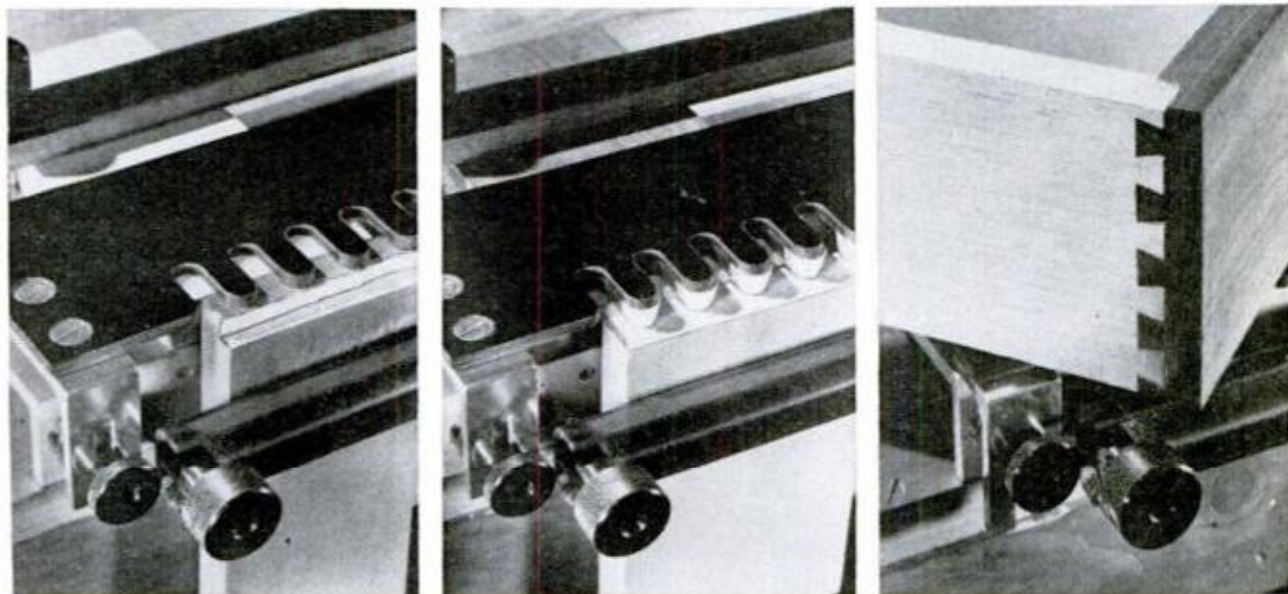


fore you put your router to an actual project.

Since conventional steel bits won't hold cutting edges if used on plastics, *always* use a carbide bit. Cutting edges on carbide-tipped bits hold up indefinitely and, more important, give neat, chipfree cuts. Of two types—one-piece solid and self-contained ball-bearing—you'll need two (of either design): a straight cutter for overhang trimming and a bevel bit (varying from 15° to 22°) to finish-dress the joint.

DOVETAIL TEMPLATE component parts: Notice that the main base is fastened to wood to provide positive clamping area

If you prefer the one-piece solid (as I do), smear petroleum jelly on the laminated self-edge to avoid any chance of the cutter creating a scorch



WITH BOTH PIECES clamped in template, router is moved left to right along complete edge (to prevent splintering). Second pass is also left to right, following fingers. The work is then test-fitted (right)

Template routing



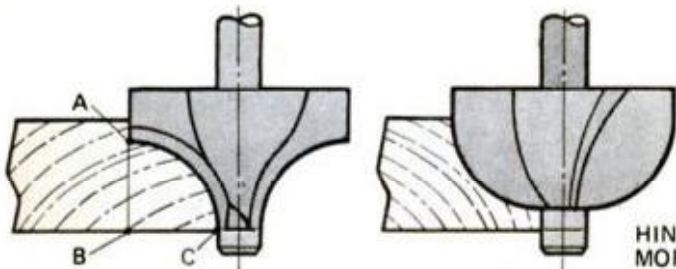
TEMPLATE CUTTING is done using template guide and pattern cut slightly under the finish-work size

Freehand routing



A REAL CHALLENGE for a creative craftsman, free-hand routing is done without guides or templates

USE ROUNDING OVER AND COVE BIT OF SAME RADIUS. (FOR 3/4" STOCK, 1/2" RAD.)



DIMENSION A-B = DIMENSION B-C
POINT B IS CENTER OF HINGE BARREL

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mark. But if you have the ball-bearing type, acquire the habit of frequently disassembling parts and cleaning them with lacquer thinner. Then oil and reassemble. If you don't, the bearing eventually clogs with contact cement and spins at the same speed as the cutter—and then it will leave a burned line along the self-edge. The bearing *must* be free-spinning so it will rotate at the speed of router movement—not the cutting flutes.

Make sure that edges of the material to which the laminate will be cemented are square and true. (For complete information see *How to work with plastic laminates*, page 154, March '70 PM).

The self-edge is cut slightly larger than the surface to which it will be adhered; then affixed to the wood with contact cement. With the workpiece clamped to the workbench, the excess laminate is trimmed off with the straight bit.

Next, the top is bonded (again with slight overhang all around) and trimmed with the straight cutter. Finally, all edges are dressed with the bevel cutter. Beveling requires only a slight pass since very little stock is removed.

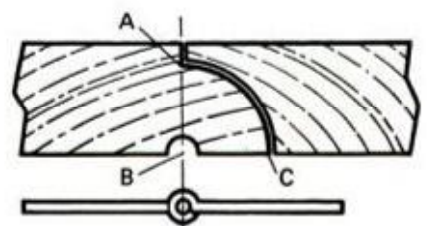
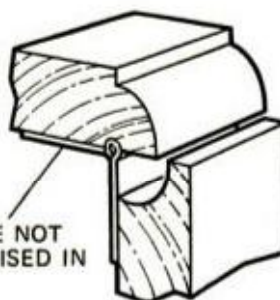
Dovetail joints

One of the strongest joints in wood-working, the dovetail is widely used in commercial furniture-making. With the help of a dovetail template and a suitable template guide, your dovetail joints will soon rank with the best. Dovetail templates sell for about \$50 and the guides for \$3 to \$5 depending upon size. No matter which brand you buy, make certain you read and understand the manufacturer's instructions.

To make dovetail joints, first install the template guide in the router sub-

DROP-LEAF TABLE JOINT (below) is created using two bits shown. The bits must have matching radii

DROP-LEAF TABLE JOINT



USE DROP-LEAF-TABLE-TYPE HINGE

POPULAR MECHANICS

base. (Note: Since the method of affixing guides varies from maker to maker, buy guides of the same make as your router.) Next, with the router installed in the sub-base (shoe), insert the dovetail bit so it extends exactly $\frac{19}{32}$ in. below the router base.

The base of the dovetail template is always affixed to a piece of wood (or the workbench). Use fh screws in screwholes provided in the base. When clamped in position, the front (overhanging) apron of the base should butt against the front edge of the workbench or board (see photo, page 141) fastened to the base.

With the template set up as instructed by the maker, always make a test dovetail joint first on scrap of the same material with which you will work. Make no mistake, dovetailing is precise work, so solve all problems—settings, cutter depth and the like—before pushing the router through your work. After obtaining a perfect cut on scrap, you can proceed on the work.

Since the boards are reversed after you make the cut, both boards are placed in the template with inside edges facing out and up. The top (horizontal) piece is first placed temporarily against the left-hand stop with its end extending about $\frac{1}{2}$ in. beyond the main template base. Then, the second piece is placed underneath the finger template and against the other left-hand stop. At the same time, move the first piece until it is flush with the second (see photo, page 141.) When both pieces are perfectly lined up, tighten all template thumbscrews.

When making the dovetail cut, never move the router on or off the template with motor running; there's too high a risk of damaging the template with the cutter. And always make your first cut along the entire edge of the workpiece—without sliding in and out of the fingers—to prevent chipping the edge.

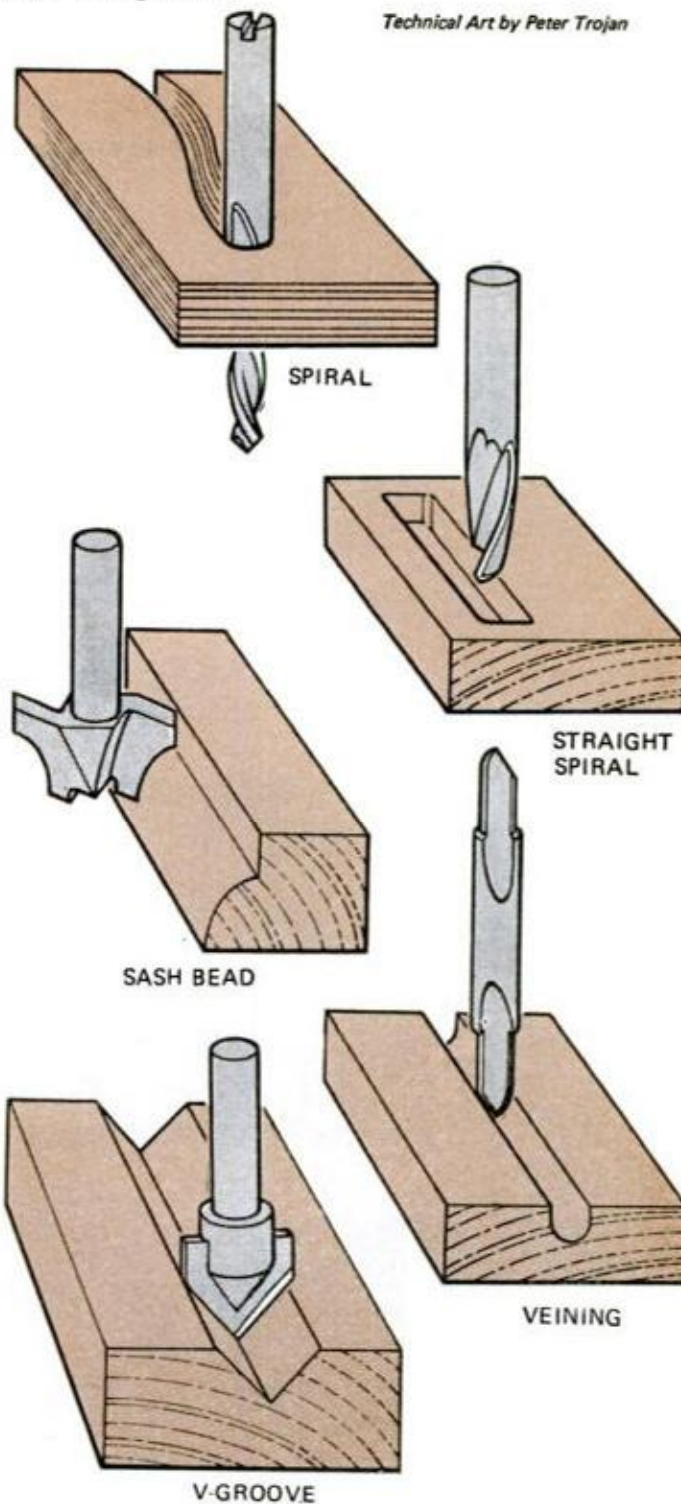
After moving the router from left to right for this first cut, shape the dovetails carefully, moving in and out of the fingers. Again, the router should be walked from left to right. After the cut is completed, turn off the router. When the cutter stops spinning, remove router from the work.

Remove the boards from the template and test the joint. If your test work on scrap was accurate, you should have a

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Special-purpose bits for experts

Technical Art by Peter Trojan



perfect joint. But if fit is loose, lower the bit slightly (perhaps $\frac{1}{64}$ in.), replace boards in template and re-rout. (If tight, raise the bit by that distance.) Once the template and router are set to produce a perfect dovetail joint, any number of dovetails can be cut accurately. Rabbeted drawer fronts, as well as the joint shown in the photos on page 141, can be dovetailed, too; it is necessary to reset the template stops, and you should refer to

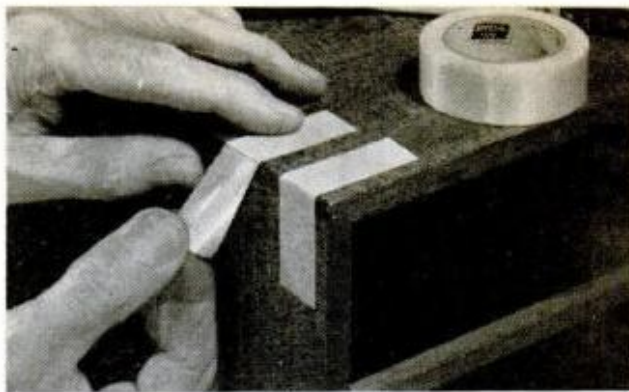
(Please turn to page 191)

Hints from

Tape aids gluing

Filament tape, intended mainly for such tasks as securing packages, is particularly handy for holding glued joints immobile while the adhesive sets in either new construction or when doing repair work. I've found the tape is strong, sticks tightly when applied to a clean surface and resists stretching when pulled.

—B. W. Ervin, Kent, Ohio.



Wire 'connectors' from tubing

Short pieces of copper tubing can be literally "pressed into service" as electrical-wire connectors when other types are unavailable. The tubes are slipped over the bared wires, compressed with a Vise-Grip pliers, and the joints taped. For even greater strength, the connections can be soldered before being taped.

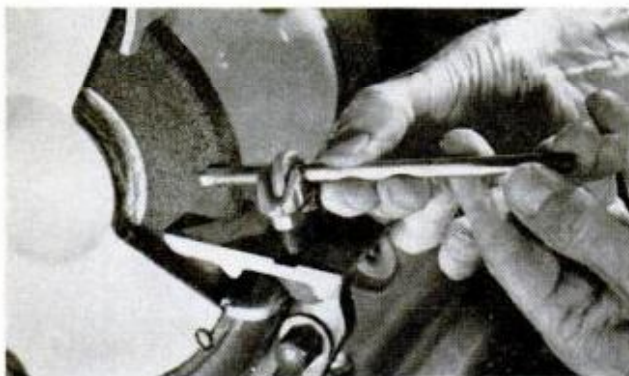
—Burt Web, Skokie, Ill.



U-bolt grinding guide

To grind opposing, parallel flat areas at the end of a metal rod, I clamped a U-bolt a short distance from the end and then placed the threaded ends of the bolt on the grinder's toolrest. This kept the rod in alignment while it was tilted forward to bring it against the sides of the grinding wheel.

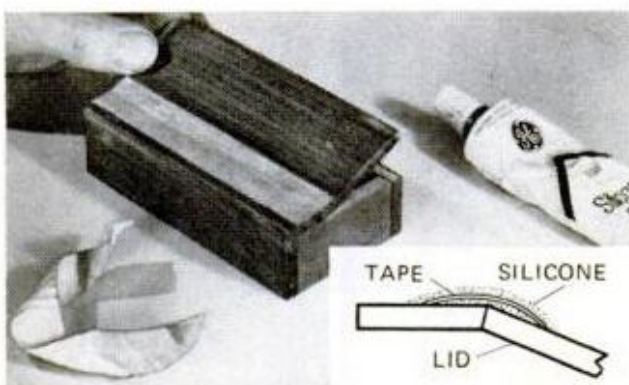
—Walter E. Burton, Akron, Ohio.



Self-closing hinge

Fabric tape and silicone sealing compound can be combined to make a self-closing hinge for a box lid. First, lid and adjacent strip to which it will be hinged, are positioned so the lid is *overclosed* by about 15°. (Beveling the edges makes this possible.) With lid closed, apply compound and immediately press in tape.

—W. B. May, Oak Park, Ill.



Cassette-tape rewriter

Here's a simple, effective way of winding a cassette tape either forward or backward, on or off the recorder. The rewriter is a 1-in. section of rubber hose slipped over the end of a pencil. With practice you'll soon discover just how many turns it takes to find the exact spot you want on the tape.

—Ken Patterson, Regina, Sask.



readers

Clamps from wire solder

Light pressure clamps can be made quickly from solid wire solder. The little C-clamps shown were bent so their ends were closer together than the thickness to be spanned, then carefully forced into position. After use, such clamps always can be returned to their original purpose—that of soldering metal.

—E. B. Walters, Chicago, Ill.

Felt 'brushes'

Disposable brushes or applicators for applying lacquer and other finishing materials are easily made from felt salvaged from old hats. For a typical brush, cut a felt strip 2½ in. long and ¾ in. wide. Fold it crosswise at the center and push it into a ⅝-in.-long slot in a ⅜-in. hardwood dowel "handle."

—Wm. T. Mayor, Philadelphia.

Tubing from clothesline

An emergency source of small-diameter flexible tubing can be a plastic-covered clothesline. A half inch or so of the cover is peeled from one end so the rayon core can be clamped between vise jaws. Then the tubular cover (usually vinyl) is pulled off. Pressing the tubing end back with a finger helps loosen it.

—Henry Jones, Houston.

Drawing multiple lines

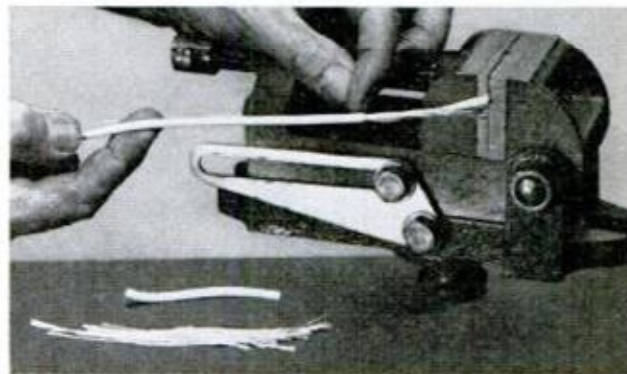
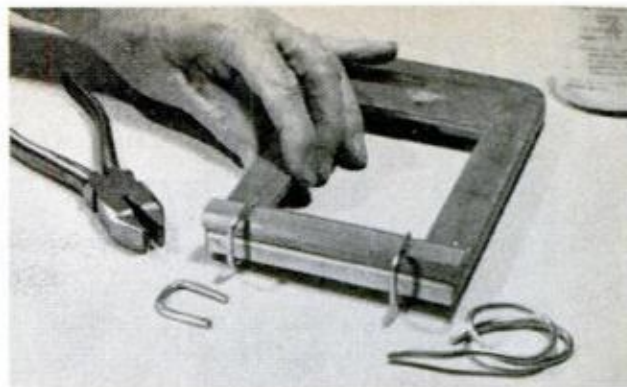
When taped together side by side, two or more ballpoint refills make handy instruments for drawing parallel lines. Novel signs can be made by using such a setup as a lettering pen. After the letters have been roughed out, lines can be strengthened, shading added or other modifications made with a single ballpoint.

—Walter E. Burton, Akron, Ohio.

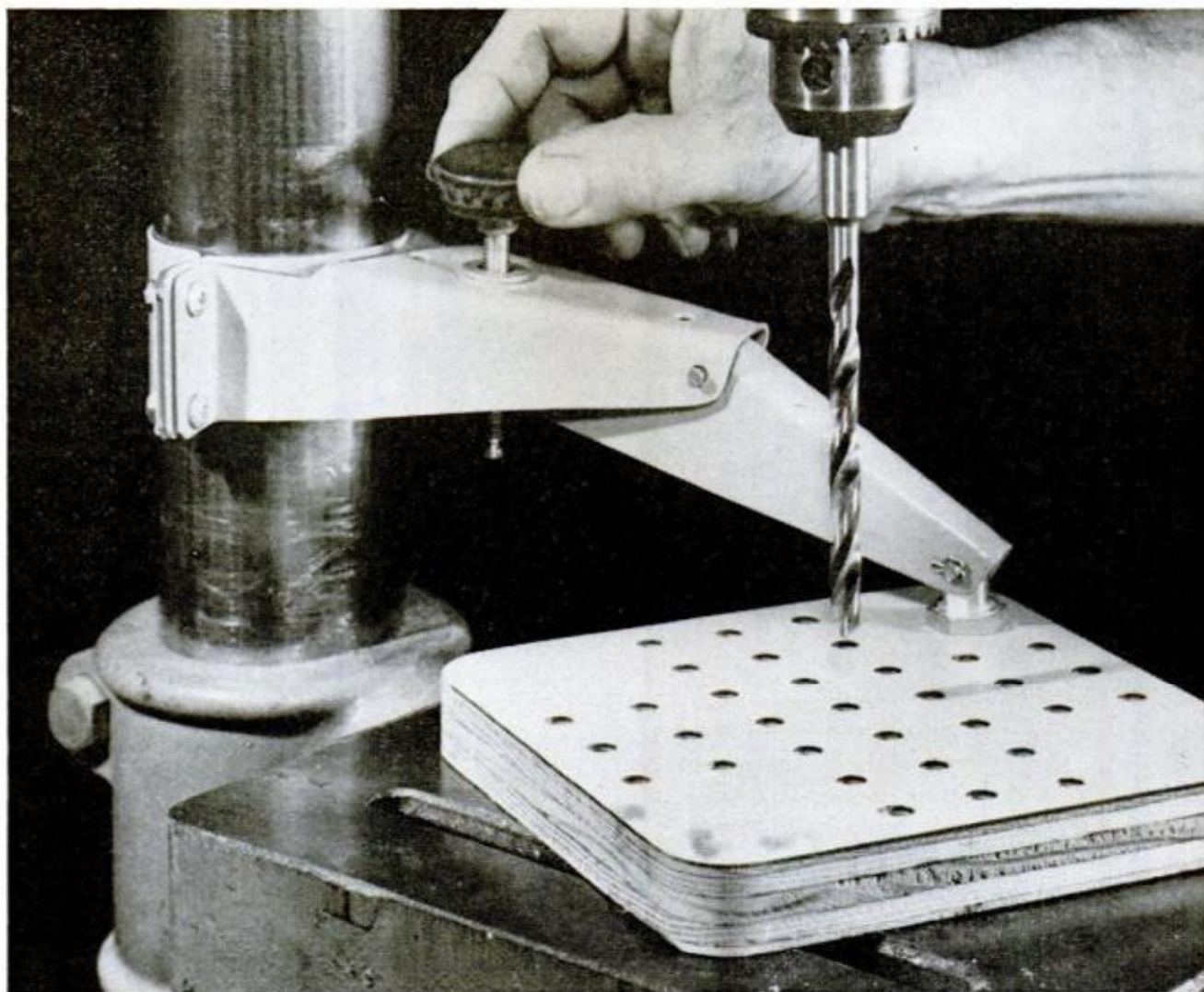
Hang it all

By replacing one bolt with an eyebolt, I made my drill easy to hang. To keep the chuck key handy, I have mine fastened to a length of monofilament fishline fed through a hole in the perforated board. A sinker—heavier than the key—is tied to the other end of the line to hold the key against the board.

—Don Anderson, Sunnyvale, Calif.



Handy hold-down for your



By C. A. ACKERMAN

Photo by Robert D. Borst

HERE'S a drill-press fixture that does away with C-clamps normally used to hold work firmly and safely for drilling. It clamps to the drill-press column and can be swung out of the way when not needed. Pressure is applied to the foot of the hold-down by tightening a knob.

The hold-down has four sheet-metal parts formed from .06-ga. low-carbon steel—a bracket, rocker and two-piece column clamp. To bend the bracket and rocker neatly, first cut tapered wooden forming blocks to fit the bending lines of the pattern. For the bracket the block must taper from $\frac{3}{4}$ to $\frac{1}{2}$ in.; for the rocker, from 3 in. to 1 in.

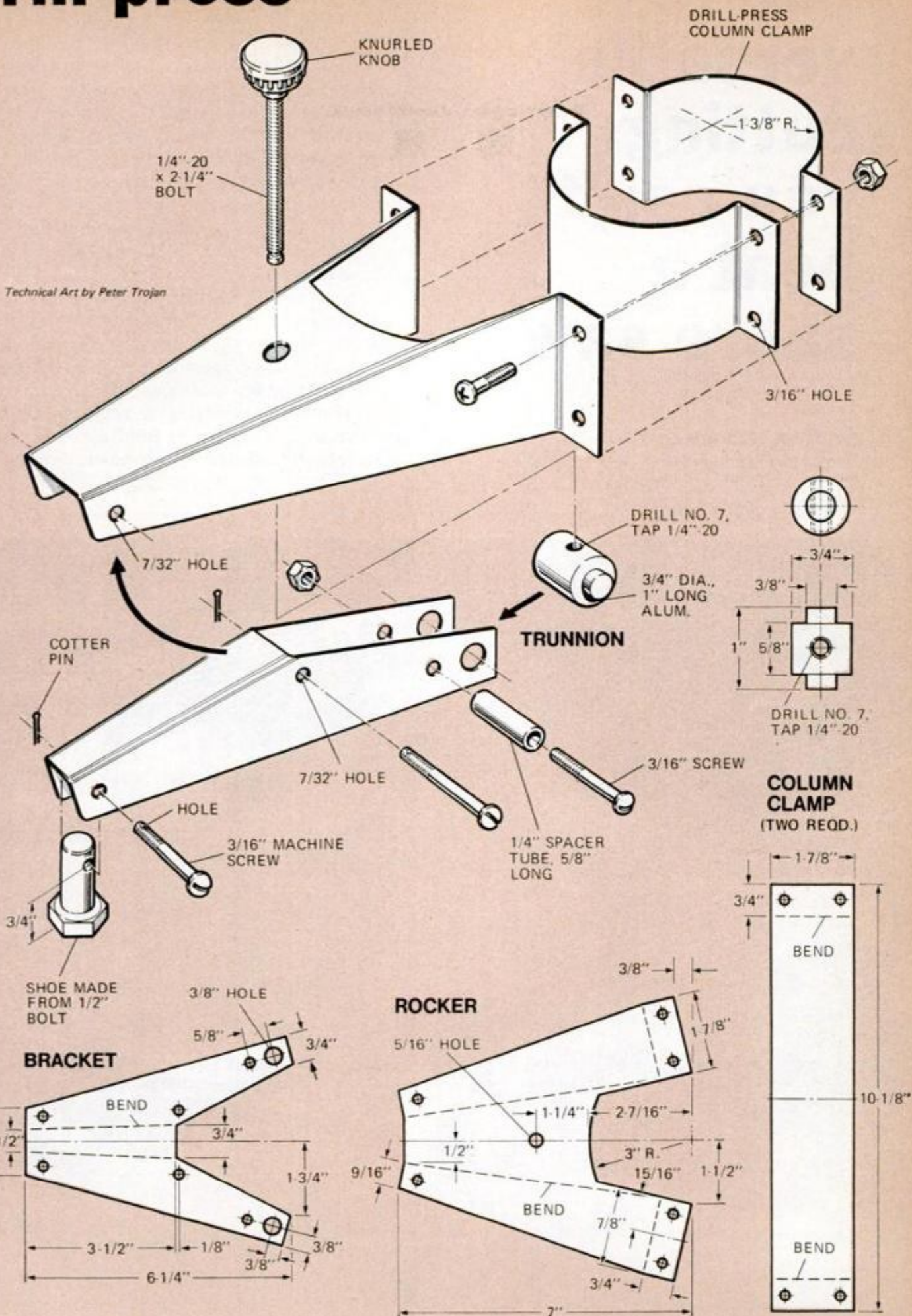
Make full-size patterns for the two parts, lay them on your sheet metal and cut out with tin snips and a cold chisel. Drill all holes while the parts are flat, being careful to spot them precisely when

center-punching. Start with a $\frac{1}{4}$ -in. bit to drill the $\frac{3}{8}$ -in. holes and work up to the final size with progressively larger bits; you'll have neat round holes. Use two C-clamps to hold the sheet metal to the tops of the forming blocks and press the metal against the sides of the blocks, tapping it as you go with a rubber mallet.

Matching holes in the column-clamp parts are made with both clamped together. The three sets of holes must align. Bend ends 90° and then bend both halves around the drill-press column. Dimensions are for a $2\frac{3}{4}$ -in.-dia. column. If parts are loose fitting, use shims.

The threaded knob passes through a hole in the rocker and a tapped hole in a trunnion nut turned from aluminum to pivot freely in the $\frac{3}{8}$ -in. bracket holes. A toggle action occurs when the knob is tightened against the rocker. ★★★

drill press



For versatile cutting, you can't beat a sabre saw

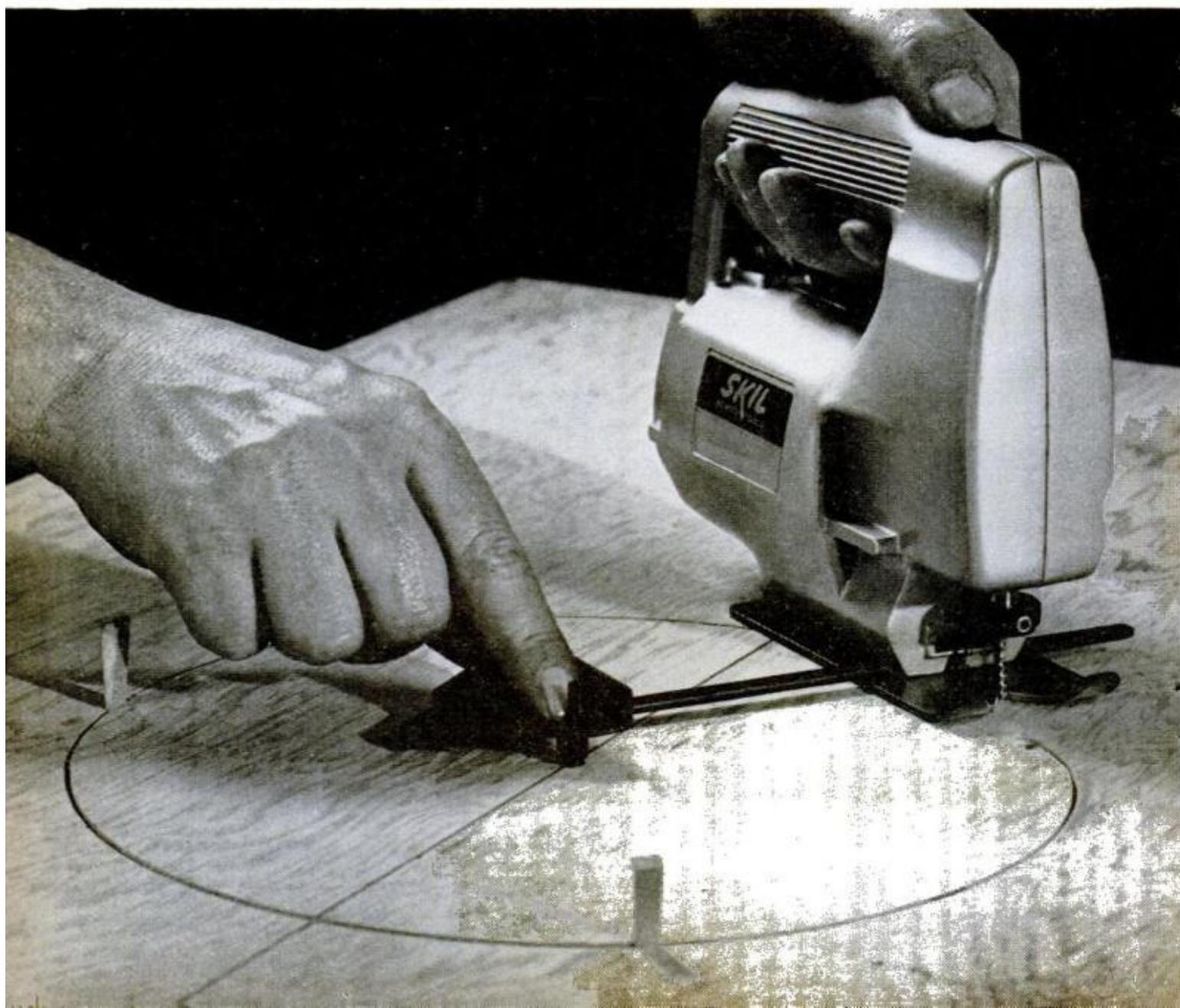
By JOHN BURROUGHS
Photos by the author

AS JIGSAWS, sabre saws aren't really very satisfactory. But as general-purpose power saws for cutting off lumber and ripping panel stock—the kinds of jobs that used to be done with arm-powered handsaws—the tools just can't be beat. Although sabre saws aren't as fast cutting as portable circular saws, they're lighter, easier to handle, safer and more versatile.

Their versatility has made them so popular, particularly with homeowners who don't have table or radial saws, that there are now more than 20 makes of sabre saws available, and most manufacturers offer several different models—in all, a good many saws to choose from.

All are similar mechanically. In each a brush-type, universal motor pinion-drives a reduction gear that has an eccentric stud. The stud operates a reciprocating saw bar with a chuck to hold a blade on its lower end. But in size, power, qual-

WHEN SAWING A CIRCLE with edge guide used as a trammel beam, wedge kerf as you near end of cut

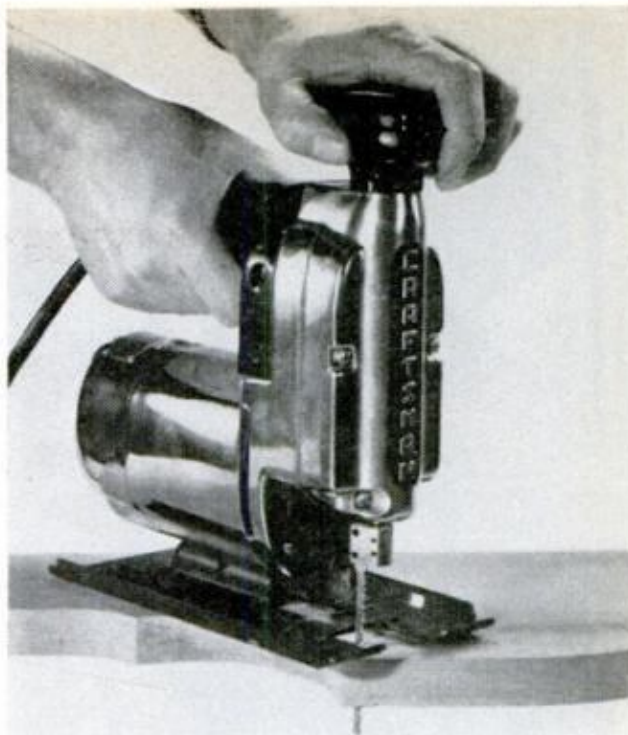


ity and price, the models differ widely. You can buy a sabre saw for under \$10, or you can pay more than \$100. Either tool may be well worth the money.

When considering which saw to buy, the real question is whether a more expensive tool's extra quality and features will prove, to *you*, worth the higher cost. The answer depends upon the work you'll do with the saw. In general, a better tool is a better buy, and for any given make, the model second from the top of the line is likely to be the best value.

● **Big or little?** Most light-duty saws with $\frac{5}{8}$ -in.-long strokes have motors that draw about 2.5 amps. and develop up to $\frac{1}{4}$ hp. Such saws readily cut 1-in. hardwood or $1\frac{1}{2}$ -in. softwood.

Heavier duty saws with 1-in.-long strokes have motors drawing up to about 4 amps. and developing around $\frac{1}{2}$ hp. These larger tools can rip 2-in. planks twice as fast as smaller models, and with



SEARS' 12-SPEED SAW has a knob for steering the blade in any direction without need to turn the saw



TO SAW SHEET METAL SMOOTHLY, use a 32-tooth, wave-set, metal-cutting blade with a slow, even feed



WHEN POWER-HACKING PIPE or angle iron, use the saw's slowest speed and flood the cut with light oil



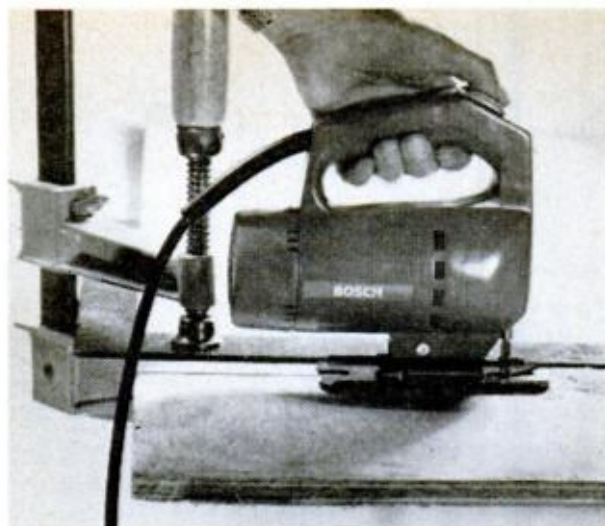
FOR A PLUNGE CUT, rock saw forward, then gradually pivot tool backward until blade cuts through



SHOES ON SOME SAWS SLIDE BACK to permit cutting to a wall when sawing openings for ductwork



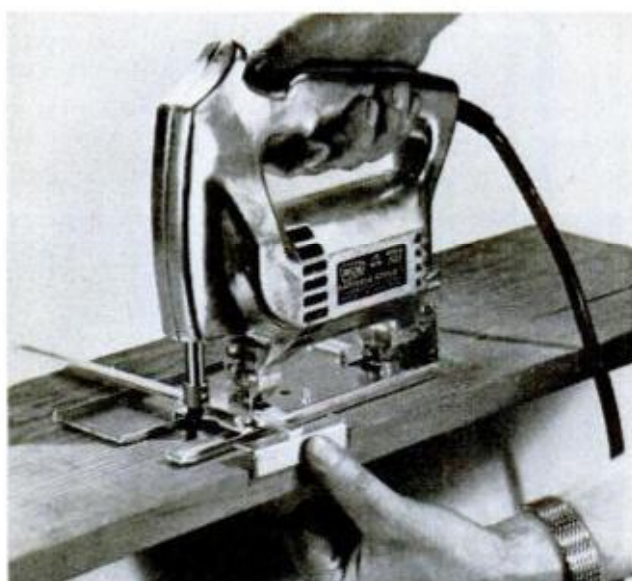
FOR PERFECTLY SQUARE CUTS when sawing lumber to length, use small try square to guide saw's shoe



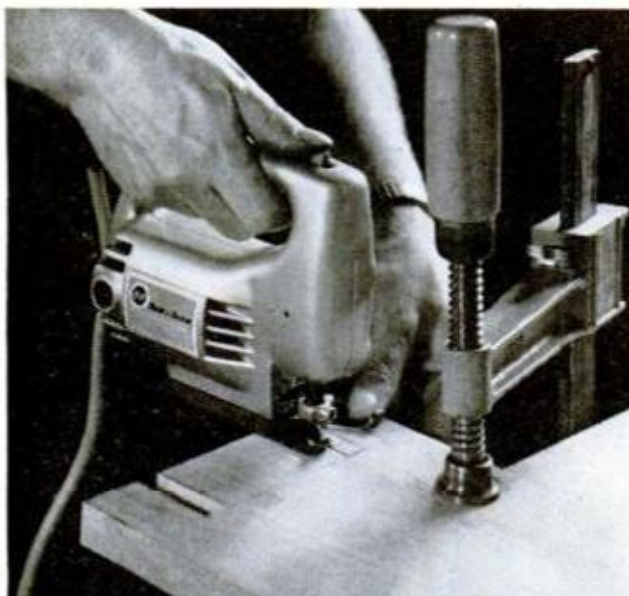
TO CUT PANEL STOCK with bench-saw accuracy, run the saw's shoe along a square clamped to the work



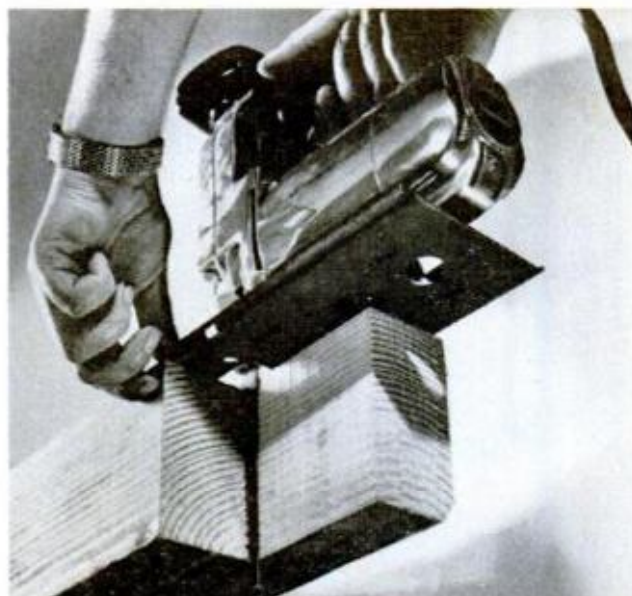
ON ALUMINUM, use a blade with teeth fine enough not to snag, but coarse enough to avoid any loading



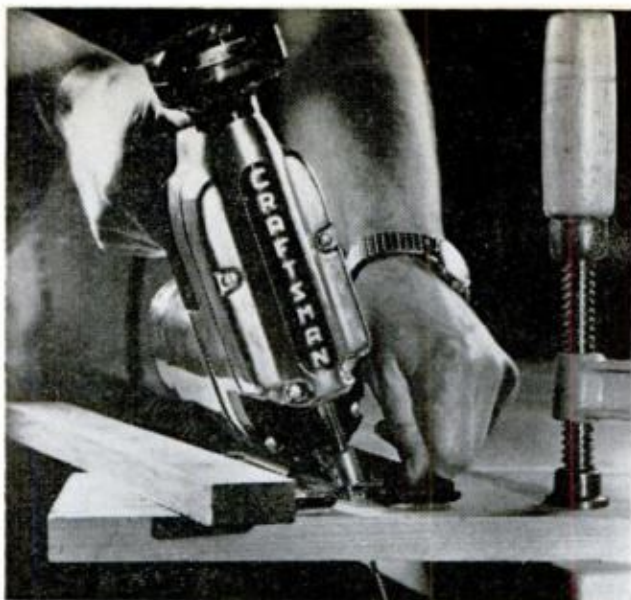
EDGE GUIDE ATTACHMENT keeps saw parallel with stock's edge and simplifies ripping of narrow strips



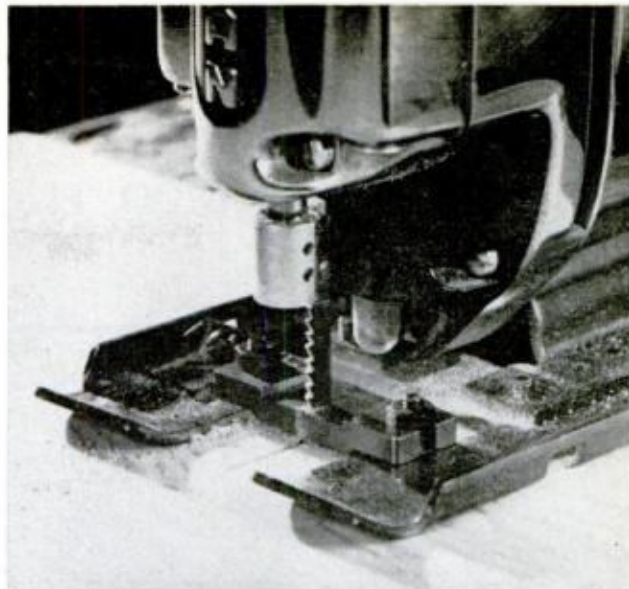
NOTCHED JOINTS can be fitted in minutes with a sabre saw. Tool is indispensable for boatbuilding
150



WITH A 6-IN. BLADE, a 1-in.-stroke saw can notch 4x4s, lop tree branches, saw openings in partitions
POPULAR MECHANICS



TO CUT COMPOUND-ANGLE MITERS with tilt-base saw, tilt the base and tack wood fence to the work



SHOE INSERT, an attachment available for some sabre saws, reduces splintering when you cut plywood

extra-length blades they can cut off or notch 4x4s.

A lightweight, light-duty sabre saw is perhaps easier to handle, and if you'll use it only for light woodwork—cutting off 2x4s and sawing plywood—it's just the tool for the work.

But if you'll use your saw in construction work, a larger, faster-cutting model will be worth the extra money. A heavy-duty saw is also preferable if you'll be sawing metal with the tool. Larger models have enough power to gradually hacksaw through mild-steel plate, and because the longer stroke utilizes more of the blade's teeth, metal-cutting blades give longer service.

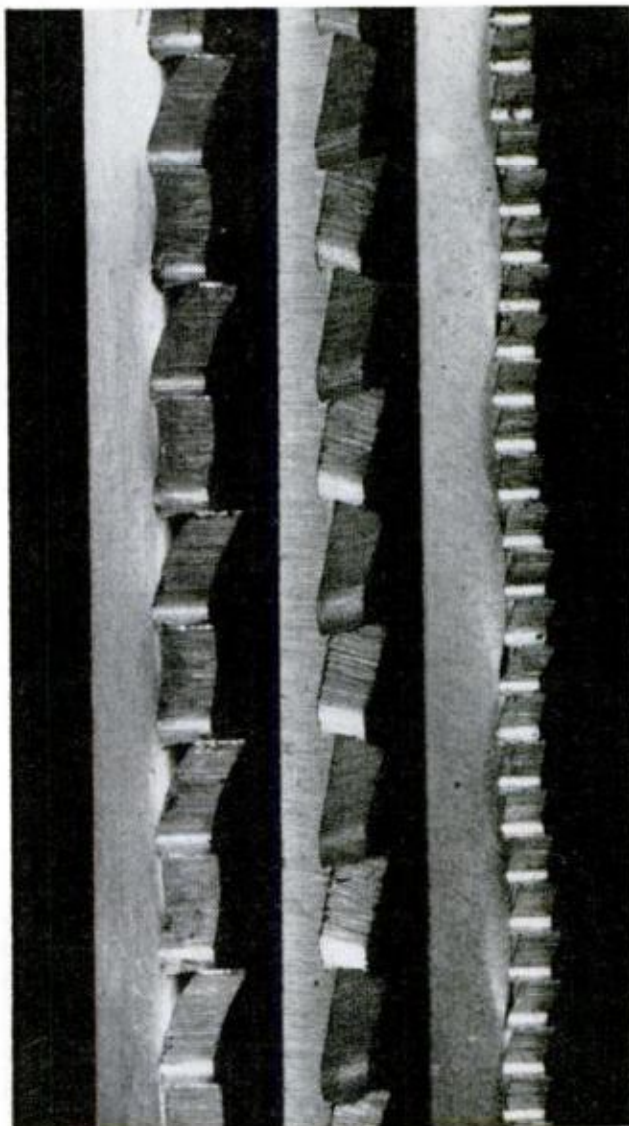
● **Single or multiple-speed?** A single-speed saw operating at a no-load speed of around 3000 strokes per minute is fine for light woodwork—but not much else.

Two and three-speed models, while more expensive, are more versatile. A three-speed tool generally has a medium speed of about 2500 strokes per minute and a low speed of around 2250 strokes.

Several higher priced heavy-duty saws now have trigger-controlled continuously-variable speeds of from 0 to 3000 strokes per minute. Others have dial-type controls giving full-power speed ranges around 1300 to 3000 strokes per minute.

Slow speed is a considerable advantage. A saw chugging along smoothly at moderate speed is more pleasant to use and easier to guide than one chattering lickety-split. And slow speed makes the tool

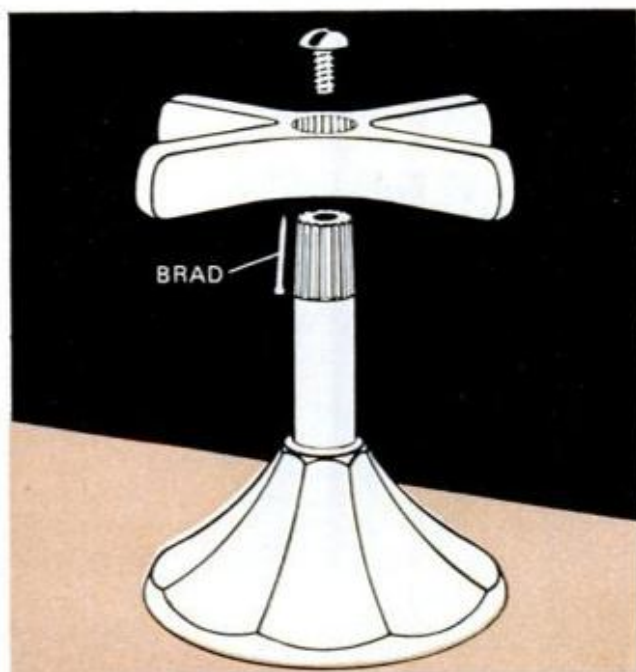
(Please turn to page 192)



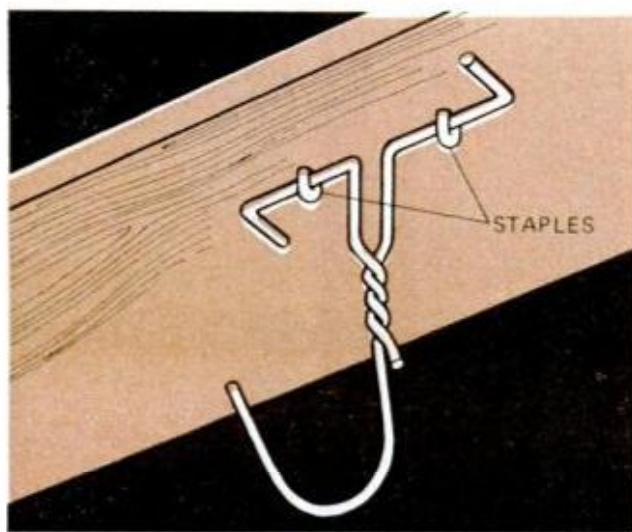
THREE KINDS OF BLADES handle most work. Fast-cutting blade with alternate-set teeth (left) saws a wide kerf. A smoother cutting, taper-ground blade (center) cuts more slowly and leaves a narrower kerf. The metal-cutting blade (right) is wave-set to minimize snagging and to produce a smooth cut

BETTER WAYS TO DO IT!

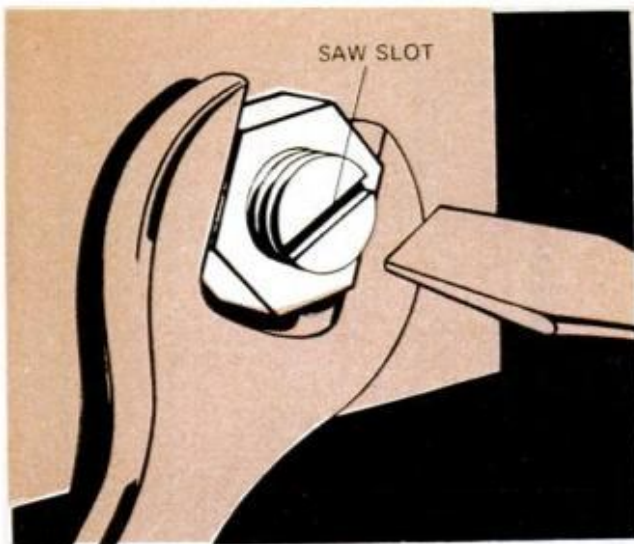
Illustrations by Adolf Brotman



WORN SERRATIONS on a faucet stem will inevitably cause a loose handle. A good temporary repair is to place one or more brads along the serrations as shown to take up the slack.—*R.E. Murray, Circleville, Ohio.*



HOOK PORTION OF WIRE COATHANGER makes a good hanger for light tools such as C-clamps when fastened to bottom of workshop shelf. Use two big staples to fasten it.—*John Walker, Walnut Creek, Calif.*



TIGHTENING A BOLT where it's impossible to reach the bolthead (to keep it from turning) is easy if you hacksaw a slot in the end. Hold the bolt with a screwdriver as you tighten it.—*E. Dussault, Oak Park, Ill.*

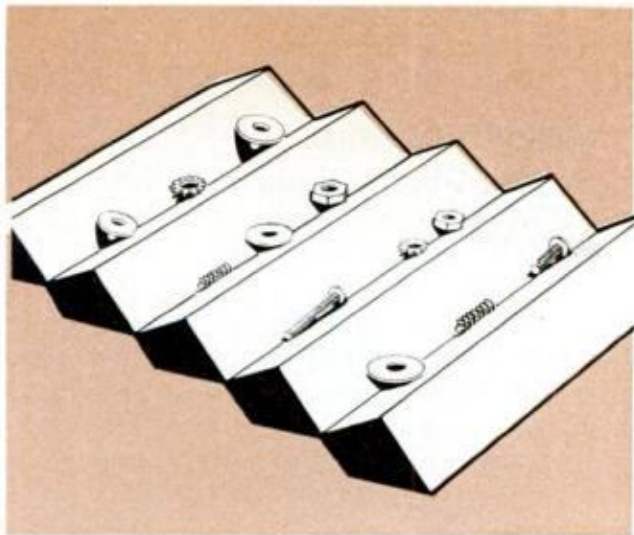


BICYCLE TUBE makes a dandy gluing clamp because it conforms to irregular shapes. Place the tube around the part to be glued; inflate it for holding power, deflate to remove it.—*John Walker, Walnut Creek, Calif.*



WHEN SOLDERING A CAN, bucket or the like, turn it over a lighted bulb. The light will shine through to show where the holes are, and you will know when the solder has them sealed.—*L.C. Schultz, Berwyn, Ill.*

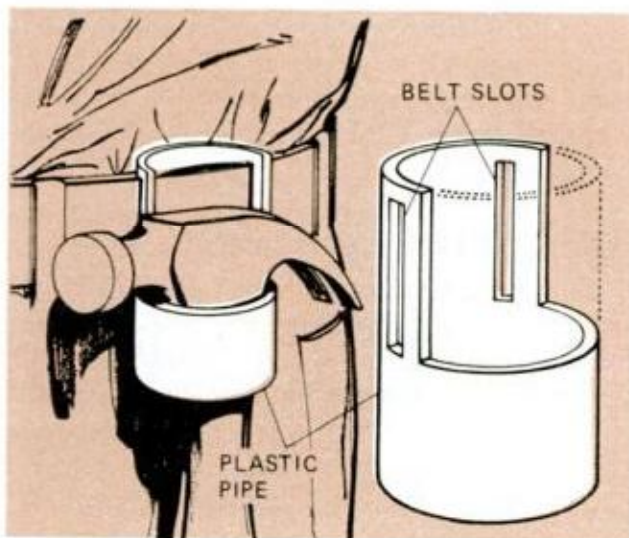
POPULAR MECHANICS



KEEP SCREWS and parts in sequence when disassembling an appliance by using a piece of heavy paper folded accordion-style. Place the parts in the valleys as they are removed.—*John Krill, North Lima, Ohio.*



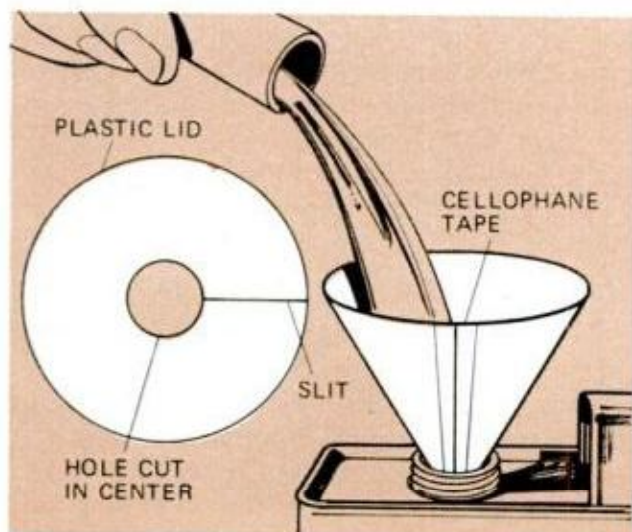
WORKING ON A ROOF, I had to raise and lower a pail frequently. A clothespin clipped on each side of the pail near the handle kept the latter erect for hooking it from above.—*Andrew Vena, Philadelphia.*



A SCRAP OF PLASTIC PIPING can be quickly made into a rigid-type hammer holster. Be sure that the pipe's inside diameter suits your hammer handle and cut pipe as sketched.—*John H. Wilson, Ottawa, Ont.*



PLASTIC BLEACH JUGS pour very slowly, usually with quite a lot of "glug-glugging." If you poke a small air hole through the jug's hollow handle, both problems will be corrected.—*John Krill, North Lima, Ohio.*



EMERGENCY FUNNEL can be made from the plastic lid of a coffee can. Cut a suitable hole at center, then cut through lid from hole to outside edge. Overlap cut, seal with tape.—*John Krill, North Lima, Ohio.*



TACK A BOTTLE CAP to the back of your shoe-polish dauber and you'll have a handy scraper for cleaning mud off the soles before polishing your shoes. Use small tacks to attach.—*William Swallow, Brooklyn.*

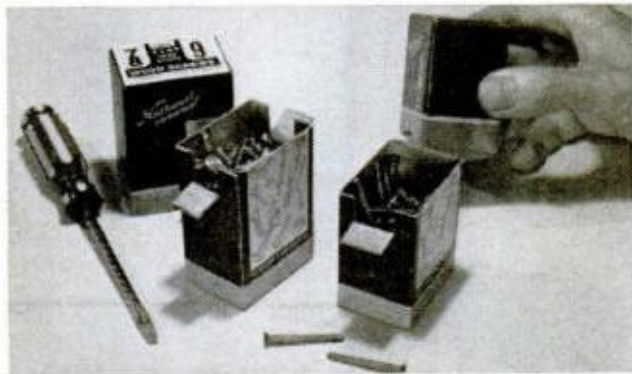


HINTS FROM READERS

Parer slices leather

A slotted-blade paring knife can be used to skive or bevel pieces of leather when you make a glued lap joint. Cutting edges must be sharp and used with a sawing action; noncutting edge can act as a guide to control movement of the cutting edge. Rest the leather on a block so the cutter can be held parallel.

—Walter E. Burton, Akron, Ohio.



Save those boxtops

Sleeve-type covers on screw boxes are often such a loose fit that when the boxes are picked up the bottoms slip out. A good solution is to cut slots part way down the sides of the box bottoms and bend out tabs as shown. One or more of these "ears" will provide enough friction to hold the loosest cover.—John F. Pilznienski, Dearborn Heights, Mich.



Wire solder twice as useful

To keep the cord on my soldering gun neatly coiled, I use a length of wire solder. Besides keeping the line tanglefree, this means that I always have at hand a length of solder should my main supply be mislaid or in use elsewhere.

—Louis Hochman, Sherman Oaks, Calif.



Notebook rings in the shop

Next time you are throwing away a worn three-ring notebook, tear out and save any rings that still close. I've found these to be handy for storing sockets and wrenches in one place. And for on-the-job use, the ring can be snapped onto one of your belt loops. Three-inch rings are best because they hold more.

—Ken Patterson, Regina, Sask.



Inner tube is a clamping aid

When gluing on edge molding to hide plywood laminations, a simple way to clamp the trim in place while the glue dries is with spring clamps and strips of old inner tube. Each rubber strip is stretched tightly over the molding and plywood edge, and a spring clamp applied to hold the strip in its extended position so it continues to pull inward on the edging.

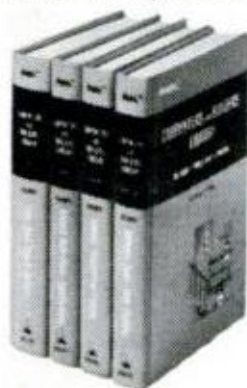
—Louis Hochman, Sherman Oaks, Calif.



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so good?"**

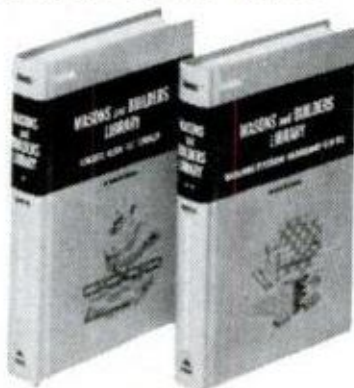
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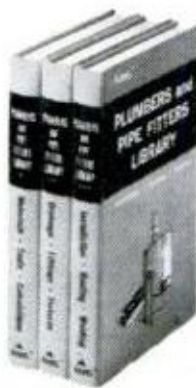
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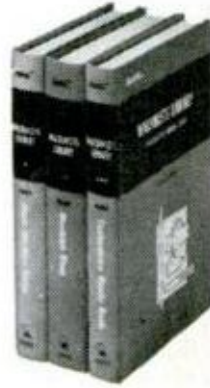
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COLOR PRINTING with Aeroprint spray chemicals is a lot less intimidating than you might expect. Not that it's that much quicker than ordinary home processing, or that much cheaper than drugstore prints of equal quality. But it is a lot simpler and easier than you might think, and it lets you try enlarging tricks (like custom cropping, burning in highlights and dodging shadows) that would cost a fortune in a commercial color lab.

But the big virtue of Aeroprint is its simplicity. To set up for conventional tray processing, you'd have to mix your chemicals (trying to mix just enough to last one printing session, since the shelf life of color chemicals is short), set out trays (as many as seven—all of which must be washed later), and bring all your solutions to the correct temperature (which must be accurate, in many processes, to within one-half degree). With Aeroprint, you set out a small grid

and three or four spray cans, and you're in business.

Actually, there are three Aeroprint processes: one for black and white prints, one for prints from color negatives, and one for color prints from slides. But there are only two Aeroprint kits: an \$8.50 kit for black and white which makes up to 40 8x10s, and a \$24.95 kit for up to 57 8x10 color prints from negatives. To print from slides, as I did, you'll need both the color kit and the developer from the black and white kit (available separately for \$4.95).

Printing from color negatives takes a lot less time than reversal printing from slides—11 minutes plus a 15-minute wash, as compared to 36 minutes and a 5-minute wash for reversal prints. It also costs a bit less: about 94 cents per 8x10 print, whereas reversal prints, using one more chemical and more expensive paper, will cost about \$1.18 per 8x10. Of course, these

Color prints from a spray can

By IVAN BERGER, Photography Editor



costs are based on the assumption that each print will come out perfectly; if you have to make some over (and you will), the three dollars or so you'll spend for commercial prints no longer looks much more expensive. Home color printing, obviously, is no way to save a lot of money, unless you're going to dodge, burn in and crop like custom labs do; it's just another way to enjoy yourself.

But reversal printing—though it costs a bit more and takes much longer than printing from negatives—does have some advantages: When you work from a slide, you know pretty well what your picture should look like. And when you print your slides with Aeroprint, you don't need to use color printing filters.

The process begins, of course, in your enlarger. If you're going to do a lot of reversal color printing, you may want to find out if your enlarger's manufacturer makes a negative carrier to hold slides in their standard 2x2-inch mounts. But most of the regular 35-mm negative carriers I've seen would work equally well, if less conveniently.

As with any other type of enlargement, you should make a test strip before your final print. Unfortunately, you can't really judge which part of the strip looks best until it's fully processed, and that takes more than half an hour. I suspect, though, that with familiarity you'd be able to judge exposure alone after the first developer and wash, which only take seven minutes.

After exposing the paper (Kodak Ektachrome RC), you spray it with the Aeroprint black-and-white developer, which brings up a negative image. Kodak recommends that this take place in total darkness, but Aeroprint recommends you use a No. 10 amber safelight while you spray, provided it's no brighter than seven watts, and at least three feet away. On the whole, I found it better to use the safelight—until you've had some practice, it's too easy to miss spots when you spray on the developer in the dark. Aeroprint tells you to spread the developer with your fingers, and that helps, but it still takes practice. Spraying too much doesn't hurt, though; it just wastes developer.

After spraying, you turn off the safelight, let the print develop for two minutes, then wash it for five. (I recommend a radio for company during those seven dark, boring minutes.)

JANUARY 1973

Now you can turn the light on and examine your print (a black-and-white negative at this point) for undeveloped or yellow spots. If you find any, you'll have to discard the print and start again. But from here on, everything is done in full room light, so you can catch your mistakes as you make them, and usually correct them, too.

The next step, though, is goofproof: Just expose the print, for 30 seconds on each side, to a floodlamp about a foot away. This step, common to all direct-



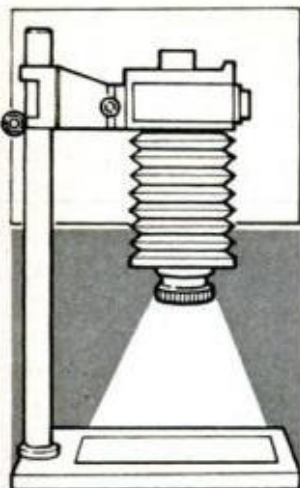
SPRAY ON CHEMICALS and out comes the picture—if you're careful through all 35 minutes of the process. Print rests on a \$2.75 Aero-grid accessory

positive (reversal) processes, exposes the silver grains that form the final image; the first development is only to chemically isolate the silver grains that *don't* go into the positive image.

The grains you've just exposed turn black when you spray on the color developer in the No. 1 can. Since the other silver grains were blackened by the first developer, this makes the whole print appear black, but the image is faintly visible if you look for it. The color developer is resprayed after three minutes, and allowed to sit another seven minutes before the next five-minute wash. But if some spots aren't darkening properly, you can

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HOW TO MAKE AEROPRINTS



TEMPORARY, BLACK-AND-WHITE negative image appears after you enlarge slide onto Ektachrome RC paper (left) and spray with black-and-white developer



POSITIVE IMAGE is created by reversal exposure, brought out by color-developer spray. Combination of positive and negative images turns print black



BLEACH removes negative image, brings out pale, bluish color. The final stabilizer spray deepens color, but it's still blue until it's washed and dried

spray again, and no harm is done. (And you can be making another enlargement during those seven minutes, of course).

You'll get some idea of your finished print when you spray on the next can—not No. 2, as you might think, but can No. 3 (printing from negatives, though, you use the cans in their numbered order). This chemical bleaches out the black-and-white negative image, allowing the color positive image to come out. But it's not completely out, yet; normally, it's still washed-out and bluish at this point.

After spraying the bleach twice (and letting it sit three minutes for each spray), you wash again for five minutes, then spray on the stabilizer in can No. 2. Again you spray twice, this time for one minute per spray, before you put the print in for its last five-minute wash. The print will still have a slight bluish cast until it dries, but shining a light through the print will show the final colors with fair accuracy.

Kodak Ektachrome RC paper is resin-coated, so it can't be ferrotyped dry. Just sponge it off with a clean paper towel, let it air-dry, and it will develop its own soft, natural gloss—and will dry with negligible curl.

There are a few precautions you should take while using Aeroprint: 1) To prevent stains on the print, each time you switch to the next chemical you should thoroughly wash the print itself, your hands and the Aerogrid or whatever other nonmetallic grid you rest the print on while you spray it (you can also rest the print on paper, if you change it between sprays). 2) As with any aerosol, you should try to avoid breathing the chemicals; but since you spray just a few inches from the paper, that should pose no problem—the Aeroprint chemicals seemed to smell up my darkroom less than trays full of ordinary chemicals do. 3) And since the spray propellant in the cans is flammable butane, you shouldn't use it near an open flame (including, I'd suspect, the pilot light on your stove, if your kitchen doubles as your darkroom)—and it probably wouldn't be a bad idea to stop smoking while you spray.

As the instructions point out, Aeroprint is not intended for processing large volumes of prints at a time. But when you only want to make a print or two, it may be a godsend. ★★★

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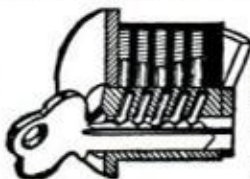
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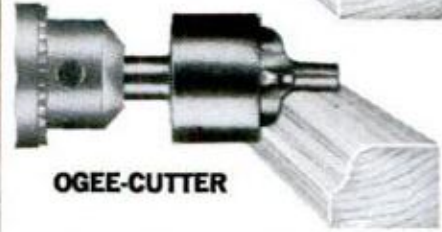
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BY MORT SCHULTZ

Common remote problem

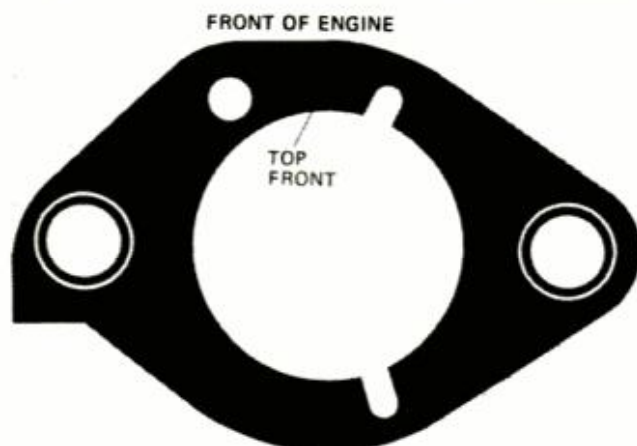
The control operating the outside "remote control" rear-view mirror of my '70 Galaxie has loosened and is about to fall inside the door. Before I start tampering, I would like to know what to expect.—Jim Statler, Port Jervis, N.Y.

Remove the plate that covers the control. Examine it. You'll find that a small Allen screw which extends in the hole to hold the control housing has loosened. Withdraw the screw, refit the control housing firmly in the hole, tighten screw with an Allen wrench and reattach the plate.

One-way gasket

Please help me. My Plymouth Satellite with a six-cylinder engine is hard to start when cold. When I do get it started, it idles so badly that my bones rattle. It didn't start doing this until I had a garage man talk me into cleaning and overhauling the carburetor.—Terri Green, Miami Springs, Fla.

If I'm right in my diagnosis, this is an old story which applies to all three 6-cylinder engines used by Chrysler Corp.—170, 198 and 225 cu.-in. In doing overhauls, mechanics have been known to install the carburetor flange gasket improperly. If the notches on the inside diameter and the 1/4-in. hole aren't lined up properly, the function of the choke, economizer jet and air-cleaner air-control valve will be fouled up. Here's a diagram showing the right way to install that gasket.



Repairing vent windows

I have a 1967 Chevrolet with vent windows that have loosened up and are rattling. Is there any way to resecure them without taking everything apart?—Howard Ferranti, Marlborough, Mass.

You're in luck. Recently, Loctite Corp. of Hartford, Conn., introduced a product called Quick-Set Adhesive that bonds glass and rubber. It sets in seconds and does the job nicely. See an auto-parts supply dealer or an auto glass shop. If neither can supply it, write directly to the company.

Datsun valve clearance

I can't seem to adjust the valves of my Datsun 240Z properly although I follow the manual. What do you figure is wrong?—Harold Joffe, Anaheim, Calif.

The manual. Instructions have been changed. Valves of all Datsun engines are to be set with the engine cold. This means that the engine must be allowed to sit still for several hours before the adjustment is made—otherwise you won't get the right clearance.

This holds true for the four-cylinder ohv A-12 engine used in the 1200 sedan, the four-cylinder ohc L-16 engine used in the 510 sedan and wagon and 521 pickup truck, and the six-cylinder ohc L-24 engines used in the 240Z sports car. To adjust each valve of the L-16 and L-24, place the feeler gauge between the cam and rocker arm. To adjust valves of the A-12, place gauge between the valve and rocker arm.

The latest specifications call for a clearance of 0.010 inch for the intake and exhaust valves of the A-12. Adjust the intake valves of the L-16 and L-24 engines for a clearance of 0.008 inch, and set the exhaust valves for 0.010-inch clearance.

Pulled pull strap

The door-pull strap of my 1970 Buick Riviera has pulled away from the door. Is there some way of repairing this without going through the sweat of removing the

(Please turn to page 162)



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AUTOMOBILE CLINIC

(Continued from page 160)

door trim?—Gerry Jamison, Granite City, Ill.

Try this. Remove the pull strap emblem cover and the screws that hold the pull strap bracket. Turn the bracket clockwise. This will expose the screw hole, which is no doubt stripped. Drill out the hole with a $1\frac{3}{32}$ -inch drill and install a license plate plastic retaining nut. You can get this part from an auto supply dealer or the parts department of a new car dealer. Reinstall the screws, bracket, pull strap and cover.

Forward lateral

My 1971 Pontiac Grand Ville has developed a front brake shudder. What do you think is the cause and what must be done to correct it?—Sam Oradell, Peapack, N.J.

In all likelihood, one of the front disc brakes has developed a faulty lateral run-out condition. Lateral runout is the movement of the rotor from side to side as it rotates. To verify the existence of this condition, adjust wheel bearings to eliminate any play as a possible cause and hook up a dial indicator so that the stylus touches the face of the rotor about 1 inch from the rotor's edge.

With the dial set at 0, move the rotor one full turn. If the total indicator reading exceeds the allowable 0.004-inch limit for a Pontiac, the rotor should be refaced if possible—replaced if not.

To cap or not to cap

I disagree with an illustration that was published in PM awhile back which showed battery vent caps in place on a battery that was being charged. I contend that battery caps should be removed to avoid a buildup of internal pressure which can damage the battery.—Thomas P. Wright, Norfolk, Va.

According to the latest Federal safety standard, "When charging batteries, the vent caps should be kept in place to avoid electrolyte spray. Care shall be taken to assure that vent caps are functioning." I interpret the word "functioning" as mean-

ing to make certain that vent holes are not dirt-clogged. The standard is printed in the Federal register of May 29, 1971, Vol. 36, No. 105, Section 1910.178, page 10616.

Book idea

Have you ever put all of the Automobile Clinic items presented during the past into one volume? If so, I would be interested in buying this book.—Rev. Harold R. Wolfe, Clinton, Ohio.

For you and many others who have asked this, I'm sorry to say that we have not compiled Automobile Clinic items in one volume, but it is certainly worth considering. If we do it, you'll be one of the first to know.

Transmitting trouble

I have a 1971 Ford Custom 500 with 400-cu.-in. engine. Every morning when I first start the car and put the transmission in reverse, it doesn't engage completely. After the car moves back a bit, it starts jumping over the gears. When I put it into drive, it strains to shift from low to drive. As the car warms up, the trouble disappears. What can it be?—J.G. Hamilton, Maplewood, La.

One of several things, including a damaged valve body, a leak in the hydraulic system, or a bad rear clutch.

Service tips

● Chrysler Corp. car owners take notice. A rattle coming from the front door window of your '71 or '72 Chrysler, Dodge or Plymouth can probably be corrected by installing a jam nut on the end of the lower track-to-bracket attaching screw. Your dealer is authorized to do this according to Dodge service bulletin 23-20-72D and Chrysler-Plymouth service bulletin 23-25-72C.

● Replacement ignition keys that bind, stick or won't work is a frequent complaint. Usually, the ignition lock cylinder is not to blame. Instead, watch out for a replacement key which hasn't been cut properly. In today's cars with improved locks tolerances are critical. A new key must be cut exactly, using a quality key cutting machine and replacement blanks. A locksmith is best able to meet the requirements. ★★★

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TUNERS for large and small appetites: Dyna's \$160 FM-5 (top) and Heath's \$540 AJ-1510

FM kits: One super

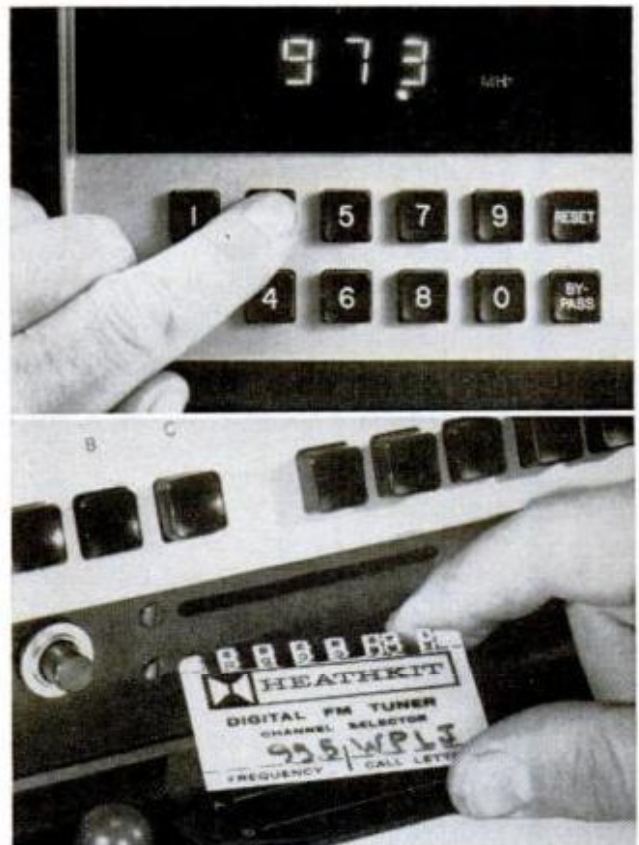
By IVAN BERGER, Electronics Editor

KIT-BUILDERS have an interesting choice these days: a \$160 tuner kit that takes five or six hours to build and delivers great performance—and a \$540 tuner that takes over 30 hours to put together, has just about the same performance, and enough state-of-the-art features to more than justify the difference.

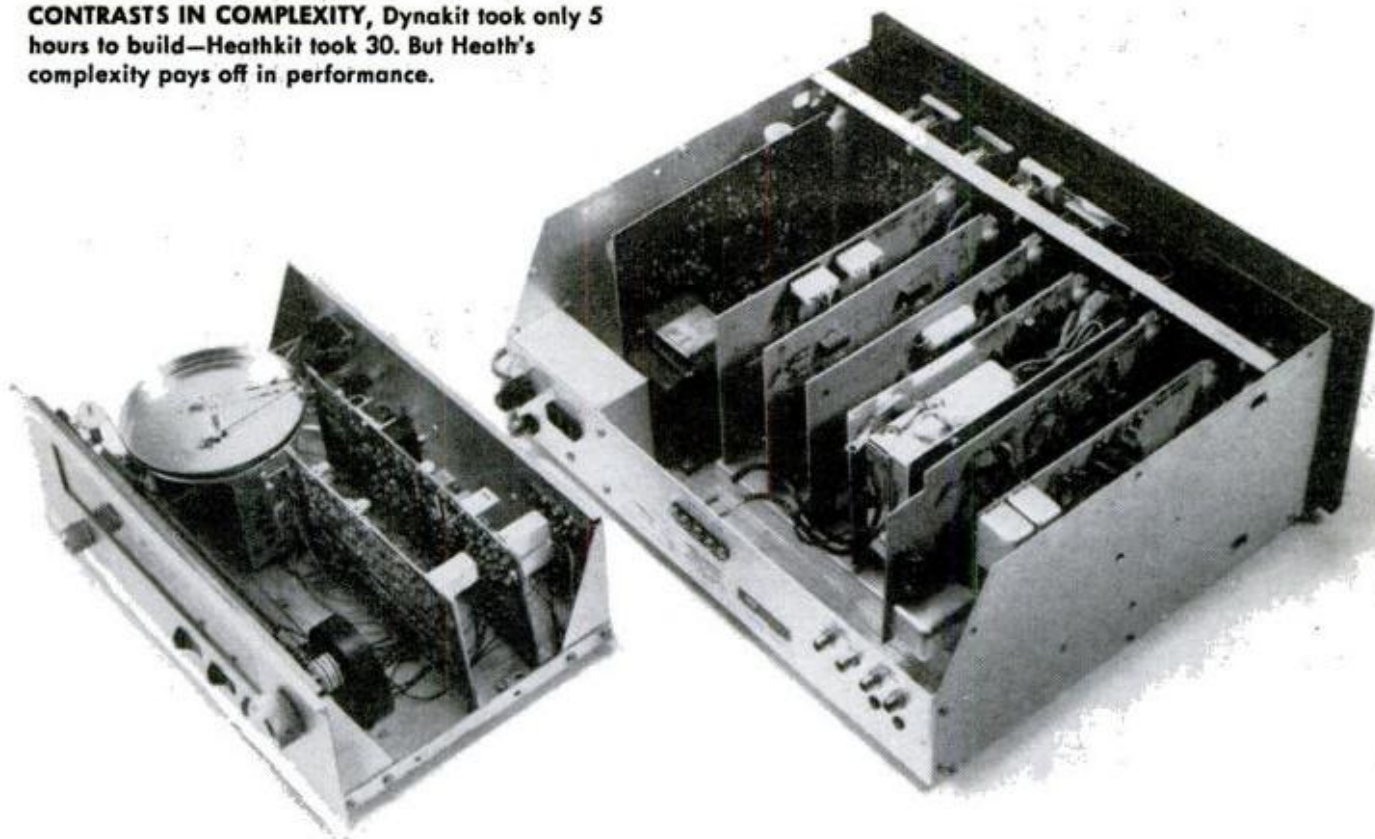
The difference between them obviously isn't their performance, but the way they deliver it. The \$160 Dynakit FM-5 does it in a conventional, straightforward way: Turn the knob till you find your station, and listen. A small blue light glows when you've hit a station, but nothing else seems at all extraordinary.

Nothing seems ordinary about the \$540

HEATHKIT tunes without knobs or dials. The Digital display (upper right) shows station frequency numerically; numbered buttons let you dial the tuner like a pushbutton phone. Plastic cards (right) pre-select stations of your choice; slots hold three cards



CONTRASTS IN COMPLEXITY, Dynakit took only 5 hours to build—Heathkit took 30. But Heath's complexity pays off in performance.



tuner, one super value

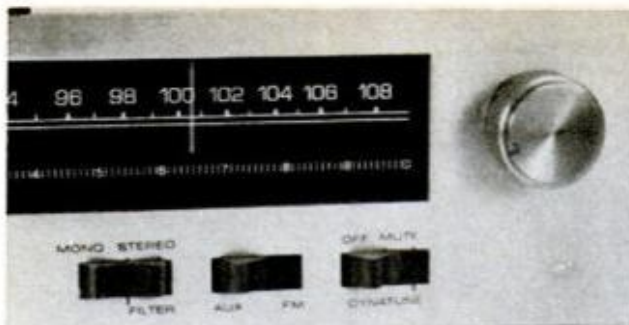
Heathkit AJ-1510 though. To tune it, you punch in your station's frequency the way you'd dial a pushbutton phone: push 9, 6 and 3, and 96.3 pops up on the dial in illuminated numbers. And you'll be tuned to 96.3 exactly (give or take 0.005 percent), even if there's no signal on that channel at the time. Or you can switch to **AUTO-SWEEP** mode, with the tuner skipping auto-

matically from one station to the next signal on the dial each time you push another button. Or switch to **PRE-PROGRAM**, and you can select any of your three favorite stations by pressing one button each. (The station preselects are plastic cards which you trim to the patterns of the wanted frequencies; 10 cards are supplied, but the slots in the tuner hold only three at a time.) The one thing you *can't* do is dial your station—the only knobs on the whole tuner are small, hidden ones which regulate the auto-sweep speed and the muting thresholds.

The knob is a bigger omission than it might at first appear. Good, old-fashioned, knob-twirl dialing is still the fastest, easiest way to scan across the dial and pick up all the major signals in your area—especially if you don't know the exact frequency of the station you want, just



TUNED LIGHT shows 1 percent station accuracy on Dyna; meter shows signal strength, not center channel



DYNA CONTROLS include mono/high-blend/stereo, auxiliary input selector, Dynatune and muting switch

that "it's a little below 91." And Dyna's TUNED light makes knob tuning even easier and faster—as does its Dynatune circuit, which locks each signal to the exact center of its channel without "pulling" away from weak signals toward stronger ones nearby on the dial, as conventional AFC circuits, which perform a similar centering job, do.

On the other hand, the Heathkit's pre-program mode is a faster way of finding your three favorite stations. Its auto-sweep mode is a little surer way of finding almost every signal on the dial. And its keyboard tuning mode is unsurpassed when it comes to picking up those stations you know are out there somewhere, but which you're not at all sure you can pick up: Punch in the station's frequency and you know you're perfectly tuned, whether you can hear something or not; then it's just a matter of fiddling with the antenna until you do hear something.

BUILDING THE TUNER KITS

By Andy Santoni

The Dynatuner is a simple kit, with only two circuit boards, both prewired, so it took only six hours to assemble. Although some patience and skill were needed to strip and tin the leads connecting its circuit boards and in stringing its dial cord, even a novice kit-builder could do it.

The Heathkit was more complex, but because it is divided into a dozen sub-kits, a novice could build it—if he wasn't discouraged by the 30 hours it takes to assemble, check out and align the kit. There were some difficulties soldering several wires into overstuffed eyelets (a problem the Dyna shared), and soldering to the chassis required a heavy iron and a steady hand. Both manuals were clear, without major errors.



HEATH CONTROLS include tuning modes, three station preselectors. Meter reads signal or multipath


Actually, there are probably no signals the Heath can pick up that the Dyna can't pick up equally well—if you can find them with the Dyna. I tried both tuners simultaneously in four locations (one urban, two suburban and one far fringe) and the farther out I got, the more I found that the Heath would pick up stations I'd missed when I tuned across the band with the Dyna—but I could find most of them with the Dyna once I knew just where to look. In my fringe location, for example, the Dyna picked up signals on 55 of the 100 FM channels, all but one or two listenably free of noise and distortion. (My host's five-year-old tuner picked up only about half as many). But the Heath picked up 88 signals, 72 listenable.

I probably could have bettered both tuners' scores if I'd had an antenna rotator, but that would have increased the Heath's lead even more. For openers, the Heath would find a few more stations through the tune-first-then-aim-antenna technique I described above. But it would also make it easier to orient the antenna for minimum distortion from the stations it found, because its signal-strength meter can be switched to read multipath levels, too. (There are also connections on the Heath's rear panel that let you monitor multipath even more critically, with an oscilloscope.) Though the Dyna has a signal-strength meter for antenna orientation (neither has—or needs—a center-channel meter), it has no multipath facilities; you have to judge minimum distortion by ear.

The Heath has a few more tricky features: For instance there's a stereo-only switch that automatically mutes all mono stations (and bypasses them on auto-sweep). I used it when listening through headphones, but I could have done as easily without it. On the other hand, I wish the

(Please turn to page 187)



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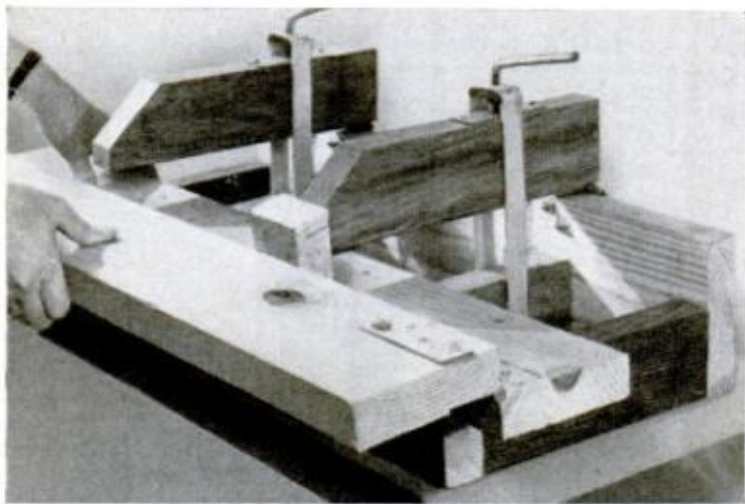
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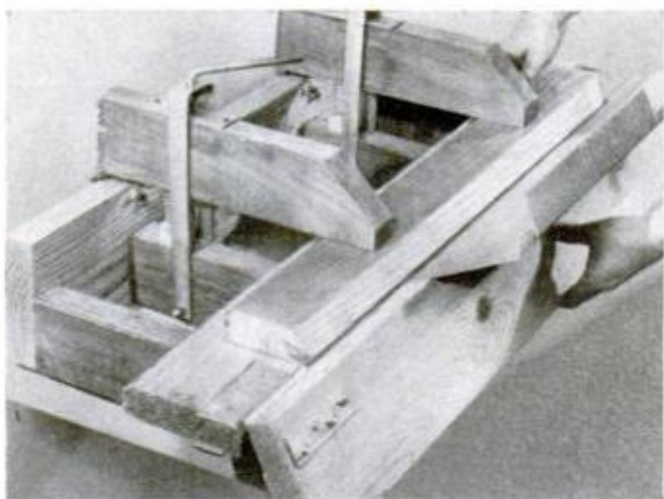
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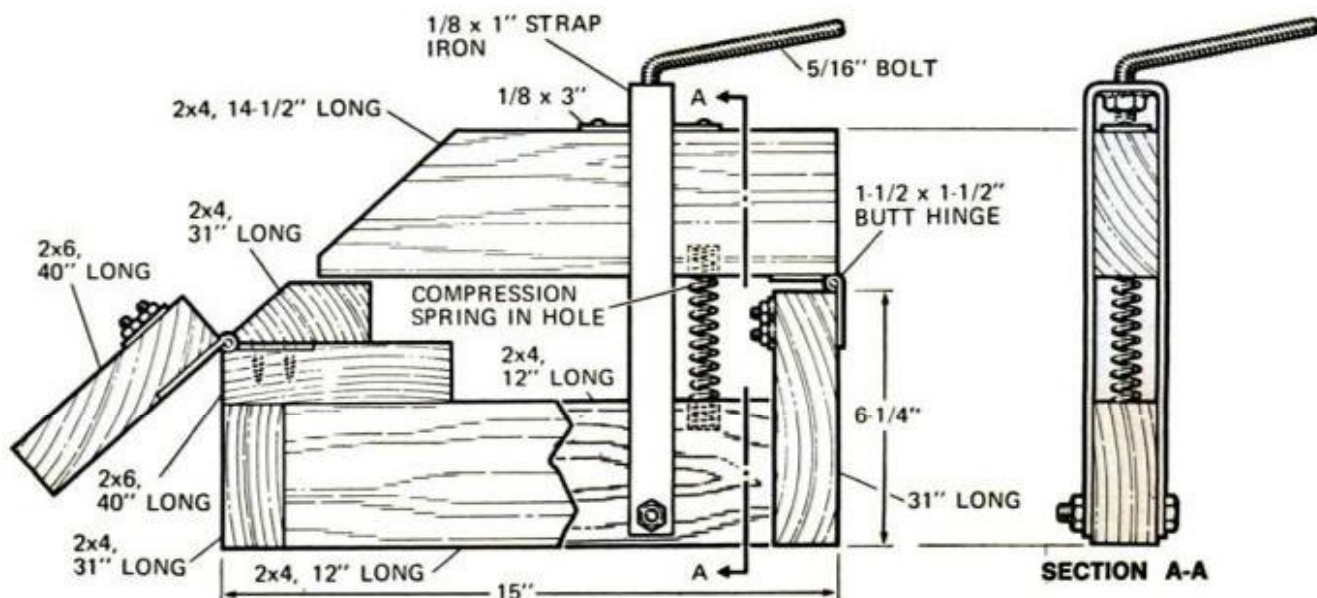


NEAT right-angle bends and flat folds are easy to make with this simple, benchtop, sheet-metal brake. The metal is inserted under the pressure plate, the two handles are tightened and the hinged forming bar across the front is brought up to make the desired degree of bend. To flat-fold an edge, you first bring the forming bar all the way up and against the beveled pressure plate; then the work is removed, flipped over and the bend is squeezed flat.

The brake is made mostly of wood of standard lumberyard sizes. Nuts, which are sweat-soldered in place, provide the tapped holes for each threaded handle, and the yokes are bent from strap iron to straddle the two hinged pressure arms. A compression spring under each arm raises the arms automatically when its handle is backed off.

To bend a metal box, the trick is to bend two opposite sides using the regular pressure plate. Then a special pressure plate is cut to fit the inside width of the box and only one pressure arm is used to hold the plate while making the bend. You can fashion boxes as small as 3x4 in.—*Ray M. Gates, St. Ann, Mo.*

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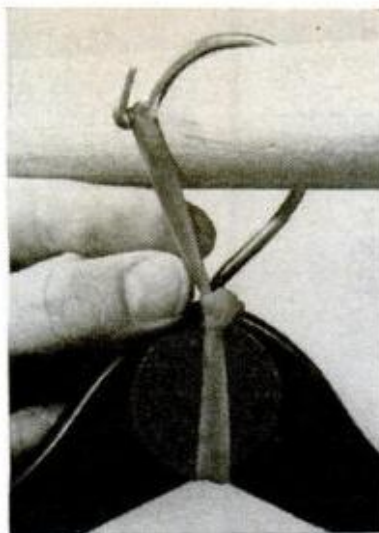


HINTS FROM READERS



A better rotary rasp

A rotary rasp chucked in a hand drill is often difficult to hold against the material being worked. Adding a "stop" greatly improves your ability to keep the rasp firmly against the workpiece. As shown above, the stop is a syrup-can lid.—*Ken Patterson, Regina, Sask.*



Hold that hanger

Tiring of coathangers dropping to the floor almost every time I removed a garment, I devised this stunt. It's a hefty rubber band fastened around the hanger with one end slipped over a hook formed in the top of the hanger. Now, hangers stay put.—*Henry Moore, Chicago.*



Switch for the better

To protect a switch controlling lights, motors and other shop equipment from being accidentally turned on if bumped against, I cover the switch with a metal drawer pull. It's protected, yet may still be operated without inconvenience.—*William W. Brown, Van Nuys, Calif.*

Get more storage with slings between garage collar beams

The wasted space between collar beams in my garage seemed to be a logical spot for storing lumber, piping and the like. So I screwed in heavy eyescrews on the bottoms of the beams, then passed through

a light-duty rope and fastened it at both ends. These slings, spaced at 3-ft. intervals, clear the car roof and provide extra handy access to the stored items.—*Virgil Gray, Portland, Ore.*

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Who'd have thought I'd make so much money without going to college?

I still have to pinch myself every time I see my paycheck — it seems too good to be true!

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Well, the college boys left for school, and I found a job. I worked hard, too, but never made it big.

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Richard Kihn, Anahuac, Texas



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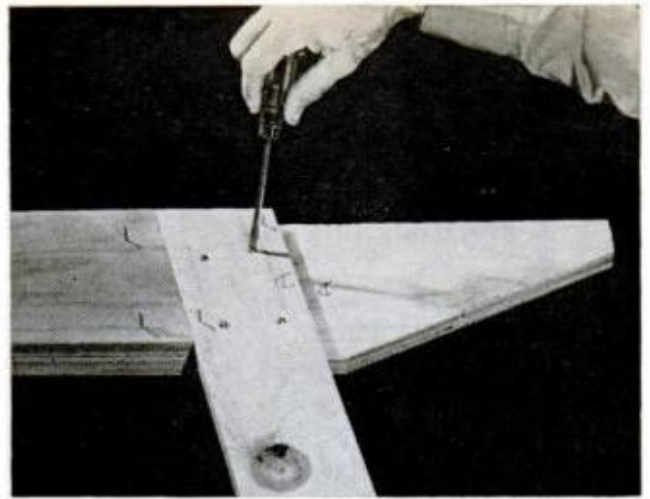
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(Continued from page 65)

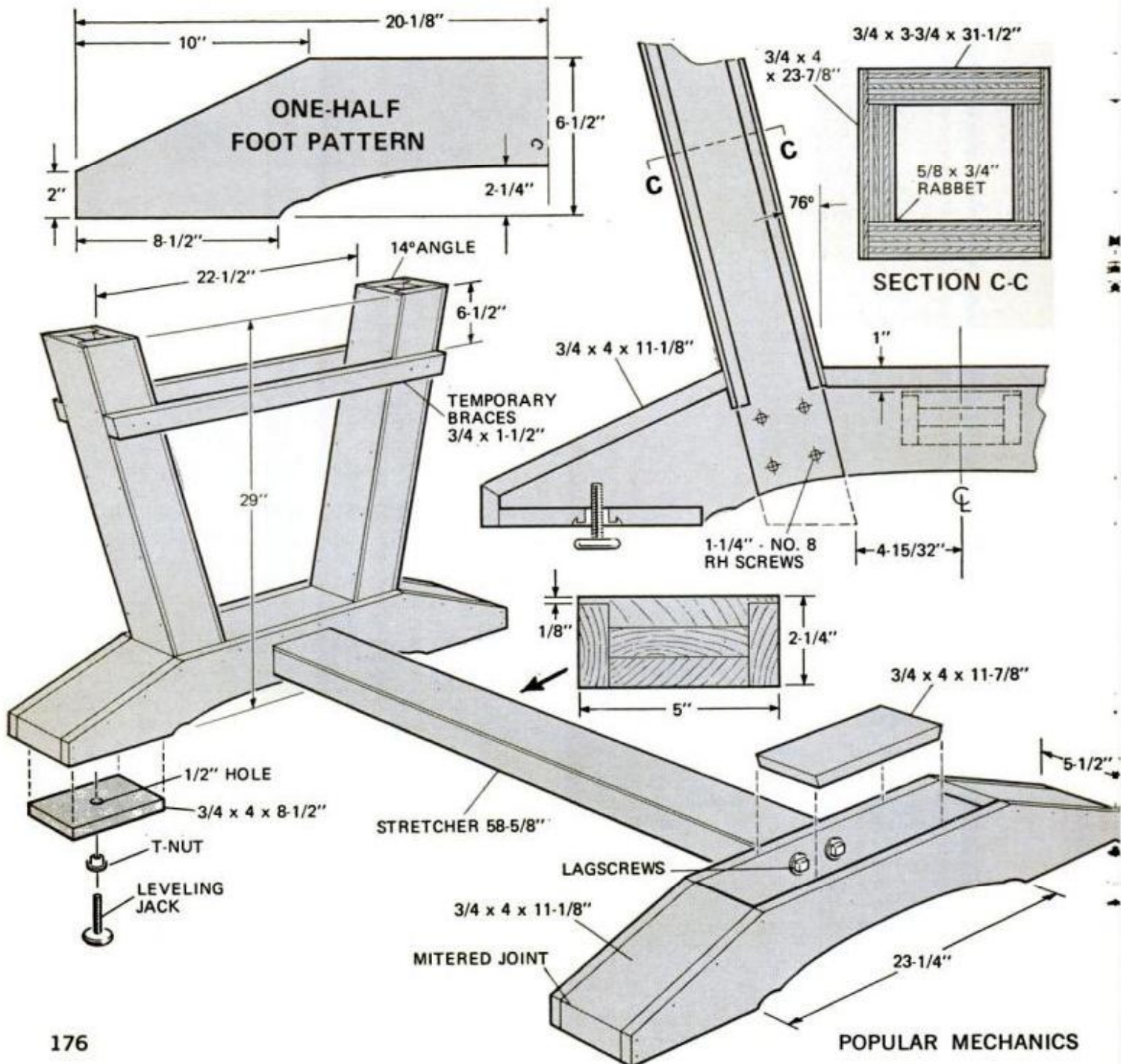
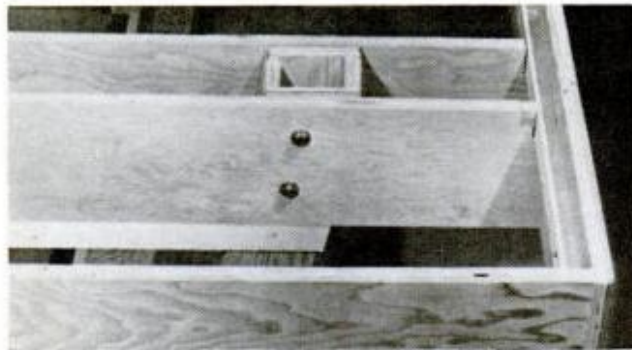
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● **Apron.** The apron consists of a rectangle
(Please turn to page 178)



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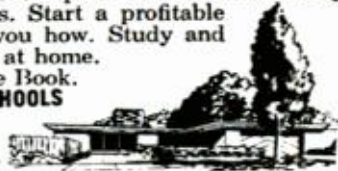
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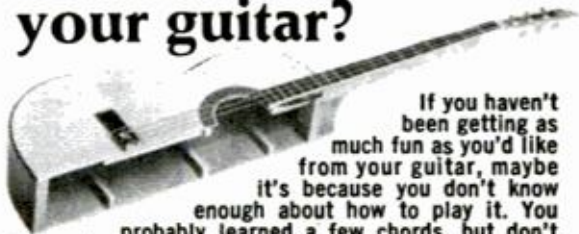
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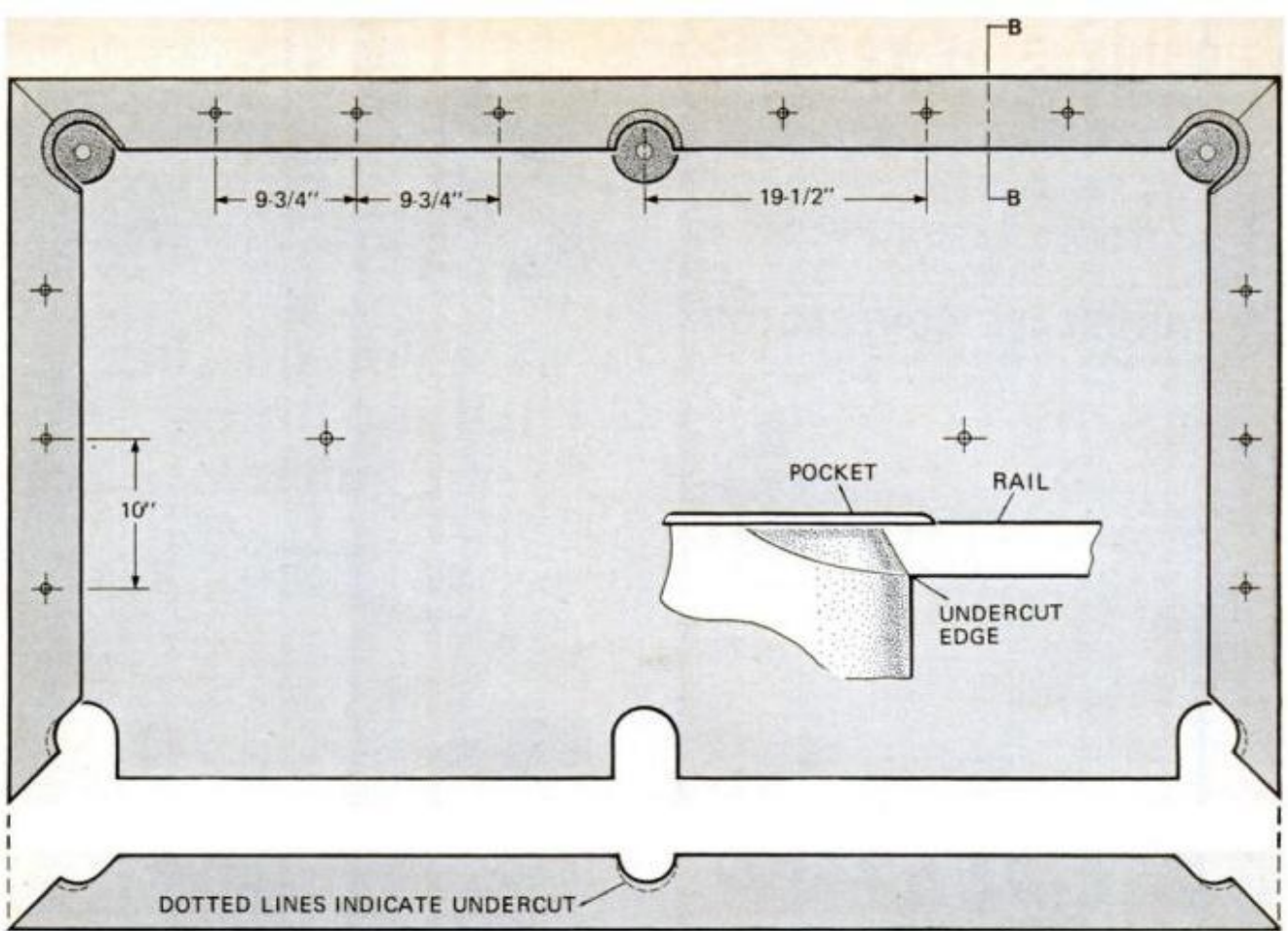
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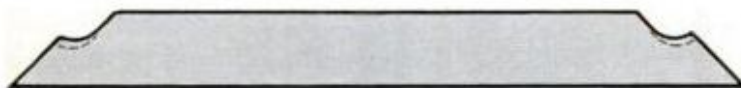
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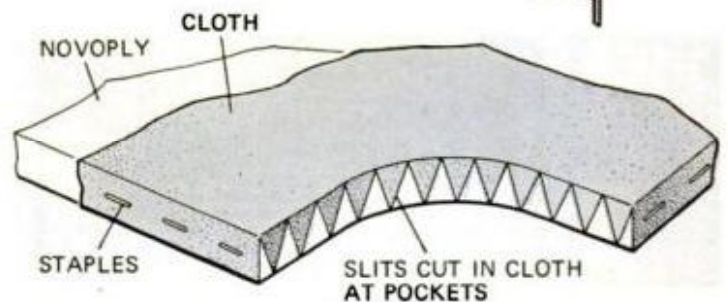
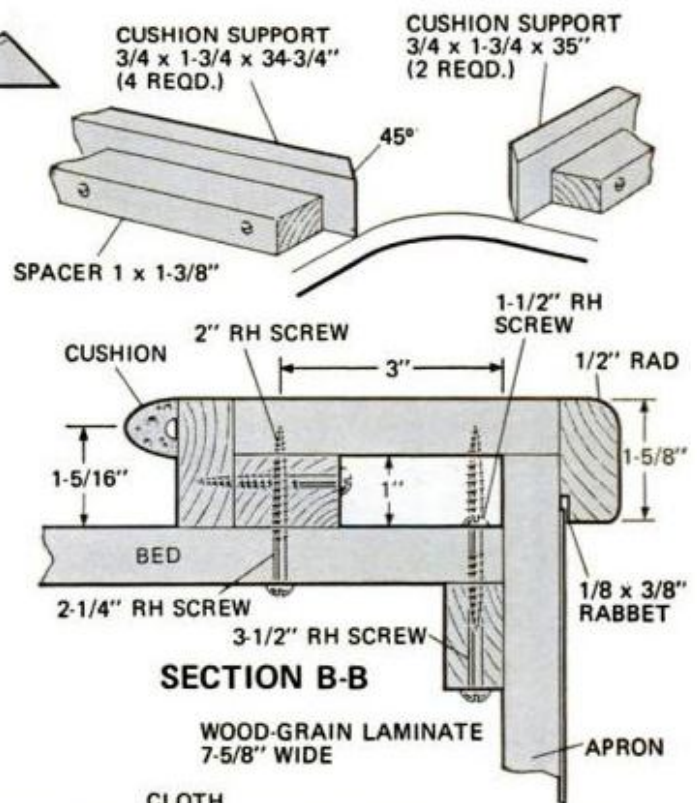
(Continued from page 176)

gular frame to which the bed, cleats and cross members are attached with screws. To maintain accuracy of the frame, use diagonal strips while the glue sets.

The bed support cleats are drilled for screws before mounting. Locate the holes as indicated and drill the holes straight and square. The two side cleats must be notched to allow clearance for the side pockets. The notch may be made with a router or by several overlapping passes on the radial-arm saw. Install cleats exactly 1 3/4 in. down from the apron's top. A scrap strip of wood 1 3/4 in. wide will aid in installing cleats. Temporarily nail the strip even with the top edge, then butt cleat to it and screw in place after gluing. Top edge of the six cross members must be flush with top edge of the bed support cleats as shown.

I covered the aprons on my table with an inexpensive, wood-grained laminate called Conolite, which is applied with

(Please turn to page 180)



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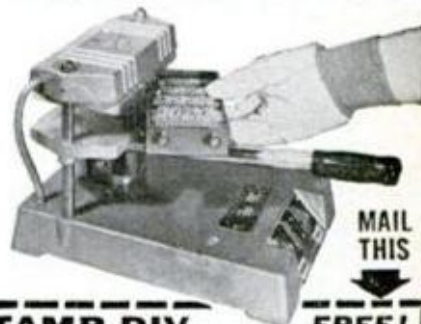
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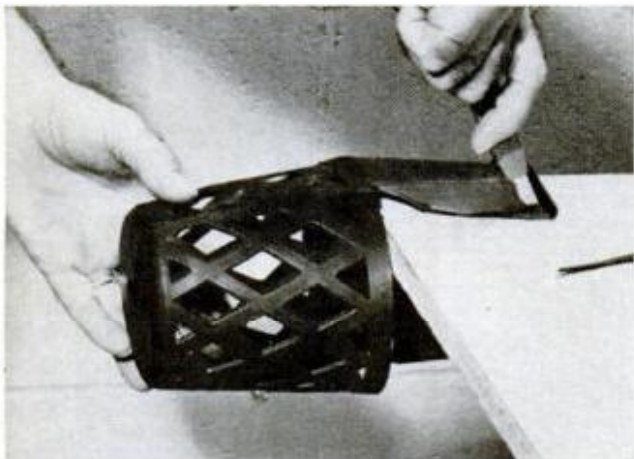
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FABRIC IS SLIT at drop-pocket cutouts and stapled to underside of the rail, then along the rail edges



POCKETS ARE TRIMMED TO FIT—differently at the sides than at the corners. See drawing, above right

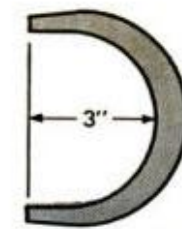
\$300 POOL TABLE FOR \$107

(Continued from page 178)

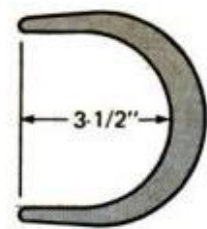
contact cement. It's offered in rolls 36 in., wide and sold by the foot. Various colors, patterns and grains are available. It can be cut with scissors, but you may find it easier to score the surface with an awl and snap it along the scored line.

Cut the laminate slightly oversize and apply contact cement to it and to the wood surface. Allow the cement to dry until it loses its tackiness, then apply carefully. Once in place, it cannot be moved. The top edge of the laminate is set $\frac{11}{16}$ in. below the top edge of the apron. The sides and bottom should overhang slightly. Trim excess with a router fitted with a laminate trimmer or by hand with a plane. Cover the end aprons first, then the longer sides.

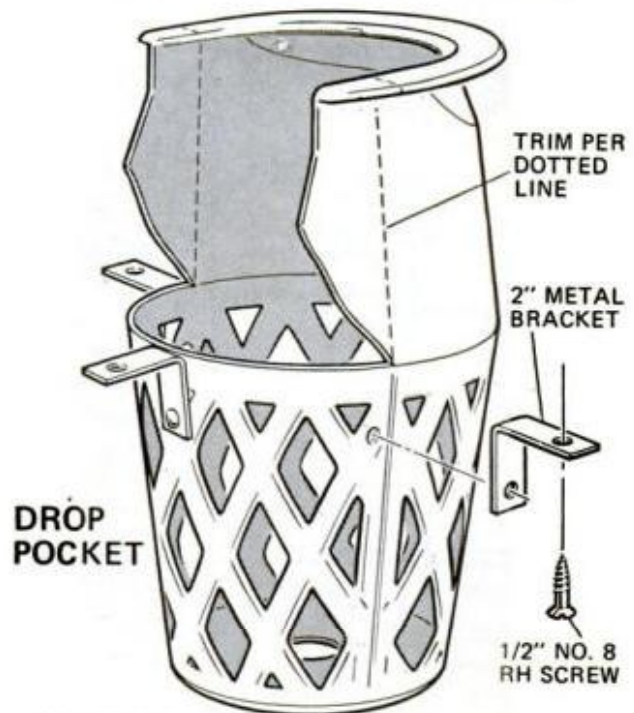
● **Bed.** The bed is cut from a sheet of $\frac{3}{4}$ -in. particleboard. Notice that $\frac{1}{4}$ in. is trimmed from the 48-in. dimension. The length of the bed is $85\frac{3}{4}$ in. The material is dense and tough, but it is easily cut with ordinary tools such as a portable



SIDE (2 REQD.)



CORNER (4 REQD.)



BRACKETS ATTACHED TO POCKETS WITH RIVETS

METAL ANGLE BRACKETS are used to attach drop pockets in table cutouts after pockets are trimmed

saw, sabre saw, or even a handsaw. Lay out the corner and side-pocket cutouts according to the diagram. After cutting, break all sharp edges with sandpaper. Drill the mounting holes, then cover with billiard cloth. The cloth is stapled to the underside of the bed. Do the long sides first, then the ends. Slit the cloth at the pockets, stopping the slits just short of the cutouts. Pull the cloth evenly around the pockets and staple to the underside of the bed. (Before installing the cloth remove wrinkles with a steam iron).

● **Rails.** The rails require some tricky sabre-saw cutting. Cut the sections to size and miter the ends 45° . Place the four pieces on a flat surface and lay out the $4\frac{1}{8}$ -in.-dia. cutouts. If you want full-size patterns for the pockets, we will send them free. Write Pool Table, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019 and be sure to include a self-addressed, stamped envelope.

Make cutouts in the usual manner using a sabre saw. After all corner and side-

(Please turn to page 182)

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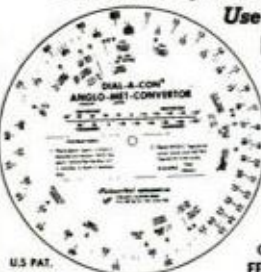
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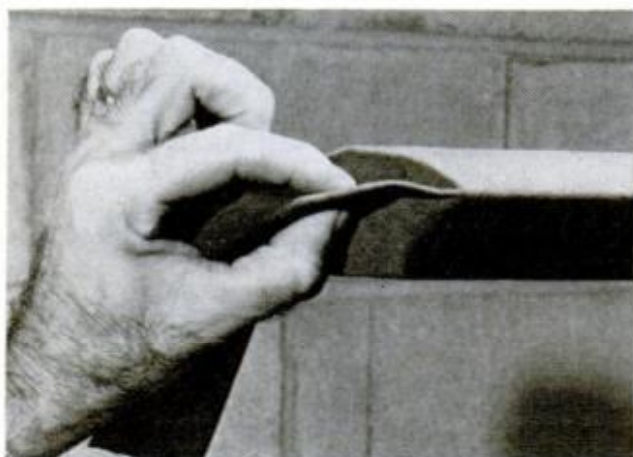
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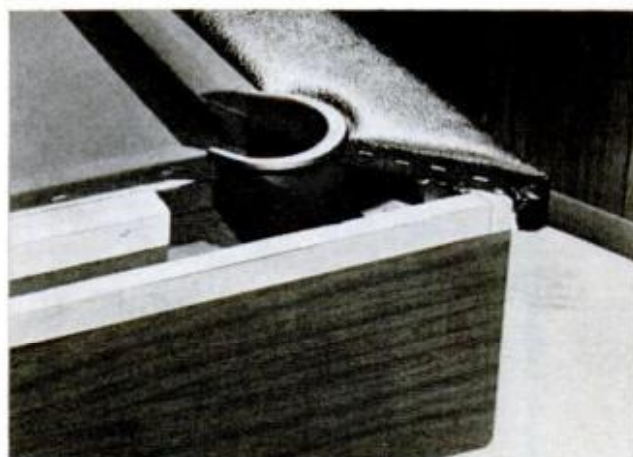
FABRIC-BACKED VINYL is stapled to underside of rails with $\frac{3}{16}$ -in. staples spaced about 1 in. apart



CUSHIONS ARE COVERED with 5-in.-wide strips of billiard cloth, pulled taut and stapled to rear side



ENDS OF CUSHIONS are glued as shown, then cloth is pinched and finally trimmed neatly with razor blade



HERE'S HOW A DROP POCKET fits corner hole. The front padded rail has been removed for sake of clarity

\$300 POOL TABLE FOR \$107

(Continued from page 180)

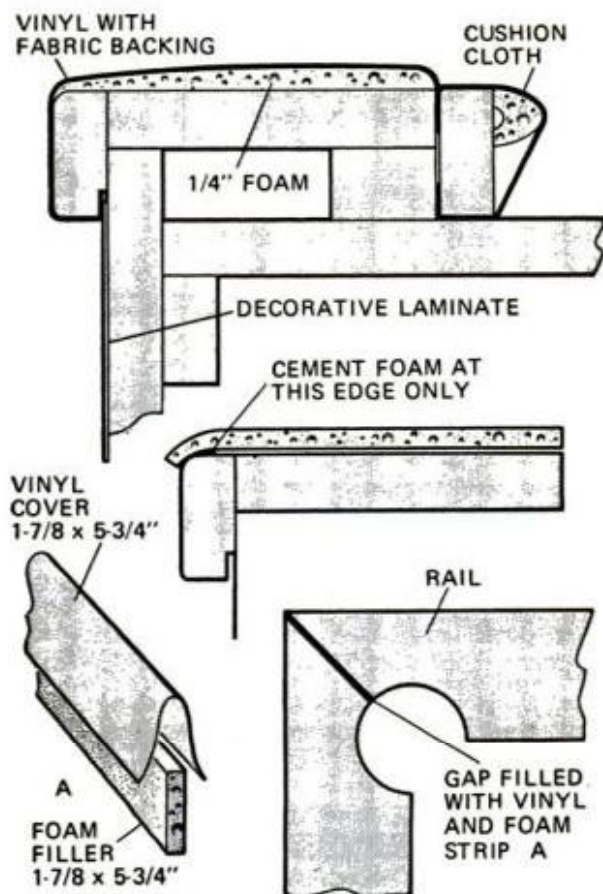
pocket cutouts have been made, tilt your saw's base to 30° and recut the section of the cutout from points A and B. Undercutting is needed to clear the drop pockets.

The outer edging for the rails is cut and rabbeted as in the drawing. Two passes on the table saw will form the rabbet—or use a router. Round off top and bottom edges, miter the ends, then nail and glue edge pieces to the four rails.

Padding the rails is not too difficult. Glue a 5-in.-wide strip of foam to the rear edge of the rail just before the round starts. Use rubber cement or Pliobond *only*. Contact cement, white glue and animal glues destroy the foam. If you use rubber cement (sold at stationery and art stores), apply it to both surfaces and let it air-dry about five minutes before joining the parts. Apply a narrow strip of cement about $\frac{1}{2}$ in. wide.

Cover the rails with a strip of fabric-

(Please turn to page 184)





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\$300 POOL TABLE FOR \$107

(Continued from page 182)

backed vinyl. This is upholstery material; two well-known trade names are Naugahyde and Boltaflex. Cut it in 9-in.-wide strips and let the ends overhang the rails slightly. Staple one edge of the vinyl to the rabbeted part of the rail back. Pull this taut toward the front of the rail and staple it again on the front edge, with staples about 1 in. apart. At the cutouts, slit material and staple it to the underside as shown on page 180. At the ends of the rails, trim the excess and where impractical to staple, use cement.

When all rails are covered and mounted to the table, there will be a slight gap at the miters. This is rectified by inserting corner fillers made by folding a piece of vinyl over a foam strip. Insert in corners before permanently mounting the rails.

● **Cushions.** The rubber cushions are cemented to the wood cushion supports with rubber or contact cement. The cushion rubber is not symmetrical, but has a top and bottom. It's mounted right when the nose of the rubber is $1\frac{3}{16}$ in. from bottom edge of the support. Miter the supports as indicated, then mount the rubber. Let rubber extend past the miter, then trim it flush with a sharp knife. It's easy to cut if the blade is dipped in water first.

Covering the cushions is next. Cushion cloth in the kit is 10 in. wide, with a small slit at the 5-in. mark. Grasp the cloth at one end and pull apart at the slit into two 5-in.-wide strips. Cover the cushions by stapling the cloth to the rear side, a trifle above center. Pull the opposite end taut and again staple at rear of the support. Work from the center out. Be sure the staples set flush. If not, hammer them all the way home. Do likewise with the rail. Ends of the cushion cloth are cemented. Pull the cloth toward the center, then carefully cut the excess with a razor blade. Pull loose ends to the back and cement.

The support spacer is attached to the cushion support with five 2-in. rh screws in each piece. Drive the screws tightly.

● **Final assembly.** Place the support spacer under the rail and screw rail into place with $3\frac{1}{2}$ -in. rh screws. Force the cushion as tight as possible against the rail and attach with the $2\frac{1}{4}$ -in. screws. Have an assistant help you. If you can't get $2\frac{1}{4}$ -in. screws, use $2\frac{1}{2}$ -in. ones with

several washers under the heads to keep points from penetrating the nail top.

● **Drop pockets.** The molded-rubber pockets are made slightly oversize so they may be trimmed to fit various tables. Pockets in the kit are cut with a sharp knife or scissors. Three metal brackets hold each pocket in place, using Pop-rivets. The other end of each bracket is attached to the table with a $\frac{1}{2}$ -in. screw. Since bracket holes vary, no dimensions are given. If too large or too far in from edge, drill new holes as necessary. Press top of the pocket down firmly against the padded rail when positioning brackets.

Rail markers are $\frac{3}{8}$ in. pressure-sensitive paper discs available at art and stationery shops. Peel off protective backing and press them in place. Paint the base as desired.

The kit, with four leveling jacks, 22 ft. of cushion rubber, billiard cloth, six drop pockets and a $\frac{1}{4} \times 5 \times 280$ -in. urethane-foam strip can be bought from The Armor Co., Box 290, Deer Park, N.Y. 11729. ★★

MATERIAL LIST

Note: Except where indicated, all lumber is fir plywood

No.	Size and description—Use
2	$\frac{3}{4} \times 4\frac{5}{16} \times 87\frac{1}{2}$ "—Side rails
2	$\frac{3}{4} \times 4\frac{5}{16} \times 49\frac{3}{8}$ "—End rails
2	$\frac{3}{4} \times 1\frac{1}{2} \times 89$ "—Side-rail back
2	$\frac{3}{4} \times 1\frac{1}{2} \times 50\frac{3}{4}$ "—End-rail back
6	$1 \times 1\frac{3}{8} \times 33$ " pine—Support spacers
2	$\frac{3}{4} \times 1\frac{3}{4} \times 35$ " pine—End-cushion supports
4	$\frac{3}{4} \times 1\frac{3}{4} \times 34\frac{3}{4}$ " pine—Side-cushion supports
2	$\frac{3}{4} \times 1\frac{1}{2} \times 46\frac{3}{8}$ " pine—End bed supports
2	$\frac{3}{4} \times 1\frac{1}{2} \times 85\frac{3}{4}$ " pine—Side bed supports
1	$\frac{3}{4} \times 47\frac{3}{4} \times 85\frac{3}{4}$ " Novaply—Bed
2	$\frac{3}{4} \times 8\frac{1}{4} \times 47\frac{7}{8}$ "—End aprons
2	$\frac{3}{4} \times 8\frac{1}{4} \times 87\frac{7}{8}$ "—Side aprons
6	$\frac{3}{4} \times 6\frac{1}{2} \times 47\frac{7}{8}$ "—Cross members
2	$\frac{1}{32} \times 7\frac{3}{8} \times 52$ "—End laminate
2	$\frac{1}{32} \times 7\frac{3}{8} \times 88$ "—Side laminate
4	$\frac{3}{4} \times 6\frac{1}{2} \times 40\frac{1}{4}$ "—Base
4	$\frac{3}{4} \times 4 \times 8\frac{1}{2}$ "—Bottom pads
4	$\frac{3}{4} \times 4 \times 2$ "—Base ends
4	$\frac{3}{4} \times 4 \times 11\frac{1}{8}$ "—Base diagonals
2	$\frac{3}{4} \times 4 \times 11\frac{7}{8}$ "—Base tops
8	$\frac{3}{4} \times 3\frac{3}{4} \times 31\frac{1}{2}$ "—Uprights
8	$\frac{3}{4} \times 4 \times 23\frac{7}{8}$ "—Upright fillers
4	$\frac{3}{4} \times 1\frac{1}{2} \times 28$ "—Temporary supports
1	$\frac{3}{4} \times 5 \times 58\frac{3}{8}$ "—Stretcher top
1	$\frac{3}{4} \times 3\frac{1}{2} \times 58\frac{3}{8}$ "—Stretcher center
1	$\frac{3}{4} \times 3\frac{1}{2} \times 58\frac{3}{8}$ "—Stretcher bottom
2	$\frac{3}{4} \times 2\frac{1}{8} \times 58\frac{3}{8}$ "—Stretcher sides
18	2" angle brackets—Pockets
18	No. 8 x $\frac{1}{2}$ " rh screws with washers—Brackets
32	No. 8 x $\frac{1}{4}$ " fh screws
32	No. 8 x $\frac{1}{4}$ " rh screws
18	No. 8 x $1\frac{1}{2}$ " rh screws
20	No. 8 x 2" rh screws
18	No. 8 x $2\frac{1}{4}$ " rh screws
28	No. 8 x $3\frac{1}{2}$ " rh screws
20	$\frac{5}{16} \times 1\frac{1}{2}$ " lagscrews with washers

White glue, contact cement, staples, rubber cement

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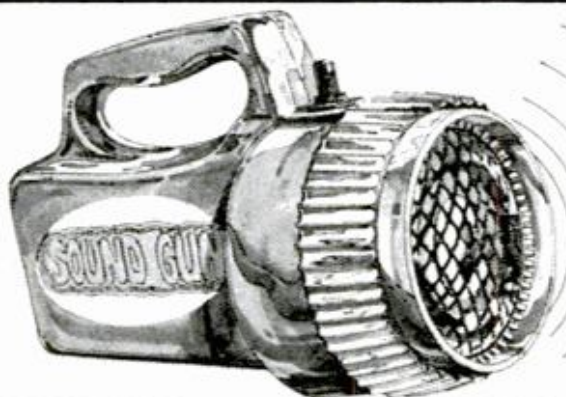
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 NAME (PRINT).....
 ADDRESS.....
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 STATE..... ZIP.....

LET RADAR DO THE BRAKING

(Continued from page 101)

in relation to the speed of the controlled car and computes the safe interval distance, then automatically applies brakes or throttle to keep the cars a safe distance apart. The Bendix version includes a fail-safe feature. A calibrated signal is periodically injected into the system by the signal processor. If the system responds erroneously, a warning light tells the driver there's been a failure and the system automatically disconnects.

With Bill Harokopus, manager of electromagnetic systems and technology, as my guide, I took the Bendix car for a trial run on Detroit freeways.

The car starts, handles and stops like any other automobile. The headway control system doesn't cut in until you attain a speed of 20 mph. Harokopus said this was an arbitrary decision and the unit could be adjusted to cut in at any designated speed.

The Bendix test car is equipped with a

It was almost as if the lead car was pulling me along by an invisible chain . . .

speed-control device on which Bendix holds the patent but does not manufacture. Once you attain the desired speed, you press a button mounted on the end of the directional signal lever and the car will maintain that speed until you reset the button. I experimented with the car at various speeds, first at 55 mph, then at 60 and 70 as we pulled out of city traffic into the country.

There are no buttons to push or levers to pull to activate the headway control. It works automatically and indefinitely once you get above 20 mph.

I started out by fixing on a car in the center lane and let the headway control take over. My car remained a consistent five to six lengths behind the lead car without braking or applying pressure to the accelerator. It was almost as if the lead car was pulling me along by an invisible chain, something like the "drafting" effect you get in racing.

I wanted to see what would happen if another car sandwiched in between my car and the lead car, but nobody cut in. I

didn't trust the headway control enough at this point to jump from the center lane behind a faster moving car in the left lane, so I pulled up within a car length or two of a slower moving car in the right-hand (slow) lane and moved over. Keep in mind all this is done without a foot on the brake or gas pedal.

The reaction was instantaneous as I moved from the center lane to the slow right lane. My car slowed down immediately to adjust the distance between the new lead car and my car.

The application of the brakes was very smooth, probably smoother than I would have accomplished by manual control. If you can imagine a giant hand grasping the back bumper to slow the car, that's what it was like.

I tried other maneuvers after this, moving back and forth from the slow lane to the fast lane. The only conscious effort I had to make was to kick down on the accelerator when I wanted to fix on a faster car.

On the return trip, there was a point where the speed limit drops from 70 to 55 mph. The lead car I was fixed on continued to go 70 and our car followed at the same speed. "You have to watch that," Bill Harokopus cautioned, "because you can get a ticket by assuming the guy ahead of you is observing the speed limit."

We got off the freeway at one point and were loping along on a side road at 30 to 35 mph behind a slow-moving lead car. A truck waiting at a crossroad gunned it and scooted directly across the road, between the lead car and my car. I hit the brakes. It wasn't a panic stop. Just moderately fast. I asked Harokopus what would have happened if I hadn't applied the brakes.

"In that situation, you would have hit the truck, because there wasn't enough time for the system to make the proper adjustment in spacing."

Ironically, with speed control, headway control and robot braking, there isn't much for the driver to do. "And that's the problem we're working on now," Harokopus acknowledged. "We've almost made driving too easy, so the driver isn't as attentive as he should be. We're going to run some studies to see what we can do to give him the benefits of these developments while making him a more attentive driver." ★★ ★

FM KITS

(Continued from page 168)

Heath's STEREO/HIGH-BLEND/MONO control were out on the front panel, like the Dyna's, instead of buried behind a trapdoor with the preprogram card slots and the other seldom-used controls. Also behind the trapdoor are the SIGNAL-MULTIPATH selector for the meter and a test button that lights all display segments at once.

But the Dyna has a few tricks up its own sleeve. Add a power amplifier, and you have a complete FM stereo system for less than an integrated amp and tuner would cost. And the FM-5's auxiliary input lets you add tape to your system, too—or phono, if you build in the \$30 PPM-5 phono preamp module.

The FM-5 has a TAPE output, too, which can be used for rear-channel outputs, should a four-channel broadcast system eventually require it (the Heath has holes for future outputs). Both Heath and Dyna feel they've left enough extra space and reserve power supply capacity to accommodate any adapters you may need.

The Heath requires a \$35 wood cabinet, unless you're going to panel-mount it. The Dyna, which looks fine in its standard, vinyl-clad metal case, also has a wood cabinet available, for \$18.

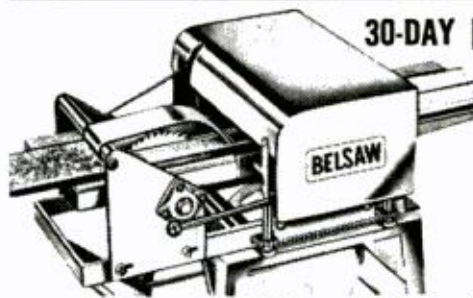
Specifications for the tuners are quite close: IHF sensitivity (the minimum signal for which the tuner can deliver a 30 db signal-to-noise ratio—unlistenable noisy) is 1.75 microvolts for the Dyna, "under 1.8 μV " for the Heath. More important, the Dyna delivers 40-db S/N with 2 μV of input, the Heath with 2.3; and for a reasonably quiet 50-db ratio, the Dyna takes only 5.0 μV , the Heath a mere 3.6 μV .

Both tuners have capture ratios of 1.5 db, to discriminate against co-channel interference. Both have very low distortion, too (0.25-0.5 percent in mono, 0.5-0.9 percent in stereo for the Dyna; 0.4 percent and less than 0.5 percent respectively for the Heath), and are equally quiet, at an ultimate 65 db. Selectivity is high, too: alternate-channel signals are down 65 db in the Dyna, 95 db in the Heath.

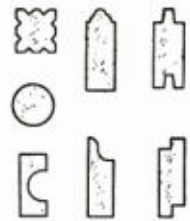
Of the two, the Heath emerges as the super-tuner, especially in difficult reception areas. But the Dyna is the more convenient, and a bigger bargain, too. Dyna is at 3060 Jefferson St., Philadelphia, Pa. 19121; Heath is in Benton Harbor, Mich. 49022.

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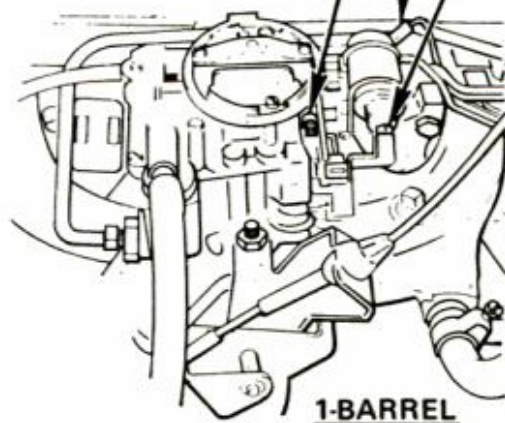
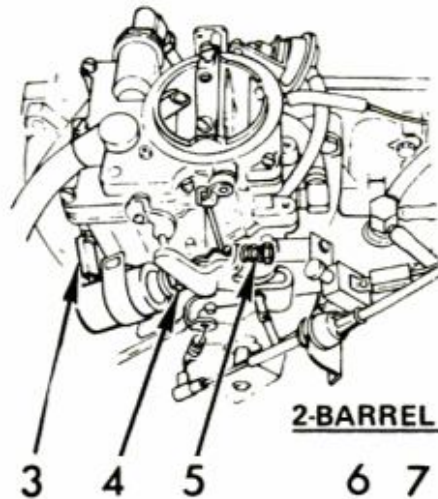
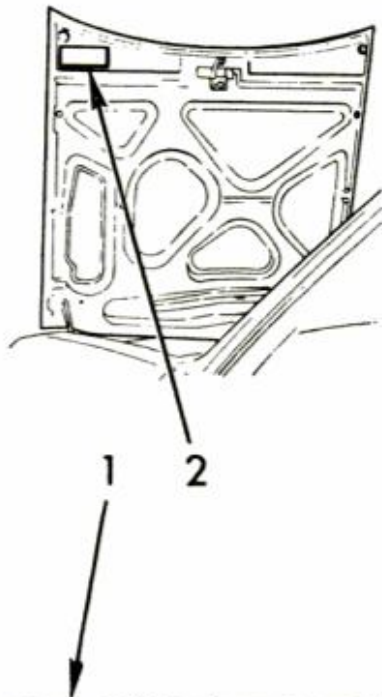
(Continued from page 133)

PART 10

See Table (1) to identify rpm specifications for your car.

A Vehicle Emission Control Information specification sticker (2) is mounted in the engine compartment. If the specifications on the sticker (2) are different from those in Table (1), use the specifications as called out on the sticker.

1. Turn on airconditioner, if installed.
2. Adjust carburetor speed screw (5, 6) to specified rpm.
3. Connect solenoid quick disconnect (3, 7). Press accelerator pedal down once.
4. Adjust $\frac{3}{8}$ -inch solenoid nut (4, 8) to specified rpm.



	1-BARREL		2-BARREL	
	Manual	Powerglide Torque Drive	Manual	Powerglide Torque Drive
Solenoid RPM	850	650 ^a	1200	650 ^a
Carb Speed Screw RPM	700	550 ^a	700	550 ^a

^aAutomatic transmission in gear, wheels blocked, emergency brake on

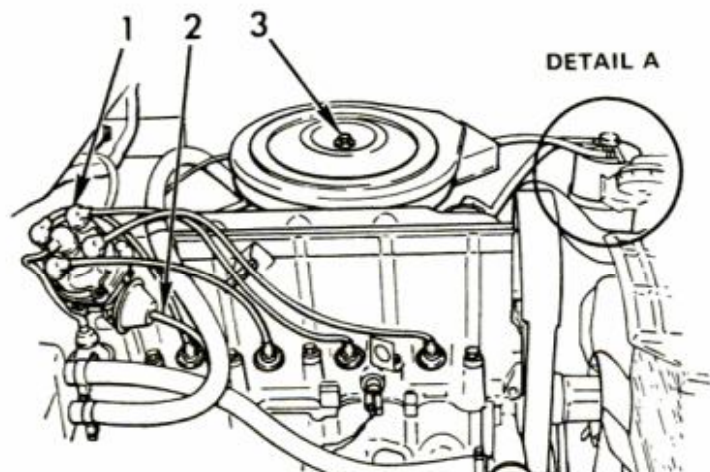
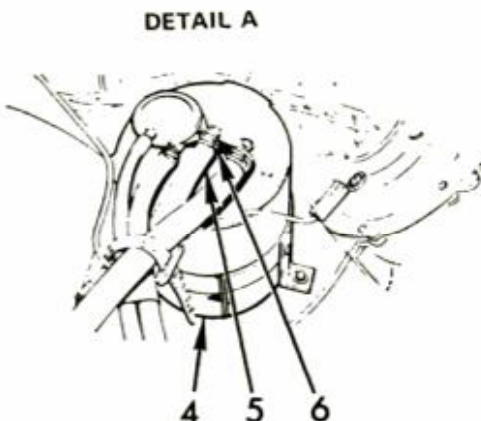
PART 11

1. Turn off airconditioner, if installed. Stop engine.
2. Connect fuel tank hose (5) to canister (4) by loosening clamp (6).
3. Remove pencil from vacuum hose (2). Connect

- hose to distributor (1).
4. Disconnect tachometer.
5. Install washer and $\frac{7}{16}$ -inch bolt (3).

ADJUST ENDS HERE

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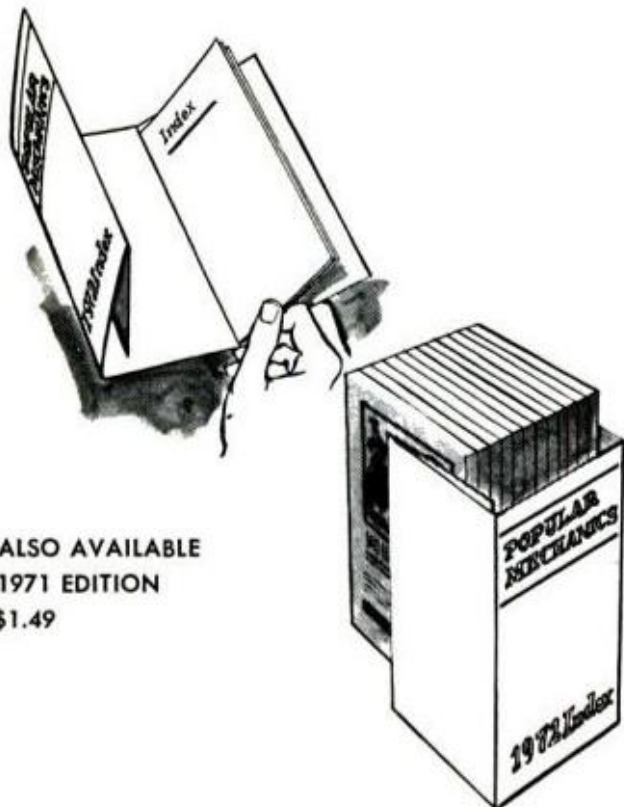
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NUMBER-GUESSING GAME

(Continued from page 136)

battery-holder posts, and for the posts which hold the poker chips. Glue the top to the center assembly, but wait until the game is completely wired before gluing the bottom.

You'll need eight double-pole, double-throw (d.p.d.t.), four single-pole, double-throw (s.p.d.t.) and four single-pole, single-throw (s.p.s.t.) switches, plus one momentary pushbutton switch and 16 miniature pilot lights (4 green and 12 red). All can be purchased at Radio Shack stores. The Philmore battery holder costs 52 cents. The lights come in packages of three (two red and one green) and sell for \$1.19 per package. The 16 toggle switches cost about \$3.65.

Tiny screws ($\frac{3}{8}$ -in. x $\frac{6}{32}$) hold the switches and lights in place. The battery holder for four C-cells is attached to the dowel posts fastened to the underside of the top. Use 20-ga., plastic-covered wire, and solder all connections. Study the wiring diagram carefully before you start. ★★★



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POPULAR MECHANICS

ROUTER KNOW-HOW

(Continued from page 143)

the manual packed with your template.

Template routing

Template guides are available in various sizes. A typical one is shown at the top of page 141. The B dimension of the guide must be less than the thickness of the template you are using or the router will not sit flat on the template. The i.d. of the guide (A) should be slightly larger than the diameter of the router bit to assure clearance. Work being cut will vary in size, by the distance between the cutting edge of the bit and the o.d. of the guide (C). Be sure to allow for this offset when cutting your template (master pattern).

To make the cut, clamp the template to the piece to be routed. With a straight bit in the router, plunge the spinning cutter into the work until the router base is flat on the template. Then, follow the pattern, making certain that the template guide is *always in contact with the pattern*. Since there is no wear and tear, the template can be saved for future use.

Freehand routing

Once you've gained experience and confidence, you'll find the router an extremely efficient shaping and carving tool when used freehand. It can be used to turn out decorative items, lettered signs and the like in minimum time. Remember that the deeper the depth of cut, the slower the rate of feed (there's more resistance to your movements).

You can rout out the design proper as illustrated in the photo on page 142 or raise the design by routing out the background. Frequently, in freehand routing it is a must to affix a long board to the router base so that the router will straddle the routed-out sections in the work. Simply cut the board to desired length, drill two holes to suit the router shoe and countersink them for screws.

Drop-leaf table joint

A cove bit is used to make the concave cut on the table leaf; a rounding-over bit—of the same radius properly extended—makes the cut in the tabletop. Use a core-box bit for the barrel hinge mortise; its location must be precise. This is a tricky joint, so first test on scrap before routing the work. ★★★

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VERSATILE SABRE SAW

(Continued from page 151)

more suitable for metalwork. Even the slowest speed of some multispeed sabre saws is really too fast for heavy-duty hacksawing because even top-quality, metal-cutting blades dull rapidly when used at more than 1500 strokes per minute. Slow speed is also useful for power-filing.

● **Saw-bar action.** In most portable sabre saws the blade travels straight up and down. A mechanism in some models rocks the blade slightly as it reciprocates, giving an orbital cutting action. Orbiting, the blade bites into the work on the upstroke and clears on the downstroke. This provides better chip clearance.

In an industrial-model saw designed for fastest possible cutting, orbital action is a significant advantage. For a saw used in a home shop, it's less important. Orbital saws are more complex mechanically and higher priced, and in home shopwork the added cutting speed is hardly worth the extra cost. Besides, you can have similar fast-cutting action with a straight-line saw by using a canted blade (angled or curved slightly forward).

Smooth saw-bar action, however, is important, since a well-counterbalanced saw is much more comfortable to use than one that vibrates excessively. To check the balance of a saw you're considering, switch the tool on and feel the action.

● **Metal or plastic casing?** Some saws have die-cast aluminum casings; others have casings of injection-molded ABS plastic. Even though the new plastics used by toolmakers are remarkably tough and stable, a metal case makes a longer lasting tool. But any portable electric tool with a metal case should be grounded electrically to protect the operator in the event the tool should short, and this means a three-wire cable with a three-prong plug.

If your shop area is properly wired with grounded receptacles, a metal-cased sabre saw is undoubtedly preferable. But if you'll be plugging into ungrounded outlets, a double-insulated plastic-cased saw is safer. Too, a plastic-cased tool is somewhat quieter.

Some manufacturers compromise, using a metal motor casing with a plastic handle—a combination used for many industrial saws. This makes the tool safe, yet satis-

fies anyone who still feels prejudice against plastic tools.

● **Tilt or no tilt?** Several sabre-saw models, light or heavy-duty, are available with a tilting or fixed base shoe. While a tilting shoe can be a convenience, it's a feature you'll seldom use. Sabre-sawing bevels isn't especially common.

Depending on saw design, a fixed shoe may be preferable. A nontilting shoe is more solid and lowers the saw's profile. A low-handled sabre saw is easier to guide than a high-handled one.

● **Selecting blades.** Since the blades do the cutting, it pays to buy quality ones. An inexpensive saw with a fine blade will give better performance than a more expensive saw with a cheap blade.

Many specialty blades are available for portable sabre saws, but three kinds handle most work: alternate-set blades, taper-ground blades and wave-set metal-cutting blades.

Alternate-set blades, with teeth swaged alternately right and left, are general-purpose blades used for rough cutting. Blades with six teeth per inch are suitable for stock more than 1 in. thick; blades with 10 teeth per inch are preferable for wood less than 1 in. thick. Alloy-steel blades stay sharp longer than carbon steel blades.

Taper-ground blades are something like hollow-ground circular saw blades. Their back edges are ground thinner than their front edges. They cut narrower kerfs than set blades and are more difficult to turn. They do make beautiful finish cuts in hardwood.

Wave-set, metal-cutting blades, though thicker, are much like hand hacksaw blades. Liberal use of cutting oil when hacksawing steel prolongs their life.

While most sabre saws use blades with standard-pattern shanks, Rockwell, Bosch and a few other makes have improved-design chucks using special blades. They grip the blade more securely, but limit your choice of blades to those supplied by the manufacturer.

In all, it's well worth shopping around before you buy a sabre saw. Look at industrial-model tools sold through industrial supply firms as well as home-shop saws sold through hardware stores. Get the best model you can afford, for your sabre saw will be one shop tool you'll use most.

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(Continued on next page)

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(Continued from preceding page)

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(Continued on next page)

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(Continued from preceding page)

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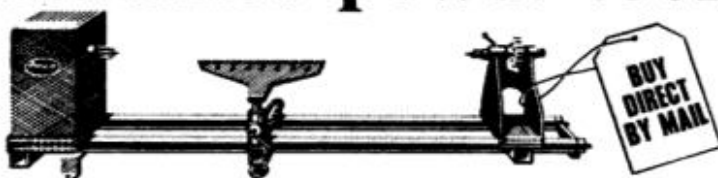
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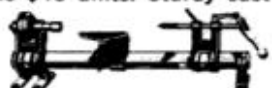
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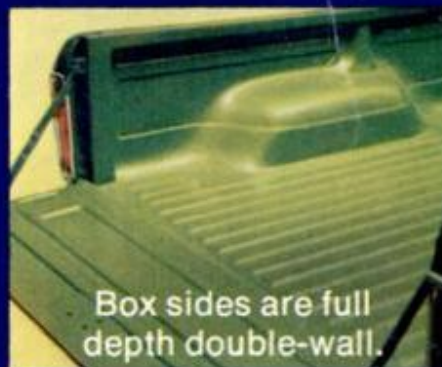
Ford box cover fits
right, looks right.



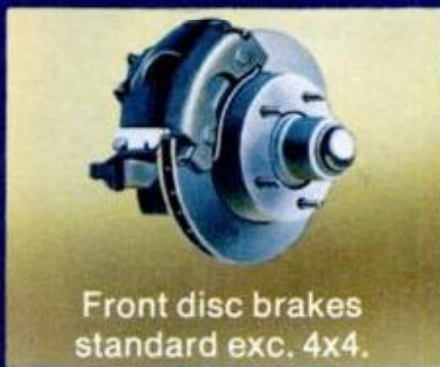
Full-foam seat 5 in.
deep is standard.



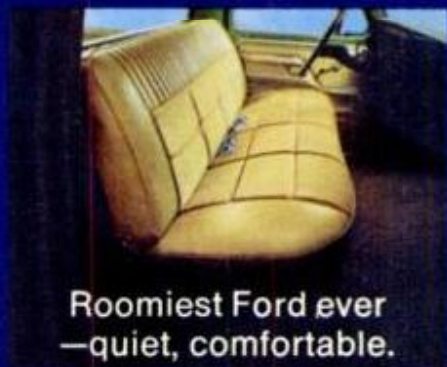
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