

your own back-yard putting green Page 66

Foil thieves:
**TAKE-IT-WITH-YOU
CAR TAPE MOUNT**

Page 111

Popular Mechanics

AUG. 1972
50 CENTS

**15 GREAT IDEAS
FOR BETTER
OUTDOOR
LIVING—**
any one of them
will make your
back yard sing

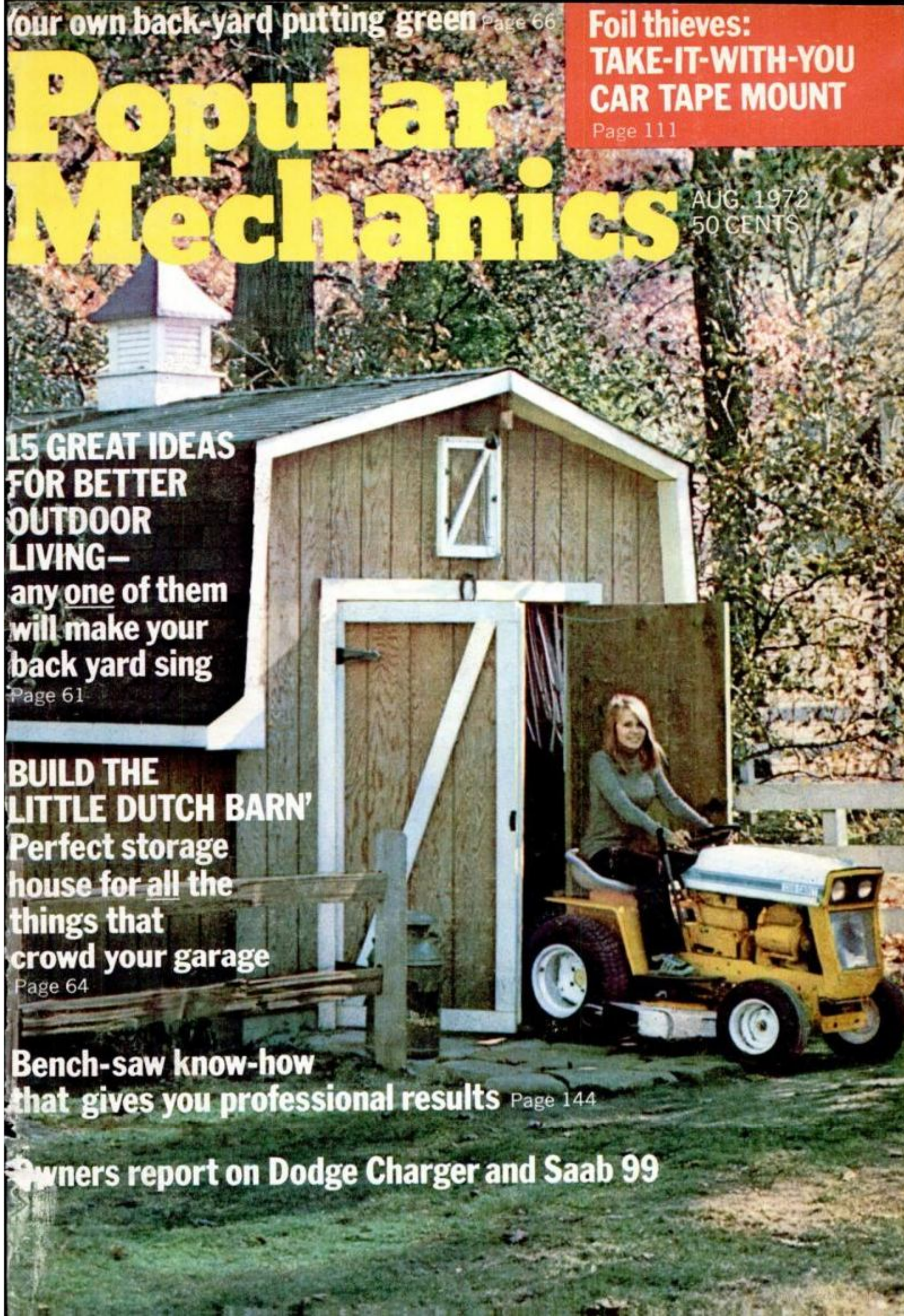
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**BUILD THE
LITTLE DUTCH BARN'**
Perfect storage
house for all the
things that
crowd your garage

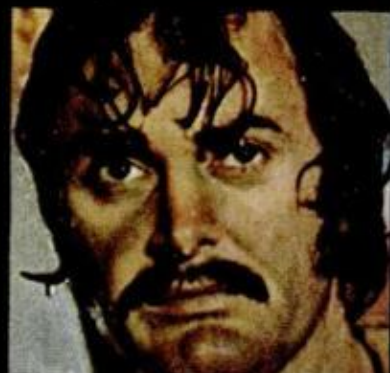
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**Bench-saw know-how
that gives you professional results** Page 144

Owners report on Dodge Charger and Saab 99



Isn't it nice to know
that while you're
taking care of her,
HighSeas is taking care
of your face?



Sometimes you don't
have time to take care of your
face the way you should.

To protect it against
the things a face runs up
against during the day.

Well now you can
with High Seas, the new
conditioning after shave.
High Seas has emollients.

It feels different than
other after shaves. These emollients
soothe and smooth your face and
help keep it from drying out.
High Seas®. The new conditioning
after shave. It takes care of your face.
While you take care of other things.



Is there a pump action shotgun that actually helps you stay on target? Shot after shot?

Yes. The Remington Model 870 "Wingmaster" is designed to do just that. Here's how and why.

Hunters don't always have a chance to get set for a shot. If a covey flushes without warning or the ducks suddenly veer from the decoys, the hunter has to go into action fast. That's when proper shooting techniques pay off.

A good hunter should practice shouldering his shotgun until getting it into position becomes a reflex. Always bring the stock to your cheek, as shown in the photo below, rather than your cheek to the stock. Keep it high enough on your shoulder so it isn't necessary to strain your neck muscles getting a good sight picture.



It's a good idea to wear your regular hunting clothes when you practice, especially if your jacket is thick or bulky. Then you'll be sure your shotgun "fits" properly when you're out in the field. And if it's a Model 870, you'll find it's balanced to swing smoothly and point fast.

So much for the first shot. But what happens if you have a chance for a double, or the bird you miss is still in range? That's when the 870's pump action comes to your aid.

Here's a tip from Remington experts. Recoil tends to force a barrel up and back. The 870's pump action actually lets you make use of this force to help bring the fore-end back to eject the hull. Then the forward motion of your hand, which chambers the next shell, helps you bring the gun back on target, ready to shoot, with no wasted time. Thus, your natural reactions to recoil help keep your shotgun under constant control... to help you get set for that second shot as quickly as possible.

What's more, the Model 870 has two separate action bars—one attached to each side of the fore-end—that let you pump

it much more smoothly, shot after shot, without twisting or binding the action. That's double insurance it will feed and eject properly under all shooting conditions.

If you have any doubts about the dependability or handling of the 870, visit any trap field and you'll find it's a favorite with trapshooters everywhere. Remember, a trapshooter can fire four or five thousand shells a year, or more—and he wants a gun that can take it. No wonder the Model 870 is the leader in the pump action field.

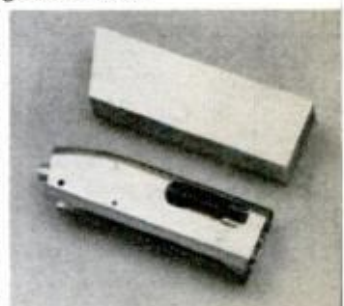
Another advantage of the 870 is that it is made in five gauges and has interchangeable barrels (within gauge and chamber length) with different choke and barrel-length combinations to suit different types of hunting. You can change the barrels yourself. In 12 gauge alone, you can choose from 21 different barrel-length and choke combinations.

If you hunt game that requires long shots, take a look at the Model 870, 20 and 12 gauge magnum models. They can shoot all 3" magnum shotgun shells, 2¾" magnum and high- and low-base shells, giving you a large selection of different loads.

This year we've brought out three new Model 870's; a 20 gauge lightweight in standard or magnum; and a special high-grade "All-American" Trap Gun.

We also have a regular left-hand model for southpaw shooters in 12 and 20 gauges. Right-hand Model 870 prices start at \$124.95*. So if you're looking for a dependable fast-handling pump that's adaptable to different kinds of game, be sure to look at the 870. Better yet, handle one and use either Remington or Peters ammunition to make sure you get the most out of it. Our patented "Power Piston" one-piece wad helps put up to 10% more shot in the pattern compared to old-style wads.

Remington Reports are based on information supplied by "Remington-Peters" experts. If you'd like a free copy of our 1972 catalog, send a postcard to: Remington Arms Co., Inc., Dept. 540, Bridgeport, Conn. 06602.



Each receiver is machined from a solid piece of steel giving the 870 extra strength to handle powerful magnum loads. A solid steel block with the first few cuts is shown at the top; a finished receiver is on the bottom.



Model 870.

Remington® OUPONT® PETERS®

Great guns deserve great ammunition. We make both.

*Price shown is suggested minimum price, subject to change without notice.

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This One



CKHL-1P6-KSHH



The two family car.

The great American dream used to be two cars in every garage. But INTERNATIONAL[®] changed all that with the new SCOUT[®] II.

The new Scout II lets you be two families in one (weekday and weekend).

All week long the Scout II works just like the rest of your weekday family—going to the station, supermarket, cleaners and school. And that's where the

fold down rear seat for extra carrying space comes in mighty handy. Of course, so does the smooth ride and optional creature comforts like automatic transmission, air conditioning, power steering and power brakes.

But come the weekend, the Scout II is as ready to play as the rest of your weekend family.

The Scout II loves to go fishing, skiing, hunting, camping or just exploring.

And with four-wheel drive you'll discover a lot of fun begins where the road ends.

So when you stop and think about it, you really don't need two cars do you?

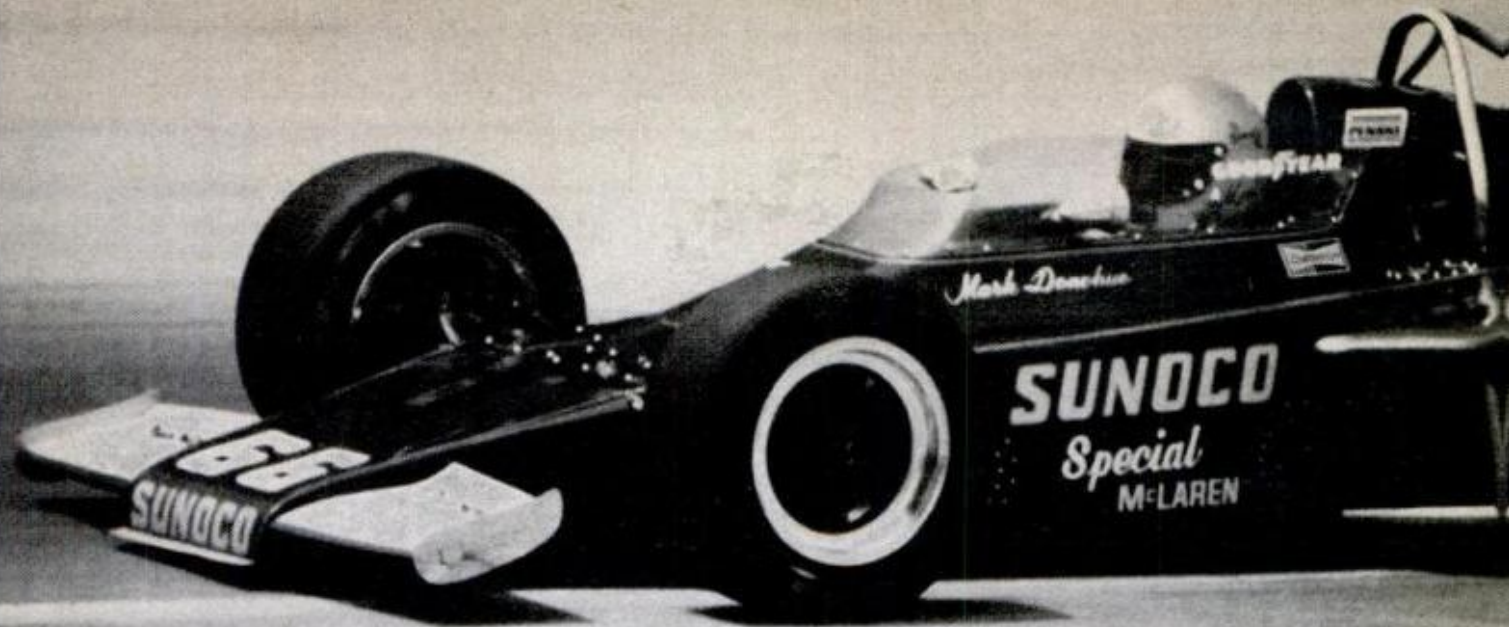
In fact, you don't need a car. You need a Scout II.

The one for both of your families. Get 'em up Scout!

Scout II

International Harvester Company, Chicago, Illinois 60611





Indy. All you have to do is win.

Amazing race.

For example, if you're the driver, go 214 miles an hour and turn sharp left.

One car had eight of the most carefully built, finest-in-the-whole-world, \$30,000 racing engines virtually self-destruct, just trying to get in the race.

We make spark plugs for

just about every kind of racing engine in the world. So we know. Indianapolis is a hard race.

This year we celebrated our 34th win by coming in first, second and third. (That's Mark Donohue in the Penske-McLaren Turbo-Offenhauser above, winning.)

Finally, for the hard core,

the night before the 500, Duane Carter, Jr. won the feature midget at the fairgrounds. In a Sesco Chevy with Champion plugs.



Toledo, Ohio 43601

20 million people have switched to Champion Spark Plugs.

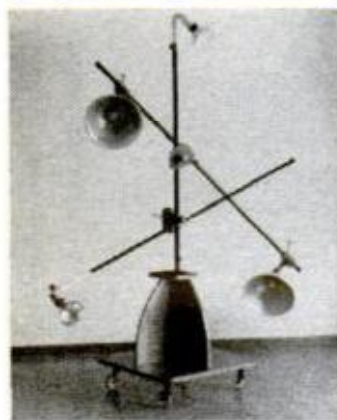
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Cover photo by Frank Aleksandrowicz, Black Star
Dutch mini-barn built for \$400—One of the 15 great ideas for better outdoor living presented on pages 61-80

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JIM LISTON

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AUGUST 1972

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Canada's smoothest whisky

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GUNK LABORATORIES, 5829 W. 56, CHICAGO, ILL. 60638

Gunk Chicago Co. River Forest, Ill.

Radiator Specialty Co. Charlotte, N. C.

LETTERS TO THE EDITOR

Recycle, don't squeeze

In *Handy new compactors put the squeeze on trash* (page 118, June PM), you mentioned all the pertinent data relating to those gadgets—but not that the residential household has the alternative of *recycling* nearly all of the trash it produces. Bottles, cans and newspapers—the most common types of waste produced—are easily recycled at centers which have been opening up all over the country. A compactor becomes less necessary when trash is recycled, as the total trash output of a family is reduced to a fraction of what it was before.

Putting a lot of trash in a little package does nothing toward re-using any of it.
CASS LAKE, MINN. JOEL A. WARD

Torino's disc brakes

I would appreciate it if you would clarify the use of front-wheel disc brakes as reported in the *Ford Torino Owners Report* (page 92, June PM).

All 1972 Torino models are equipped with front-wheel disc brakes. Power assist is standard on the Gran Torino Squire model, a mandatory option at extra cost on Torino and Gran Torino station-wagon models equipped with airconditioning or any optional engine and on models equipped with the 429-c.i.d. 4V engine or with trailer towing packages, or is optionally available on all other Torinos.

What the story failed to make clear was the distinction between *manual* disc brakes and *power* discs.

FORD MOTOR CO. MICHAEL W. R. DAVIS
DEARBORN, MICH. TECHNICAL & PRODUCT INFORMATION MANAGER

That Vietnam goof

As an infantryman who served with the 101st, I would like to thank you for bringing to the American public an honest account of how wastefully their tax dollars are spent (*Our great Vietnam goof*, page 70, June PM).

I have personal experience with the M-16/M-79 over-and-under, and I cannot remember anything good about it. Our

(Please turn to page 8)

Have you seen this coupon before?

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It has helped to start many men and women on the road to higher pay.

Just looking at it won't get you anything... but putting it in the mail may change your whole future!

The LaSalle coupon is one of the most often-seen coupons in America. To many who have mailed it, it has proved a first step to opportunity and good fortune.

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Cut coupon along dotted lines, fill in your name and address . . . fold, seal (tape, paste or staple) and mail. No stamp or envelope is necessary.

Please send me, without obligation, FREE booklet on the field I have checked:

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ARMSTRONG RHINO TUFF TIRES

LETTERS

(Continued from page 6)

platoon went through several of them the year I was there. They just fell apart.

I was also a PRC-25 operator and was forced at one point to carry two extra handsets sealed in plastic bags. And the Lord only knows how many I had to exchange.

CLINTON, MISS.

GLYNN KEGLEY

After seeing all the blunders the brass made in Nam, it is really nice to have someone speak out in the Grunts' behalf. I handled various types of small arms and found many of your observations to be true. I really liked the "60," though, and never had much trouble with it.

Most of the "lifers" weren't in the field that much, and those who did get out in the bush seemed like they were still trying to fight World War II.

ANCHORAGE, ALASKA ARTHUR GOLDBERG

Col. David Hackworth has the right answer to the cost-effectiveness, plastic-goods quartermaster corps, as well as the "let's get out now" mania. Too much junk is being sent over there.

Why doesn't the Army furnish its troops with the Sherman, Browning, M-1 and mortar used in years past? The BAR—you need a Browning to win a war.

ENSENADA, MEXICO GEORGE MORALES

The colonel was wrong in using the Sherman as an example. I believe he will remember that on equal grounds the Sherman was outclassed by every country's tanks in World War II. After talking to many vets, I find the majority very satisfied with the M-16 and M-16A1.

Maybe we are looking for reasons for failure in Vietnam rather than the truth. We fought a mistake and are still fighting it.

LAKWOOD, COLO.

ROLAND RAMADAN

Your story by a retired Army officer named Hackworth proves at least two things: The Army has its fair share of soreheads and poor losers just as does every other calling and, secondly, that *PM* should limit the content of the magazine to subjects it knows something about and stay out of military tactics and political issues.

The current fad of putting down the

POPULAR MECHANICS

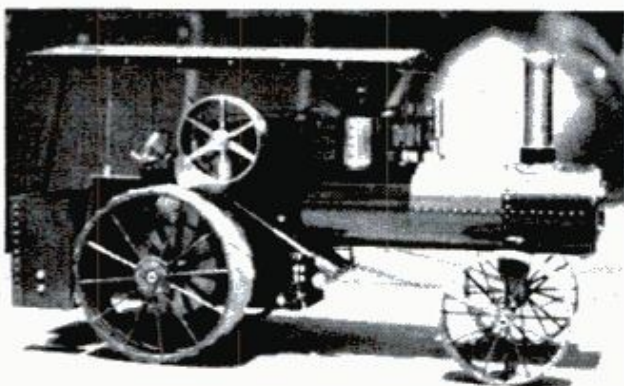
military services has produced an extremely predictable type of individual, such as Hackworth, who is willing to make "newsworthy" statements castigating those services.

Those in the services are the first to admit there are many things that need correction and improvement, and there are some individuals in the services who would be better suited for a livelihood elsewhere. However, all officers cannot be blithely put in the category of being uncouth clods hungry to get their "ticket punched," as does Hackworth. Hackworth should be an expert on "ticket punching" and "brownie points" from the number of decorations he claims.

VIRGINIA BEACH, VA. L. W. CASSELL
COLONEL, USA (RET.)

Engine builder

I just finished building the *Model steam tractor* (page 94, Feb. '71 PM). I've also built the *Model walking-beam engine* (page 156, Aug. '69 PM).



Both have been run with air, but not steam. (I'm reluctant to build a fire in the tractor and scorch the paint.)

LONGVIEW, TEX. CHARLES K. REYNOLDS

The ol' Cannonball

The author of *Your car goes with you on this train* (page 110, June PM) seemed pleased with the service the Auto-Train gave him. My family and I were not.

On Dec. 29, 1971, we took the Auto-Train from Sanford, Fla., to Lorton, Va. We drove to the "terminal" (which at that time was a tent) early. We were supposed to leave Sanford at 8:00; we left at 9:00. We were doing fine for an hour when we had to stop because a train ahead of us had fallen off the track. We were delayed an hour. The dinner was fair.

(Please turn to page 10)



Tires that skid cause more accidents than blowouts. That's why you need Armstrong Rhino Tuff Tires—specially built to grip the road for your family's protection. For the newest in safe, dependable tires—from glass belts to steel belts, from bias ply to radials—see your Armstrong Dealer today.

ARMSTRONG TIRES

LETTERS

(Continued from page 9)

The rest of the night we had to stop in every state to change conductors. They did not have a movie that night because the machine was out of order.

The next morning we found they forgot to load breakfast on the train. They stopped and bought packaged Danish. We were going along for about two hours when we hit a car. The train engine was demolished so we had to wait two and a half hours for a new one to arrive.

There were a few other problems. The airconditioning unit in one car caught fire. The chemicals from the toilets came up from all the bouncing the train did.

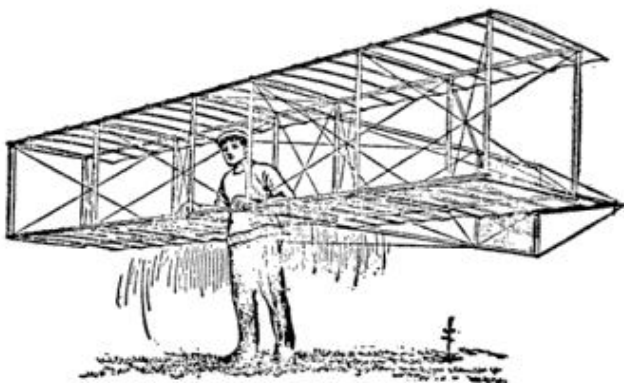
The author mentioned the "food was superior to the airline variety." It's supplied by the same company that supplies most of the airlines.

FREEPORT, N.Y.

GLENN POLLY

Air surfing—nostalgic revival

The article *Air surfing: a nerry new sport* (page 98, June PM) credits "hang gliders" and air surfing with being a new sport. Perhaps more properly it might be



regarded as a nostalgic revival. Here's a drawing included with the plan for a hang glider published by PM in *The Boy Mechanic* in 1913.

CARTERVILLE, ILL.

HERBERT R. BOLLAND

Let's keep history straight and give credit where it is due. Otto Lilienthal, familiar to students of aviation history as the probable inventor of hang gliding, made hundreds of flights and went to his death in one of them in 1896!

RANDLEMAN, N.C.

ROBERT G. VAUGHN

Illuminated magnifier

The Illuminated Stand Magnifier shown at the top of the first page of *Exciting*

New Products (page 130, June PM) is all you say it is—but the price is wrong. It sells for \$9.95 postpaid.

NEW YORK

M. FROMMER

Sorry about our error. The correct price is \$9.95 from Better Vision Co., 23-26 143rd St., Whitestone, N.Y. 11357.

How the kid climbs aboard

All four of my children are demanding bunk bed/desks like the one in *This kid studies under his bed* (page 156, June PM). One question: Where did those metal handhold-steps come from?

MADISON, WIS.

RONALD E. WYLLYS

They're boarding steps (generally used on boats) and are available from almost any fair-sized marine-supply shop. Those shown are bronze, which can be special-ordered if the dealer has only chrome.

Great Workshops

I really look forward to each article in your Great Workshops series. Most editors of mechanical magazines seem concerned mainly with the "end product" and have forgotten the man who likes working with his hands for the enjoyment of it and just being in the shop for the joy of being there. You are doing a fine job.

LONG BEACH, CALIF.

E. LEONE SHURTE

It's fascinating the individual approach these people take in laying out and using their shops.

PORTLAND, ORE.

WILLIAM F. ROONEY

I would like to tell you how much I enjoy the workshops featured in PM. I happened to purchase your June 1970 issue at a newsstand and saw the workshop of the Minneapolis lawyer featured under the title *Is this the best workshop in the world?* I finally got around to subscribing to your magazine and came across the fourth in the series (*This shop paid for itself . . . and grew and grew*, page 63, June PM). I somehow missed the second and third; can you supply dates of the issues?

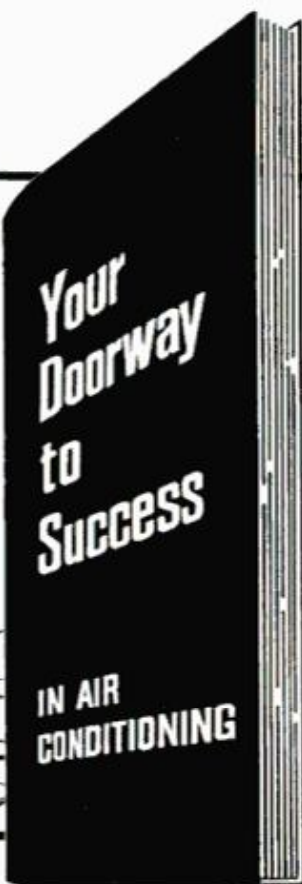
OCEANSIDE, CALIF. ROBERT F. ANDREWS, MD

The four Great Shops appeared in June '70; June '71; January '72 and June '72. The fifth will be in October—and we plan to have more after that.

★★★

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job holding you
down?**

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salary specialist
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There's a great, new job in your future, and it's closer than you think! Just send for our informative free book, *Your Doorway to Success in Air Conditioning*, and find out how to move up to a high-salaried job in air conditioning! With man size benefits: action, variety, challenge, security, prestige—everything you've always dreamed of in a career with a wide-open future!

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The air conditioning industry needs thousands of service men this year, and you could be right in line if you are professionally trained the easy, new Liberty way.

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Liberty School, Libertyville, Illinois 60048

Free Book—No Obligation

LIBERTY SCHOOL
Technical Division, Dept. J-8
1111 West Park Ave., Libertyville, Illinois 60048

Okay! Rush me the free book, *Your Doorway to Success in Air Conditioning*, and full details about your professional training. No salesman will call.



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It means more service.
More convenience.
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PUBLICATIONS WORTH WRITING FOR

GARDENERS will find a wealth of information in *PM's* new *Complete Gardening Guide*, a set of 12 plastic-laminated hang-up boards containing basic gardening information ranging from "Basic landscaping" to "House plants." The 8½ by 11-inch boards come in an attractive spiral binding. Other subjects in the guide include: "Man-made parts of your landscape," "Garden surfaces," "Gardening in your climate," "How to improve your soil," "Starting seeds," "All kinds of transplanting," "Trees," "Shrubs," "Pruning," "Flowers," "Establishing a lawn," "Vegetables," "House plants," "Storage structures." To order your *Complete Gardening Guide*, send \$3.95 with your name and address to Popular Mechanics, Dept. GG, Box 1014, Radio City, N.Y. 10019.

THE HANDIEST 'TOOL' in your shop will be *PM's* *Master Shop Guide*, a set of 12 hang-up boards packed full of charts and information on basic shop techniques and materials. The wipe-clean, plastic-laminated boards will last for years, even under constant use you're sure to give them. Subjects include: What nails, screws, bolts, wall-fasteners, drills, abrasives to use and why; how to order and use lumber, hardwoods, moldings and plywood. Send \$3.95 with name and address to Popular Mechanics, Dept. SG, Box 1014, Radio City, N.Y. 10019. ★★★

POPULAR MECHANICS

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

After more than two years of preparation, NRI has made available two new home training programs in Automotive Servicing and Repair, acclaimed by experts as "amazingly complete" and "up with the times." NRI asked two of America's foremost automotive experts to critique its new program. William H. G. France, president of NASCAR and the International Speedway Corp., 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." Car-tester/writer Tom McCahill was equally enthusiastic. "I've been around cars since bathtub gin, and I've never seen home training for mechanics as great as this."



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 assorted 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 Tom McCahill and Bill France and train at home with the leader. Rush coupon now for free NRI Automotive Catalog. NRI AUTOMOTIVE DIVISION, Washington, D.C. 20016. No salesman will call.

In Canada write: NRI Canada, 330 Progress Ave., Scarborough, Ont.

**Rush coupon
for FREE catalog**



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Washington, D.C. 20016



946-082

Please send me your new Automotive Catalog. I understand there is no obligation. No salesman will call.

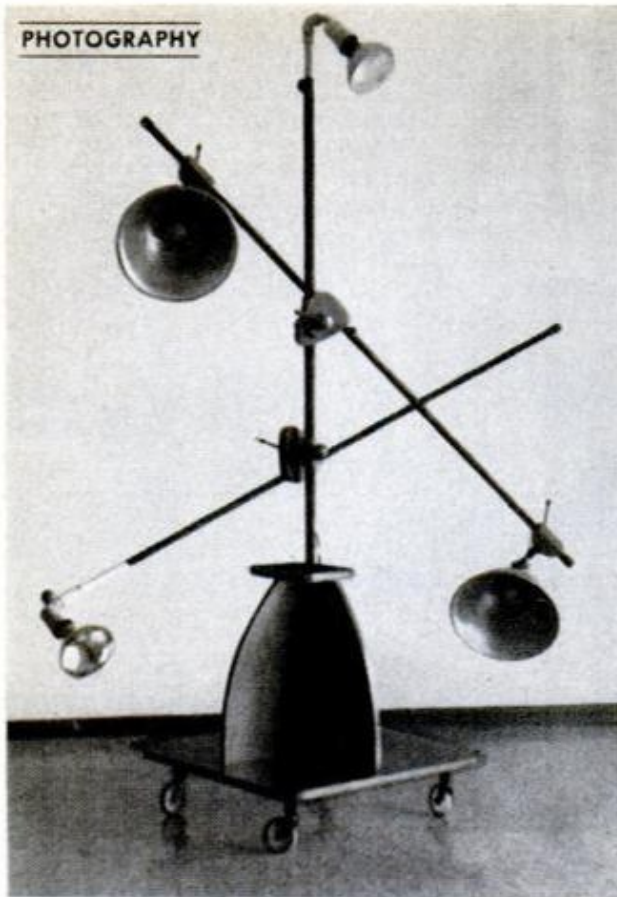
I am interested in Master Course Tune-Up Course.

Name _____ Age _____

Address _____

City _____ State _____ Zip _____

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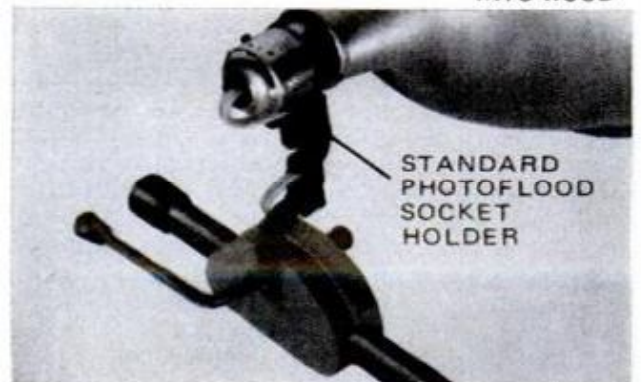
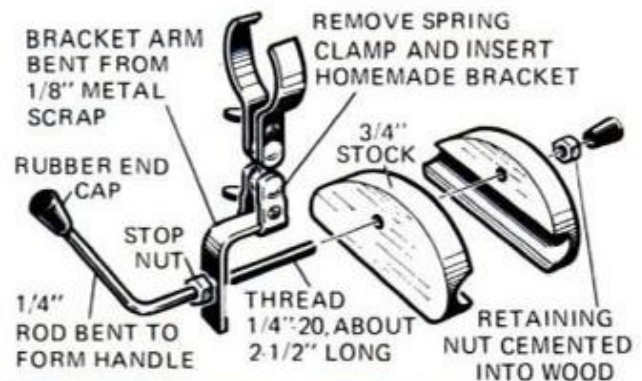
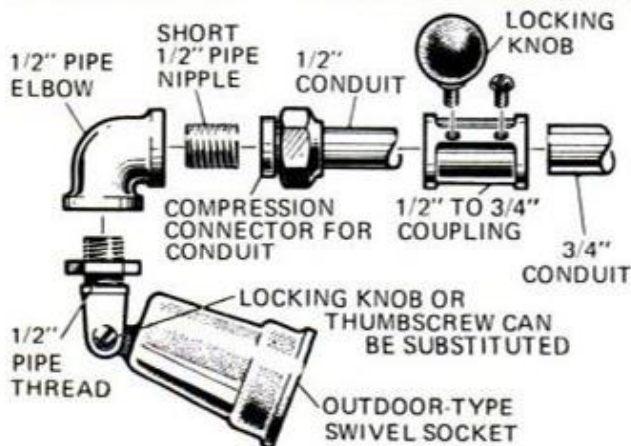
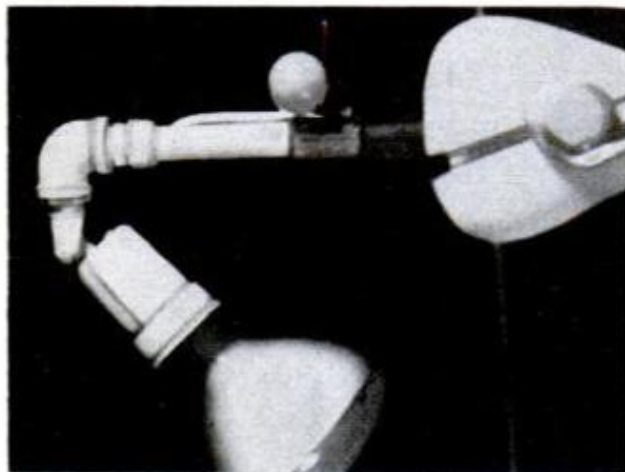
REFLECTOR-FLOOD MOUNTING is similar for both swinging boom and telescoping upright. But the 3/4-inch conduit and the 1/2 to 3/4-inch coupling shown apply to the upright only; the 1/2-inch conduit telescopes inside the larger tube for height adjustment

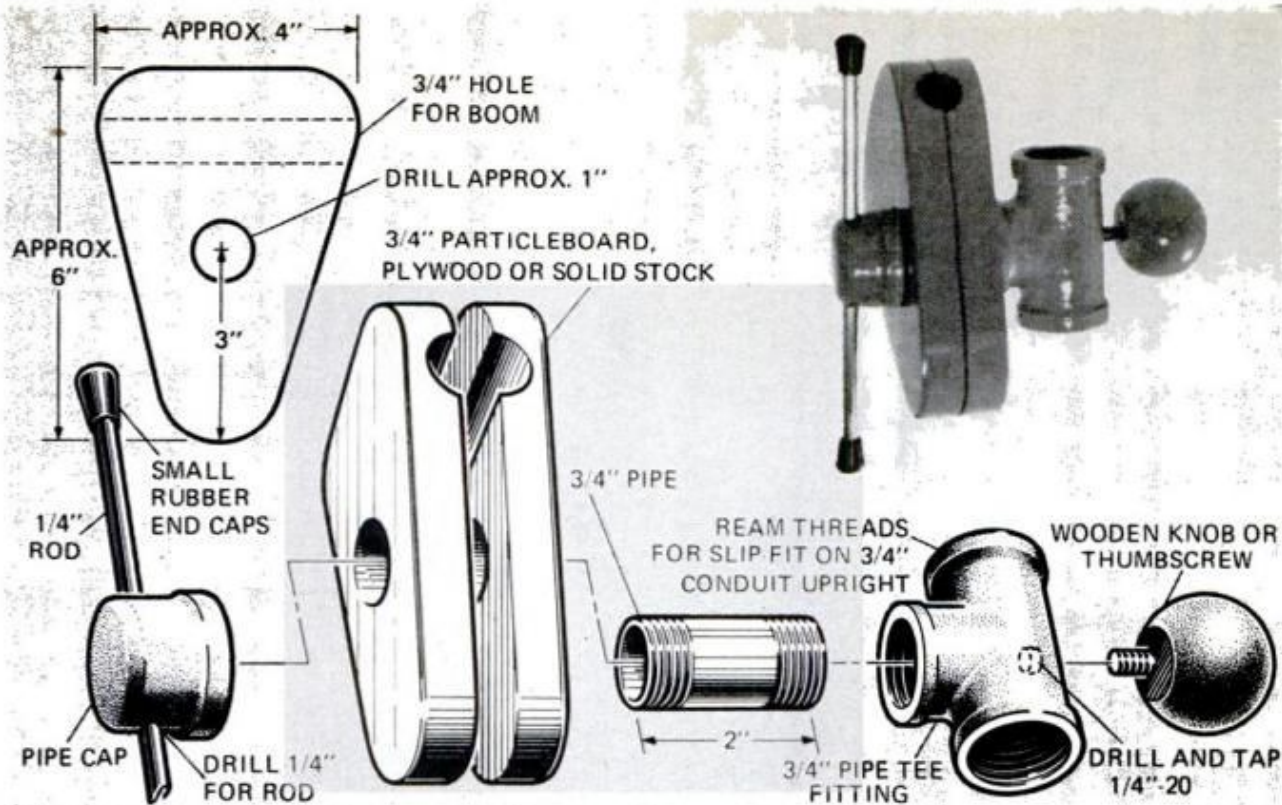
Build a rolling dolly for your photo lights

By ROSS SCOTT

IF HAULING LIGHT STANDS out of your closet discourages you from using your floodlights, this octopus-like, rolling stand should encourage you again. It's flexible to handle all the lighting you need for small-object or tabletop photography; for portraits and other, larger subjects, you may want to build more—or modify the dolly base to hold extra stands when you need them.

The basic design is easy to adapt to your needs—build as many booms as you need, modify the upright to hold your projection screen (with your projectors stored on the dolly base), or even use it as a rolling microphone boom. As shown here, the unit holds both reflector-flood bulbs and regular flood bulbs in standard reflectors. You can adjust the lighting patterns of the latter type by changing reflectors or adding "barn doors." ★★★





CLAMPING BOOMS to the upright post takes this heavy-duty assembly. To drill hole for the boom, cut the clamp sides from wood or particleboard, clamp them around 1/8-inch hardboard filler and drill a 3/4-inch hole through all three pieces. Remove the fill-

er and you'll have enough clearance for proper clamping action. Smaller clamp (facing page) is drilled similarly. Socket and holder shown with latter come from standard, spring-clamp floodlight assembly; just remove the spring and substitute bracket



Car and Camera.

Behind the wheel or the viewfinder, speed counts.

When Mario Andretti shifts gears, he doesn't have time to take his eyes off the road. With a Minolta SR-T 101 you don't have to look away either.

To adjust exposure, simply align two indicators in the viewfinder. A scale shows the exact shutter speed, so you never lose sight of your subject.

As the official camera of the Vel's-Parnelli Jones Racing Team, we're running the biggest automobile photography contest ever — The

Minolta Car and Camera Competition. Grand prizes: 2 Alfa Romeo 2000 Spider Veloces, each with an SR-T 101. Other prizes: \$9,000 worth of Minolta equipment. All prizes will be awarded.

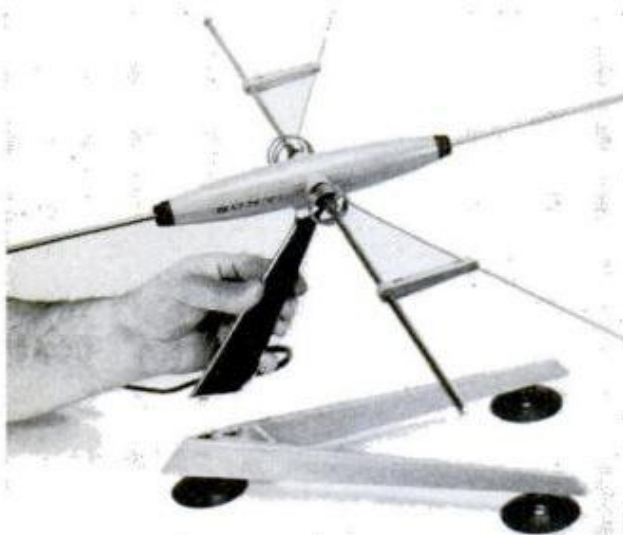
For details, see your photo dealer or send a postcard specifying your name, age, address and present camera brand to The Minolta Car and Camera Competition, P.O. Box 229, Cooper Station, New York, N.Y. 10003.

Minolta

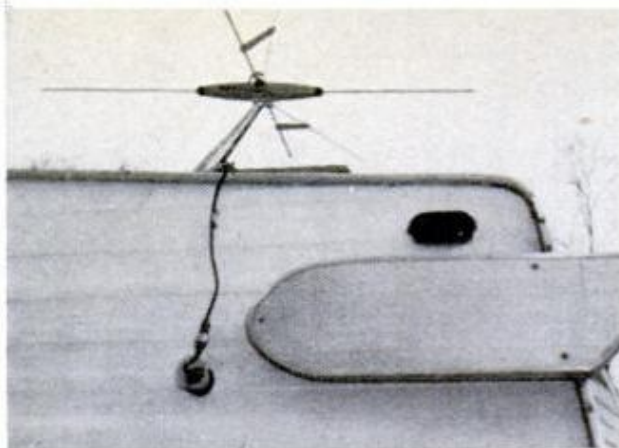
Enter our Car and Camera Competition.

When identified by a factory-sealed "M" tag, Minolta 35mm reflex cameras are warranted by Minolta Corporation against defects in workmanship and materials for two years from date of purchase, excluding user-inflicted damage. The camera will be serviced at no charge provided it is returned within the warranty period, postpaid, securely packaged and including \$2.00 for mailing, handling and insurance.

NEW FOR YOUR CAR



TWO NEW TV ANTENNAS are designed especially for mobile use. One above, made by Sony, has rooftop mount to fit car or camper, sells for about \$25. It features a quick-disconnect arrangement that lets you detach the antenna without removing the roof mount. Telescoping antenna at right attaches to the side of a motor home, camper van or similar RV. When not in use, its arms fold neatly out of way (far right). \$35.80, Antenna Corp. of America, Box 865, Burlington, Iowa 52601.



KIT-BUILT BATTERY CHARGER works automatically—you just plug it into house current, clip it to the battery terminals and forget it. It brings the battery up to proper voltage, then shuts itself down, maintaining just enough trickle current to compensate for normal leakage. Designed for 12-volt auto-type batteries, it has a 10-amp. capacity, assembles in few hours. GP-21 kit is \$29.95. Heath Co., Benton Harbor, Mich. 49022.



“Fish Story”



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Ask any Winston man why he smokes Winston
and he'll tell you ... *how good it is!*
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20 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report APR. '72.

AUGUST 1972

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ALL By BILL McKEOWN OUTDOORS

THE GROWTH OF HIKING as a sport is hard to measure, and so are all the reasons for the boom. A market study by Wenzel Tent Co., one of the long-established manufacturers who recently entered the field with a new line of backpacking gear, estimates that in 1970 the wholesale level of sales was \$20 million. Then, in 1971, that total more than doubled to \$50 million worth of backpacking equipment.

Today's packer can buy frame, pack and duffel of reasonably good quality for \$40, and a sleeping bag with synthetic substitute for down for the same amount, Wenzel notes. This summer I've seen many backpack campers who must have fitted out for under \$15 at surplus stores. But there is also a trend toward top-grade gear, and the brand names carried across the hills are old familiars plus new ones mixed in that you might not expect: Gerry, Camp Trails, Kelty, Sears, Holubar, Coleman, Bean, Thermos, Himalayan, Eddie Bauer, Trailmaster and others. New lightweight freeze-dried and compact foods are usually considerably more expensive than the originals. But for the dedicated backwoodsman, who will cut half the handle off his toothbrush to save weight and knows that every added ounce feels like a pound on his back late in the day, the freeze-dried edibles can mean extra days in the woods for him.

WHY SO MANY CAMPERS want to get away from crowds is easy to explain, but where they want to go instead and how they prefer to travel has not yet been documented. There is no charge for back-country camping by backpackers in the national parks, although many parks require fire permits. To learn if more areas should be set aside for back-country camping, however, an experimental free permit system is being tested this season at Great Smoky Mountains National Park on the North Carolina-Tennessee border, the Rocky Mountain National Park in Colorado and California's Sequoia-Kings Canyon National Parks. Permits are issued on a first-come, first-served basis.

The National Park System now has 28,000 campsites at 524 campgrounds in 86 areas, and its popular 30-cent guide, *Camping in the Na-*

tional Park System, includes the Amistad Recreation area in Texas, the Fort Larned National Historical Site of Kansas, and the Katmai National Monument, Alaska, for the first time. The camping guide can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402, and, like other government publications, the price is so low that an outdoorsman may feel like he's getting a tax refund—which, in a way, he is.

MANY RVS CARRY EXTRA BATTERIES, the Recreational Vehicle Institute points out, and servicing them, switching them around, taking them out for a charge or relocating them in unsuitable compartments can be potentially dangerous. A fully charged battery generates explosive hydrogen gas, and erupting battery acid can also injure the face and eyes. Mike Radigan, national director of the RVI, notes that a recent National Safety Council survey pointed to the following as possible causes of accidents:

- Installing a fully charged battery while some switches are on.
- Installing a battery with cables crossed.
- Fastening cables to battery post which is broken inside the battery.
- Filling a warm battery with water when a spark is present.
- Using a match for light when checking fluid level.
- Connecting battery to a charger that is already turned on, or removing battery before switching off charger.

Battery servicing by a responsible and experienced garage mechanic—or at least some instruction from one—is a good idea for RV owners who are new to camping.

A NEW HUNTER SAFETY PROGRAM that will, it is hoped, be national in scope has been announced by Don Berchtold, president of Crosman Arms, the maker of CO₂ air and spring-powered firearms. With the passage of a bill last year which grants federal aid to states for hunter safety instruction programs, local training classes in proper gun handling should now be possible. Crosman plans to work directly with authorized safety instructors to allow both indoor and outdoor shoot-

(Please turn to page 20)

Our outboard engineering know-how



helps us know how to build better stern drives.

OMC Stern Drives are made by the same people who make more outboards than anyone else. And that pays off when we build stern drives. For instance, the OMC Stern Drive 75° power tilt that lets you beach, trailer and launch more easily. The full 90° port to starboard turning that gives you up to 50% more maneuverability than others. And resistance to salt water corrosion that is unmatched by competition.

Our engineering shows everywhere you look. It shows in a power shift that eliminates jerks and hesitations. And a quiet-mounted engine that lets you knife through the water virtually vibration-free. And in automatic kick-up of the outdrive that protects you from sunken hazards.

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IT'S WHAT YOU'D EXPECT FROM THE MAKERS OF JOHNSON & EVINRUDE.

ALL OUTDOORS

(Continued from page 18)

ing and gun-handling instruction in areas where extensive outdoor rifle and shotgun ranges are not available.

"Our recreational guns," Berchtold states, "are constructed in the same manner, and have the same weight and feel of rimfire rifles, pistols and shotguns. We believe they are ideally suited for hunter safety work." Crosman will make available both their guns and pellets or BBs practically at cost. In the past, instructors have sometimes had to pay for supplies out of their own pockets, and practice firing has been very limited. With Crosman guns, backstops of boxed newspapers or magazines are claimed to be suf-



ficient for indoor range safety and excellent short-range accuracy is reported.

Free service and repairs for any guns purchased for the classes are also being offered. Some states already require that hunters pass an approved safety course before being allowed to obtain a license. Details of the Crosman Hunter Safety Program may be obtained from Terry Lynch, Crosman Arms Co., Fairport, N.Y. 14450.

THE CARELESS BOATMAN can now be stopped right where he is by Coast Guard boarding officers and corrective action taken. And if the hazard cannot be cured on the spot on the water, the boat can be ordered back to shore. Under the authority of the new Federal Boat Safety Act passed last year, pleasure craft on federal waterways are in trouble if they lack sufficient life-saving or firefighting devices, are overloaded, display improper navigation lights at night, have a leakage and/or accumulation of fuel, lack required flame-arresting devices on inboards, or do not have adequate tank and engine space ventilation.



SMALL CHANGES can make a big improvement in items of outdoor equipment we found while testing several new products. A travel bag from L.L. Bean, the fine old outfitter in Freeport, Me., offers a choice of hand grips or shoulder straps for toting it when your hands are already full. Bean's travel bag is leather-reinforced at wear points, costs \$24.50 post-paid. Sears' Jetwind looked like a number of other sailing surfboard modifications until we tested her in a gusty breeze. Then we found she could accelerate with a real push, and though stiff enough with two aboard, might flip in a hurry for a careless single-hander helmsman. Olympic skipper George O'Day helped develop her. A real performer for under \$500. And Normark's fine \$6 Swede 45 looks like a lot of other pocket camp knives—with two exceptions. These are screws in the handle that make it quick and simple to dismantle and clean when switching from fish scaling to slicing food. A Rapala product



Dangerous and reckless operation includes obvious overpowering as well as carrying too many passengers, and it's obvious the Coast Guard isn't kidding around about boat safety. Neither are the states, and a number are passing laws so that waterways that do not come under federal jurisdiction will have the same requirements as those that do.

NATIONAL HUNTING & FISHING DAY, Sept. 23, 1972, has received official recognition from President Nixon. ★ ★ ★

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DETROIT LISTENING POST

BY ROBERT LUND

THE 'WONDERFUL' WANKEL looks more and more like a short-term bridge-the-gapper between the conventional piston engine and the turbine. The evidence is subtle. When GM gets into a new product program, suppliers scramble for a place in line for a piece of the action. In the case of the Wankel, suppliers who were pitching to produce parts for the engine a few months ago now take the position that if they can't get in and out with a profit in three to four years, they might as well forget it. That doesn't sound like the Wankel's going to be a volume engine for too many years.

Another vote for the turbine: Chrysler says the new turbine it's working on will be the pilot job for a production version. That's not the same as saying the turbine's ready to roll. But it's just one step removed from production.

FILL 'ER UP. Turbine, Wankel, stratified charge or a scrubbed-up version of the present piston engine—you might as well resign yourself to the idea that any car you buy over the next five years is going to be a gas guzzler. You'll have to fill the tank more often. The best results anybody's been able to wring out of the new engine so far burned 10 percent more fuel than a standard piston plant. That experiment was with a turbine.

Fuel consumption is so far out of line on experimental versions of the Wankel and stratified-

CHEVY MONTE CARLO won't be the only '73 car with the little-rear-quarter-window fad: Cadillac introduced it on '71 Eldorados, and, sure enough,

charge engines that engineers don't want to talk about it.

LONG-OVERDUE FILE: You wonder what takes Detroit so long to gear up for a good thing? So do we. GM, at last, hopes to have front disc brakes standard on every car in its catalog within the next few months. If they're not standard when the '73s go on sale, they'll come up as a running change next year. Next item in the file: electronic fuel injection. But that's another story.

YOU'LL SEE SOME '73 CARS on the road before you read about them in the papers and magazines if you keep your eyes open the next few weeks. This has happened before, but the door's wide open this year. Most car companies have given up asking dealers to keep the new stuff stashed away until announcement day.

It's a curious change in the rules. If a publication digs up the dope on the new cars on its own, it's entitled to print whatever it turns up. The companies don't make it easy to obtain information before they're ready to release it, but they no longer try to suppress preview stories as they used to a few years ago.

But once you accept the information above the table, visit the proving grounds and drive the cars, take the handouts (news releases) and engineering books from the

(Please turn to page 24)

as Auto Editor Bill Hartford said then, ". . . it grows on you and is likely to show up on pretenders in the future." (See '71 Cars, page 24, Oct. '70 PM.)



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Highest quality tobaccos—specially softened for milder taste.



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Filter Kings, 17 mg. "tar," 1.3 mg. nicotine; Longs, 19 mg. "tar," 1.4 mg. nicotine, av. per cigarette, FTC Report April '72

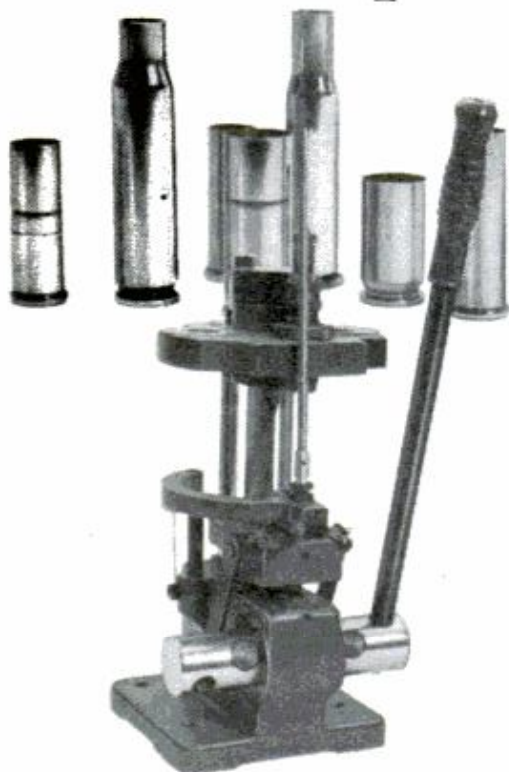
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AUGUST 1972

23

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The quality performer handloaders prefer.



Winchester- Western Cartridge Cases

From Winchester-Western's own brass mill. Formulated by our own experienced metallurgists. Cartridge cases of custom-blended alloys in 41 calibers for rifles, pistols and revolvers. Start-to-finish control brings you a better-built brass cartridge that users recognize. A uniquely smooth, durable case everytime for exact chambering, flawless ejection, and maximum reloadability. Perfectly tailored and superbly engineered to Winchester-Western's total system of matched components. *WINCHESTER-Western*. 275 Winchester Avenue, New Haven, Conn. 06504

1972 | winchester
the way you
want it

DETROIT LISTENING POST

(Continued from page 22)

public relations men, the rule requires that you observe the publication date dictated by the car manufacturer. It's a contradiction to put an embargo on publications when dealers are selling the cars openly a month or more before the official release date. What's the point of the secrecy bit once the cars are on the road? Not that it matters much this year. Except for the GM intermediates, appearance changes on most of the '73s are so minimal you'll have a tough time distinguishing the difference between old and new.

GM WILL FOLLOW UP its redo of its mid-size cars this year with new metal for its big cars next year—the '74 models. Chrysler's also considering a major going-over for its full-size cars in '74, but might hold off another year. Big C's evaluating everything it has in the corporate garage with the view of adding cars and dropping cars.

UP PERISCOPE? Some sort of out-of-the-car periscope is inevitable for cars coming in '75 and after. There are several regulations, announced or pending, relating to rear vision that can only be satisfied by going to a periscope. Automakers anticipate the government will eventually require head restraints for the rear seats. There's also a standard coming that'll specify that the driver must be able to see the back corners of the car. If you put high-rise headrests in the rear, they cover up the back window. So the only way to go is to use a periscope.

BUYING TIP. If you're figuring to buy a Ford, Chrysler or American Motors car, and are willing to settle for a '72 instead of waiting for a '73, this is the time to tackle the dealer. Ford, Chrysler and AMC are cutting the downtime between model changes. This means the dealer has only a few days to clean out his '72s before the first of the '73s arrive.

Ford has reduced the changeover period to two days. Chrysler will close three to five days. American Motors will take two weeks. With big inventories of '72s to clear out, most dealers will be shaving prices to reduce the load of '72s carried over to the '73 model year. GM will take a breather of a month between model runs, giving dealers a longer time to move the '72s, so GM outlets won't be quite so eager to trim their prices.

★★★

12 ways to beat the "wage-price" squeeze!

If you've been told that you can't get a decent raise because of the government freeze on wages, then you haven't heard the whole story.

The fact is—in spite of the freeze on wages—you have always been entitled to an increase in pay—

—if you could get yourself promoted to a more responsible position where you now work...

—or if you could switch to a better-paying job with another company.

For example, here are 12 ways to beat the "wage-price" squeeze!

- If you're a veteran with some technical experience—or if you're a pretty good mechanic or repairman—all you may need to qualify for a promotion is some specialized career training in fields like (1) Engineering; (2) Drafting; or (3) Electronics. (Or you might prefer to open a business of your own, with valuable training as an (4) Electrician; (5) Auto Mechanic; or (6) TV Repairman.)

- If you're a salesman, office worker, or production foreman—or if you're just plain good at working with people—all you may need to start moving up the executive ladder is some specialized training in (7) Business or Production Management; or (8) Hotel/Motel Management. (Other alternatives, for both men and women—(9) Secretarial training...or (10) a career in Interior Decorating.)

- Or if you're already working with numbers—maybe as a Biller or Traffic Manager—all you may need is some professional training to become an (11)

Accountant or (12) Computer Programmer.

In other words, if you want more out of life than you can buy today on your present salary—things like a bigger home, a better car, and greater financial security for your family—all you may need

to get it, is some specialized training in the career field of your choice. And, thanks to ICS, you can now get this training right in your own home...during your spare time...without ever setting foot in a classroom.

Just take a moment to consider the 12 career titles listed in the coupon below, then check off the field you would like to specialize in, and mail the coupon to ICS for a free Career Guidance Booklet.

Your free booklet will describe the higher earnings and greater financial security you might expect, once you have picked up the specialized training you need. It will also explain why ICS can now give you this specialized training, during your spare time, so that you will not lose a single day's pay from your present job while you prepare for your new career.

In addition, you will receive a free "Demonstration Lesson" that lets you see for yourself why preparing for a new career—the ICS way—may be a lot easier than you think.

Please bear in mind, as you check off your career choice, that over 8,500,000 men and women have turned to ICS for career training, since 1891.

ICS has also provided training programs for divisions and branches of companies like Ford, U.S. Steel, Chrysler, Mobil, DuPont, etc.

ICS career training is approved for Veterans and Servicemen under the new G.I. Bill, and is Accredited by the Accrediting Commission of the National Home Study Council.

Now it's your turn to discover how ICS training can start you in a rewarding new profession—by just mailing the coupon today for your free Career Guidance Booklet and free "Demonstration Lesson."



Free Booklet & "Demonstration Lesson." Mail coupon to: ICS, Scranton, Pa. 18515

ICS Scranton, Pennsylvania 18515

RA320W

Please send me a free Career Guidance Booklet and a free "Demonstration Lesson" for the field I have checked below. I understand that I am under no obligation.

ACCOUNTING

- CPA Training
- Business
- Tax Specialist

BUSINESS MANAGEMENT

- Administration
- Management
- Production

COMPUTER PROGRAMMING

- Essential Concepts
- Cobol; System 360; Fortran IV

ENGINEERING

- Civil
- Mechanical
- Chemical
- Electrical
- Industrial

HOTEL/MOTEL MANAGEMENT

- Executive Training

ELECTRICIAN

- Master Electrician

DRAFTING

- Architectural
- Mechanical
- Electrical
- Electronic
- Aircraft
- Structural
- General

AUTOMOTIVE

- Mechanic
- Air Conditioning
- Body Rebuilding and Refinishing
- Diesel-Gas

ELECTRONICS

- Computer Servicing
- Communications/Broadcasting
- Solid State Electronics
- Sound Systems
- Telephone
- Industrial

- Technician
- FCC Licensing

INTERIOR DECORATING

- Decorating
- Design

SECRETARIAL

- Executive
- Medical
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- Servicing and Specialized Training
- CATV/MATV
- HIGH SCHOOL DIV.
- For men and women who want to earn a High School Diploma

Name _____

Address _____ Apt. No. _____

City _____ State _____ Zip _____

Approved for veterans under the new GI BILL/Approved for Federally Insured Loans Accredited by the Accrediting Commission of the National Home Study Council



Good for planes, not hearts

SOME HEART PATIENTS in Bremen, West Germany, complain that signals from a new radar tower interfere with the functioning of their pacemakers, electronic devices that maintain proper heart rhythm. A few pacemakers reportedly have conked out completely. The strong radar signals also cause radio listeners to hear a "bleep" every eight seconds and TV viewers to see a picture marred by a pattern of white lines. Perhaps the only people happy about the tower are air-traffic controllers and pilots.

ONCE-A-WEEK SHOWERS will be one of the homelike comforts available to astronauts aboard Skylab, the extended Earth-orbit mission scheduled for '73. A shower curtain attached to a 42-inch-diameter hoop will be pulled out of a floor mounting and hooked to the crew cabin's ceiling. The astronaut will spray himself with warm water from a hose resembling the spray attachment on a kitchen sink. Each crewman will be limited to about three quarts of water per shower. A vacuum system will draw used water from the enclosure and into a disposable bag that will be deposited in the waste tank.



It's all a matter of taste

EATING HABITS OF COWS have come under the scrutiny of investigators at an experimental farm near Seesen, West Germany. Researchers hang a "chow meter" around a cow's neck, then turn Bossie out to graze. The device is a chronometer that registers the hours and the duration of the cow's chow times as she wanders across pastures of different types of grass. The researchers are hoping to learn more about cows' taste in grass.

A LITHIUM-SULFUR BATTERY, currently in the research and development stage at the Argonne (Ill.) National Laboratory, is expected to deliver five times as much power per unit of weight as conventional lead-acid batteries. Scientists base that expectation on the results of past research on high-energy batteries. "Results of performance tests on laboratory-size cells indicate that a lithium-sulfur battery could satisfy the performance requirements of an electric automobile," says a senior researcher. The battery is expected to be available for commercial use within 6 to 10 years.



Fast tonsilectomy in Moscow

A FAST FREEZE SPEEDS UP tonsilectomies in one Moscow hospital, according to Tass, the Soviet news agency. A cryoapplicator, cooled by liquid nitrogen flowing through a Teflon tube, quickly freezes the tonsils. Then the surgeon inserts a scissorslike instrument

(Please turn to page 30)



STEVE PETRASEK HAS A SYSTEM TO GET FROM OHIO TO MONTANA IN 31 HOURS.



Steve is a Firestone tire engineer who hunts elk every season. With a jeep in tow, Steve and two buddies make the run from Akron to Montana in a light camper pickup.

They've done it in about 31 hours for the last nine years. Because they've systemized things down to the last spare bolt: Two-hour driving shifts, fuel records, and food and gear allotments figured to the final fresh egg.

The tires they'll be using next season are a natural part of this computer-like approach.

Firestone's Wide Oval Tire System for campers. Here's how it works:

On the front, you put Firestone's Transport 500 Wide Oval* truck tires. They're the *steering* part of The System. They have a wide, wide tread that grips the road to deliver more mileage under normal conditions than the tires they replaced in our line. (The Transport Wide Oval.)



On the rear, you put Firestone's Traction All Season™ Wide Oval™ truck tires. They're the *drive* part of The System. Their computer-designed tread lets you run along at turnpike speeds, then pull off the road (even into snow or mud or sand) and keep on going.

Two pairs of Firestone tires teamed together to provide your camper with stability, traction, and long tire life.

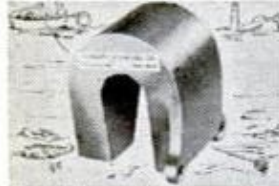
They work! Take it from Steve (write to him C/O Firestone, Akron, Ohio 44317 for more information). Or ask your local Firestone Dealer, the man with The System.

The Wide Oval Tire System for Campers.

Firestone

LIVE IN THE WORLD OF TOMORROW . . . TODAY!
UNUSUAL BARGAINS
NEW PRODUCTS · NEW MATERIALS · NEW IDEAS

"FISH" WITH A MAGNET



Go treasure hunting on the bottom! Fascinating fun & sometimes profitable! Tie a line to our 5 1/2-lb. Magnet—drop it overboard in bay, river, lake or ocean. Troll it along bottom—your "treasure" haul can be outboard motors, anchors, other metal valuables. 5 1/2-lb. Magnet is war surplus—Alnico V Type—Gov't cost \$50. Lifts over 150 lbs. on land.

Stock No. 60.215H . . . 1 1/2 lbs. . . . \$ 5.75 Ppd.
 Stock No. 70.570H . . . 3 1/2 lbs. (lifts 40 lbs.) . . . \$ 6.75 Ppd.
 Stock No. 85.152H . . . 15 1/4 lbs. (lifts 350 lbs.) . . . \$33.95 FOB

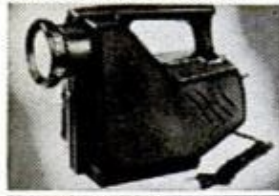
GIANT WEATHER BALLOONS



"Balls of fun" for kids, traffic stoppers for stores, terrific for amateur meteorologists. Create a neighborhood sensation. Great backyard fun. Exciting beach attraction. Amateur meteorologists use to measure cloud heights, wind speed and temp. Made of heavy-duty neoprene. Inflate with vacuum cleaner or auto air hose; or locally available helium for high rise.

Stock No. 60.568H (8' size) . . \$2.00 Ppd.
 Stock No. 60.632H (16' size) \$7.00 Ppd.

AMERICAN MADE OPAQUE PROJECTOR



Projects illustrations up to 3" x 3 1/2" —enlarges them to 35" x 30" if screen is 6 1/2 ft. from projector, larger pictures if screen is farther away. No film or negatives needed. Primarily intended for children. Projects charts, diagrams, color or black-and-white in darkened room. 115 v. A.C. . . . 6 ft. cord and plug included. Size 12" x 8" x 4 1/2" wide. Weight 1 lb. 2 ozs. Plastic case.

Stock No. 70.199H \$8.75 Ppd.

3" ASTRONOMICAL TELESCOPE



See moon shots, orbits, stars, phases of Venus, planets close up. 60 to 180 power. New improved aluminum, over-coated 3" diam. f/10 primary mirror, ventilated cell. Equatorial mount with locks on both axes. 60x eyepiece and mounted Barlow lens. 3x finder telescope, hardwood tripod. FREE: "Star Chart," "How To Use Your Telescope" book.

Stock No. 85.050H \$32.95 Ppd.
 Stock No. 80.162H \$24.95 Ppd.
 DELUXE 3" \$59.50 Ppd.
 Stock No. 85.105H . . . 4 1/4" . . \$94.50 Ppd.
 Stock No. 85.086H . . . 6" . . \$239.50 FOB

ASTRONOMICAL TELESCOPE KITS



Grind your own mirror for powerful telescopes. Kit contains fine annealed pyrex mirror blank, tool, abrasives, diagonal mirror, and eyepiece lenses. Instruments you build range in value from \$75.00 to hundreds of dollars.

Stock No. 70.003H \$10.75 Ppd.
 4 1/4" diam. . . 3/4" thick . . . \$10.75 Ppd.
 Stock No. 70.004H \$16.95 Ppd.
 6" diam. . . 1" thick . . . \$16.95 Ppd.
 Stock No. 70.005H \$24.50 Ppd.
 8" diam. . . 1 1/8" thick . . . \$24.50 Ppd.
 Stock No. 70.006H . . . 10" diam. . . \$44.50 FOB
 13 1/2" thick . . . 30 lbs . . . \$72.50 FOB

AMAZING NEW WANKEL ENGINE KIT!



Thrill to the fun of building your own see-through motorized model of revolutionary pistonless type engine . . . only engine experts think economically modifiable to meet new pollution standards. Replaces piston, cylinder, crank assemblies with rotating discs (sections removed for firing chambers). Smaller than conventional; fewer parts, greater reliability, same speed w/less horsepower. Feat: flashing plugs, rubber fan belt, stick-shift on-off switch. Req. 2-1.5V batt. (not incl.).

No. 71.424H (4 1/2" X 5" X 9") \$6.75 Ppd.
 519-Page Wankel Engine Book \$15.25 Ppd.
 Stock No. 9.439H \$15.25 Ppd.

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148 PAGES! MORE THAN 4,000 UNUSUAL BARGAINS

Completely new 1972 Catalog. Packed with huge selection of telescopes, microscopes, binoculars, magnets, magnifiers, prisms, photo components. Ecology and unique lighting items, parts, kits, accessories—many hard-to-get surplus bargains. 100's of charts, illustrations. For hobbyists, experimenters, schools, industry.

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SCIENCE WORLDWIDE

(Continued from page 28)

and—snip, snip—the tonsils are removed. The procedure reportedly takes but a few minutes.

The environment

A COLD PIPELINE that would carry oil emulsified in brine is proposed as a solution to the problem of shipping crude from Alaska's North Slope. The method was devised by a Stanford University scientist who says that lab experiments show it's feasible to use a pipeline with interior temperature of from 20° to 30°F. Cold mixtures of 50 percent North Slope crude oil in brine flow as easily as the oil alone at 130° F., according to the researcher. A cold pipeline would not thaw Alaska's permafrost, an environmental danger that conservationists associate with the hot pipeline now being planned.

A HUGE FLOATING "EGG BEATER" restores oxygen to a section of water in the vicinity of a cardboard manufacturing plant



on England's River Thames. Discharge from the factory adds 5 million gallons of de-oxygenated water a day to the river, periling what little life it manages to support. Powered by a 200-hp motor, the beater's blades can aerate the water almost to a point of oxygen saturation, say company spokesmen, who now are thinking about organizing a fishing competition in the river.

SIGN OF THE TIMES: Bottled spring water from Scandinavia is finding a ready market in the Netherlands, Germany, Belgium and Britain—countries where the local product must be heavily laced with chemicals to insure safe drinking. ★ ★ ★

WIN A YAMAHAULER



DODGE TRADESMAN B200

Custom Features Include

Headers, Mag Wheels & Ignition by Cragar
 Goodyear Custom Wide Treads
 Sears Heavy Duty Shocks & Instruments
 Willard-Exide Juice Box Battery
 Craig Stereo Sound
 Tilt Steering Wheel by Grant
 Electric Sunroof by American Sunroof
 Custom Upholstery & Interior by Tony Nancy
 Custom Paint by Bill Carter
 Engine Dress-up by Cal Custom
 Custom Awning by Carter Shade
 AC/DC Converter & Safety Equipment by Rocket Industries

OTHER GREAT PRIZES

- (10) **2nd Prizes:** Yamaha Mini Enduros
- (10) **3rd Prizes:** Screamer Custom Wheels by Cragar (Set of 4)
- (10) **4th Prizes:** Goodyear Custom Wide Treads (Set of 4)
- (12) **5th Prizes:** Complete sets of S-K Wayne Hand Tools
- (25) **6th Prizes:** Yamaha Official Racing Team Jackets
- (25) **7th Prizes:** Hot Rod Magazine 1-year subscriptions



Here's the contest you've been waiting for! First prize is a fabulous \$10,000 custom Dodge Van and two new Yamaha motorcycles (250cc and 125cc Enduros). The Yamahauler Dream Van is completely custom designed by Hot Rod in their traditional show-stopping manner. It's a luxurious workshop on wheels, with a list of super-custom extras as long as your arm: custom exterior paint patterned after the official colors and graphics of the Yamaha racers, plush custom-built and richly upholstered interior, convertible bench/bed, custom compact refrigerator, hand fold-out workbench complete with power tools, sensational 4-speaker AM/FM/Tape stereo sound, cool Frigiking air conditioning, carpeting throughout, custom performance equipment, open-air sunroof, custom loading ramps for the bikes, and much much more for hauling your new Yamahas in grand style.

ENTER AT YOUR YAMAHA MOTORCYCLE DEALER

No purchase is required. You simply stop by your nearest participating Yamaha dealer and fill out an entry blank. (Or mail a self-addressed, stamped envelope to Yamahauler Contest, P.O. Box 611, Rosemount, Minnesota 55068 for your entry blank.) This is a skill contest. You answer three multiple choice questions (Tip: your dealer will help you with these) and then tell us in a few words "Why or how you would make good use of the custom Yamahauler Dodge Van and a pair of Yamaha motorcycles." You must be a licensed driver to enter. Winners will be determined on the basis of originality, creativity and awareness of Dodge and Yamaha features. The Dodge Yamahauler Contest ends September 30, 1972. All entries must be postmarked by October 3, 1972, and received by October 10, 1972. All prizes or alternates will be awarded. Winners will be notified by mail no later than Oct. 20, 1972. Contest valid at participating Yamaha dealers in continental United States and Alaska. Void where prohibited or restricted by law.

YAMAHA

The great machines for '72

You'll never have a better opportunity to win your Dream Van, so visit your nearest Yamaha dealer today and enter!

Two trail riders from Attex



By JOHN LINKLETTER

POWERING HIS WAY up a steep incline, Scott (above) takes a hill with his Sport 5.30. At right, he pulls his bike alongside John's Sport 2.40 to talk things over. Below: John zips along a rocky trail on the 2.40. Both Attex bikes are powered by Sachs two-cycle engines



"SAY GOOD THINGS about those bikes" was the firm warning from sons Scott and John as I took to the typewriter.

Their word goes, because they're the experts in this case. They rode the Attex Sport 2.40 and Sport 5.30 for weeks on paving, on rocky trails in back-country Connecticut, in mud and in snow. The bikes survived the enthusiastic use in good style, and the boys had fun—which, after all, is the point of having the machines.

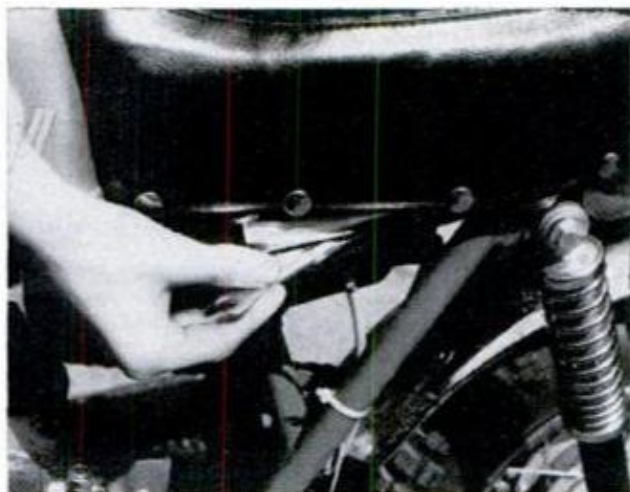
The two cycles are new in the Attex lineup and fit into that group PM calls *The Minicycle—a whole new breed of bike* (page 140, Oct. '71 PM). (Also carrying the Attex label is a group of rugged all-terrain vehicles, all of which are products of the ATV Manufacturing Co., Glenshaw, Pa.)

The Sport bikes are handsome, with lots of chrome and bright enamel. Both have headlights, speedometers and are powered by Sachs two-cycle engines. Those engines produce a surprisingly quiet purr that's hardly audible in a house when the bikes are in the driveway. The 2.40 has a

SPECIFICATIONS

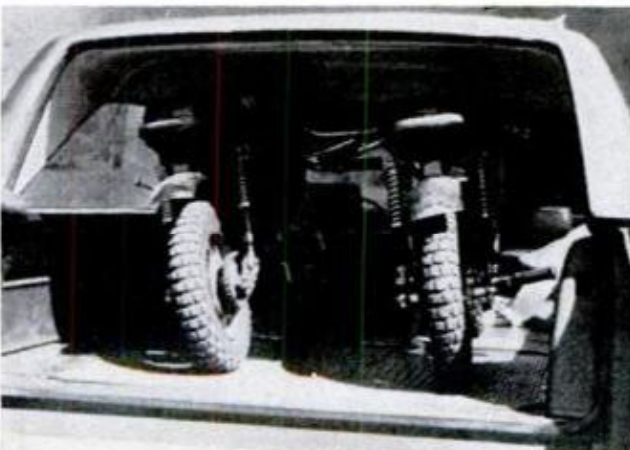
| Model | Sport 2.40 | Sport 5.30 |
|------------------------|------------|------------|
| Engine displ. (cc) | 47 | 49 |
| Hp | 2.4 | 5.3 |
| Speeds | 2 | 5 |
| Length overall (in.) | 57 | 57 |
| Height overall (in.) | 37 | 37 |
| Width overall (in.) | 27.5 | 27.5 |
| Ground clearance (in.) | 6 | 6 |
| Tire size | 3.00x10 | 3.00x10 |
| Wheels (in.) | 10 | 10 |
| Dry weight (lbs.) | 100 | 115 |
| Starting system | Pull | Kick |
| Brake operation | | |
| Front | — | Hand |
| Rear | Hand | Foot |
| Price | \$295 | \$365 |

two-speed automatic transmission that slips smoothly into high as you give it throttle. The 5.30 has a five-speed foot shift that took the two boys a few minutes to master, but they wound up liking that bike the better of the two. ★ ★ ★



TOOLKIT, hidden under the saddle, is a standard—and very handy—bit of equipment on each bike

SIDE BY SIDE, both bikes, with handlebars lowered, fit into our Dodge station wagon with room to spare



LEARN TO BE A SKILLED LOCKSMITH



Change combination of pin tumbler cylinder—**EARN \$1.50 in 15 MIN.**

Owner loses key; pick car trunk—**EARN \$5.50 in 10 or 20 MIN.**

TYPICAL JOBS EARN YOU \$271 PART TIME (in only 53 hours!)



Install new knob door lock—**EARN \$15.00 in 30 MIN.**



After-hour emergency opening—**EARN \$2.50 to \$5.50 in 20 MIN.**

Hundreds have succeeded like these Belsaw Graduates:

R. W. Davis, St. Louis, Mo.: "I am doing a wonderful business thanks to your course in locksmithing. Last Saturday I took in \$110.00."

Pierson Crook, Los Angeles, Calif.: "I am making \$200 a month extra income with the Belsaw Locksmith Course. I would recommend your course to anyone."

Big demand for skilled Locksmiths! Earn big money spare time in your own home. Be your own boss. No layoffs. Steady year 'round income. Age and schooling are no handicap.

BELSAW INSTITUTE training...approved by master locksmiths...helps you start faster with easy picture lessons guided by your own mail instructor.

Get thorough job training on all types of locks. We supply tools, equipment and business help: how to start, how to charge, how to get jobs, how to earn while you learn and build a lifetime cash-profit business. Accredited Member National Home Study Council. Approved by State Board of Education. Approved for Veterans.



This \$125 key machine is yours to keep!

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FREE BOOK

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Get a little in the Navy

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If you qualify, we can guarantee you any one of 68 job fields. What's more, we'll send you to a school that will make you a real pro. That way, you get more jobs in the Navy and when you get out, you've got somewhere to go.

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There's a new 3 year Navy enlistment. So you can come in for 6 years or 4 years or now, 3 years.

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You can be guaranteed East or West Coast and choice of sea duty or airman recruit work.

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See Africa. See Europe. See Japan. Join the Navy and see the world. (It's still true.)

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New guys now earn \$288 a month. (Congress gave us a raise.)

more

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You can wear a beard (nicely trimmed) if you want to. It's a Naval tradition. It's also a brand new Navy.

More freebies.

Besides free travel and free education and that \$288 a month, you get free food and free clothing and free housing and free health care and 30 paid vacation days per year.

If you think you've got what it takes to make it in the new Navy,

Call:
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It's toll free, there's no obligation, and a real live Navy recruiter will answer all your questions 24 hours a day, seven days a week. In Washington, D. C. call 433-2000

Or:

See your Navy man right now. He's listed in your phone book under U.S. Government, Navy. He's got all the answers—or he knows where to find them.

Or:

Send to: Captain Donald E. Oglevee
Building 157, Fourth Floor,
Washington Navy Yard,
Washington, D.C. 20390

61

I want to know more about:

- More job, training, education.
- The new 3 year enlistment.
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- Guaranteed East or West Coast home port.
- More bread.
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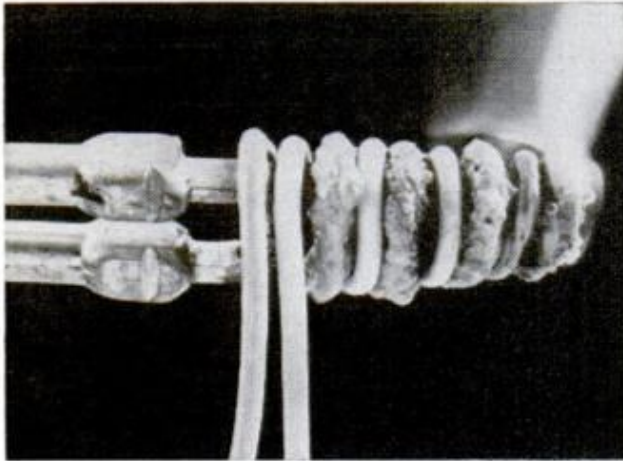
Name _____ Age _____

Address _____

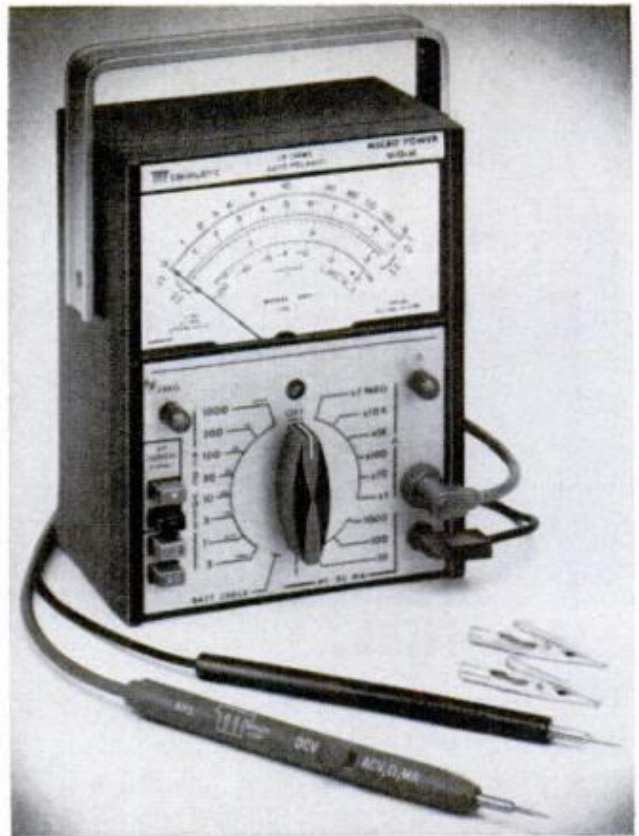
City _____

State _____ Zip _____

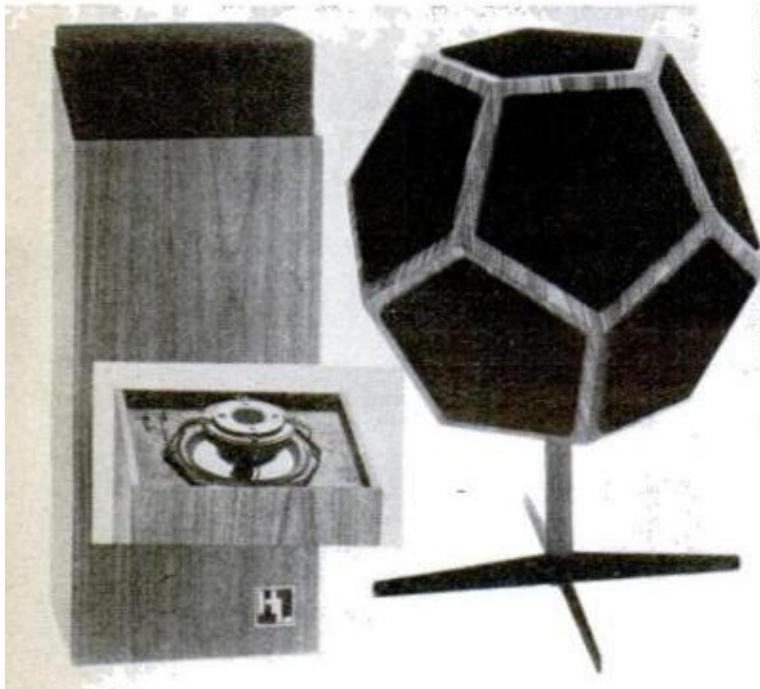
NEW IN ELECTRONICS



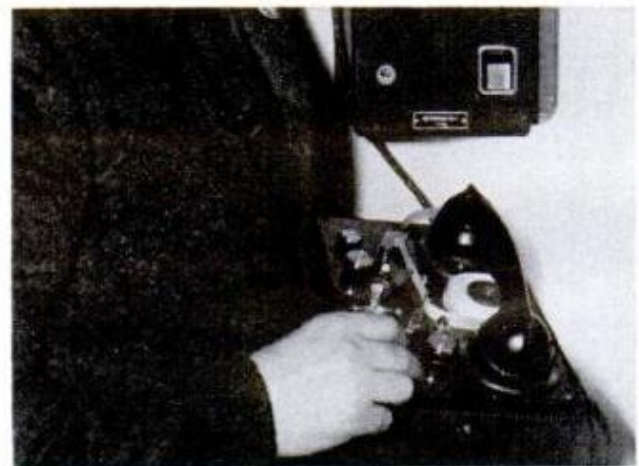
HEAT-RESISTANT INSULATION of irradiated PVC (right strand on soldering-gun tip) stays intact long after regular PVC (left strand) is a smoking ruin. It's also more resistant to cut-through, abrasion and crushing. Type RX-7000 wire at electronic distributors, price according to size. Alpha Wire Corp., 711 Lidgerwood Ave., Elizabeth, N.J. 07207.



LOW BATTERY DRAIN on this new, portable FET volt-ohm-milliammeter means you can leave it on indefinitely without finding a dead battery next time you use it. Other features include automatic polarity switching, a low-power ohms circuit that won't bias transistors, simplified zero adjustment. Model 603, \$150. Triplet Corp., Bluffton, Ohio 45817.



TWO OMNIDIRECTIONAL SPEAKERS take different approaches. Hegeman I (left) aims its 8-inch woofer and 1-inch tweeter up and out (inset), radiating sound hemispherically. Design Acoustics' D-12 radiates sound spherically using 11 drivers (9 tweeters, 1 direct-firing mid-range and a 10-inch woofer) in a 12-sided enclosure. We've heard both—they're worth hearing. Hegeman I, \$199 pair; Hegeman Labs, 440 West 34th St., New York, N.Y. 10001. D-12, \$325 each; Design Acoustics, Box 2722, Palos Verdes, Calif. 90274.



MORSE-CODE TELEPHONE for the deaf and dumb has built-in telegraph key and dot-dash printer. The 4½-pound unit uses transistorized circuits, operates on battery or a.c. power, is portable, works with any phone, including payphones. No permanent connections are needed—just set the telephone receiver in a cradle on the unit. To receive calls, a flashing light, attached to the phone line, serves as a "bell." Fonomorse, about \$210. Bruno Fracassi, Via Michaelangelo Pinto 22, 00149 Rome, Italy.

(New in Electronics [continues on page 38](#))

POPULAR MECHANICS

Материал, защищенный авторским правом

ASK THE AC ENGINEERS

“What are the advantages of AC's new, improved spark plug insulator?”



AC's new spark plug insulator, now made with an improved alumina ceramic material, helps increase reliability and durability.

Because of the new ceramic material, all AC Spark Plug insulators now have added structural strength . . . improved insulation under high-temperature operating conditions . . . increased resistance

to thermal shock . . . and added protection against corrosion.

So, next time, whether you service your own car or have it done, be sure to ask for reliable ACs.

Remember, there *is* a difference in spark plugs.

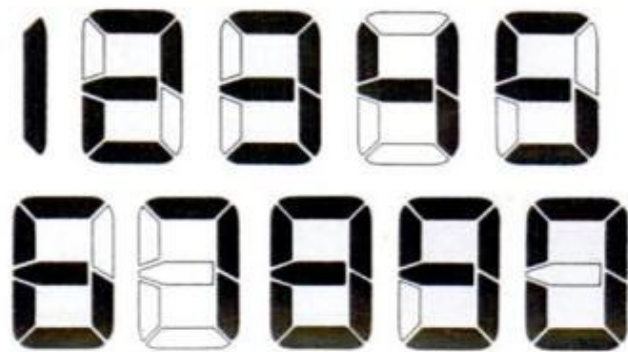


AC SPARK PLUG DIVISION OF GENERAL MOTORS

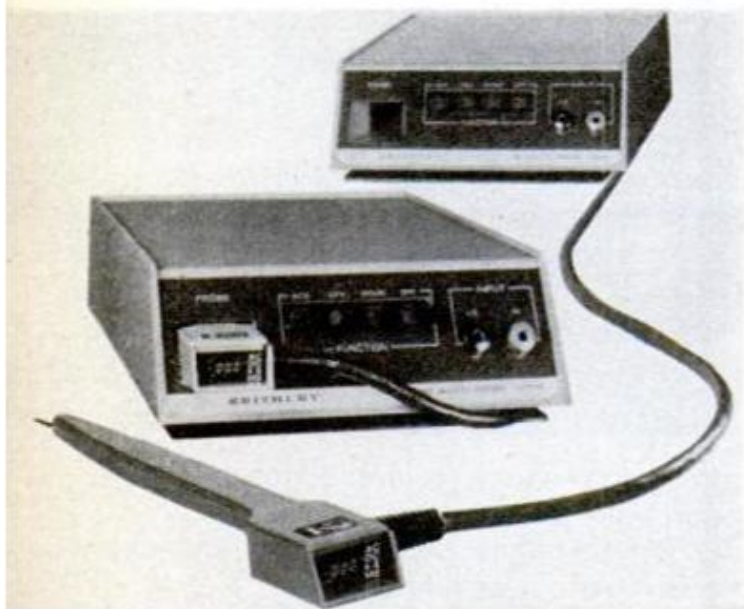
(Continued from page 36)



PICTURE RADIO. New SoundScene radio from GE holds four photos or clippings up to 3 3/8 inches square; hinged pressure pads keep them in place. Speaker and on-off switch are on top; preset volume and AM tuning on bottom. Model P2755, \$12.95 with battery. General Electric, Audio Dept., Syracuse, N.Y.



NO HANDS, or other moving parts, in this new, all-electronic watch. Time is shown digitally on a liquid crystal display whose seven transparent segments turn white when voltage is applied. Timing is by a quartz-crystal oscillator, whose 32,768-Hz. output is divided in half 15 times to yield one timing pulse per second. Accuracy within five seconds per month and year's battery life are claimed. Walchron, \$200. Waltham Watch Co., 231 South Jefferson St., Chicago, Ill. 60606.



KEEP YOUR EYES on the probe of this new multimeter, and you can read what function you're measuring (ohms, d.c. or a.c. volts), polarity, data and decimal points, with no danger the probe will slip off the test point. Probe fits in meter, too, for conventional readout. Model 167, \$325. Keithley Instruments, 28775 Aurora Rd., Cleveland, Ohio.



POLICE-CAR FACSIMILE SYSTEM transmits maps, photographs of suspects and missing persons, written messages, stolen-car lists and other information to squad cars in Bristol, England. Facsimile transmissions can't be intercepted by ordinary radios or misunderstood. Messages are 4 1/2 inches wide and as long as needed. Equipment costs about \$1500 per car: most of it fits in the trunk.

Warner Programs are Your Guide to Financial Security and Success

INSTANT MONEY...

Plastics are the wave of the future—now you can become a part of this industry. Start in your spare time to build your own future. Imagine, you can turn 25¢ worth of raw material into finished products that sell for \$3.00. You become a Warner distributor and reap the full benefits of its over 50 years experience in know-how and help. Three exciting fields for Immediate Profits... and any man, regardless of age, education or experience can learn. Warner methods guarantee your ability to *succeed!*

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NEW PROCESS...

The Multi-Million dollar a year marking industry is now within reach of the small independent operator. Warner's research has produced a revolutionary new process which allows you to enter this field. The Warner method and quality is equal to the best in the field... and *your service* (the basis of any business) can assure you earnings up to \$16.50 per hour in *your Spare time!*

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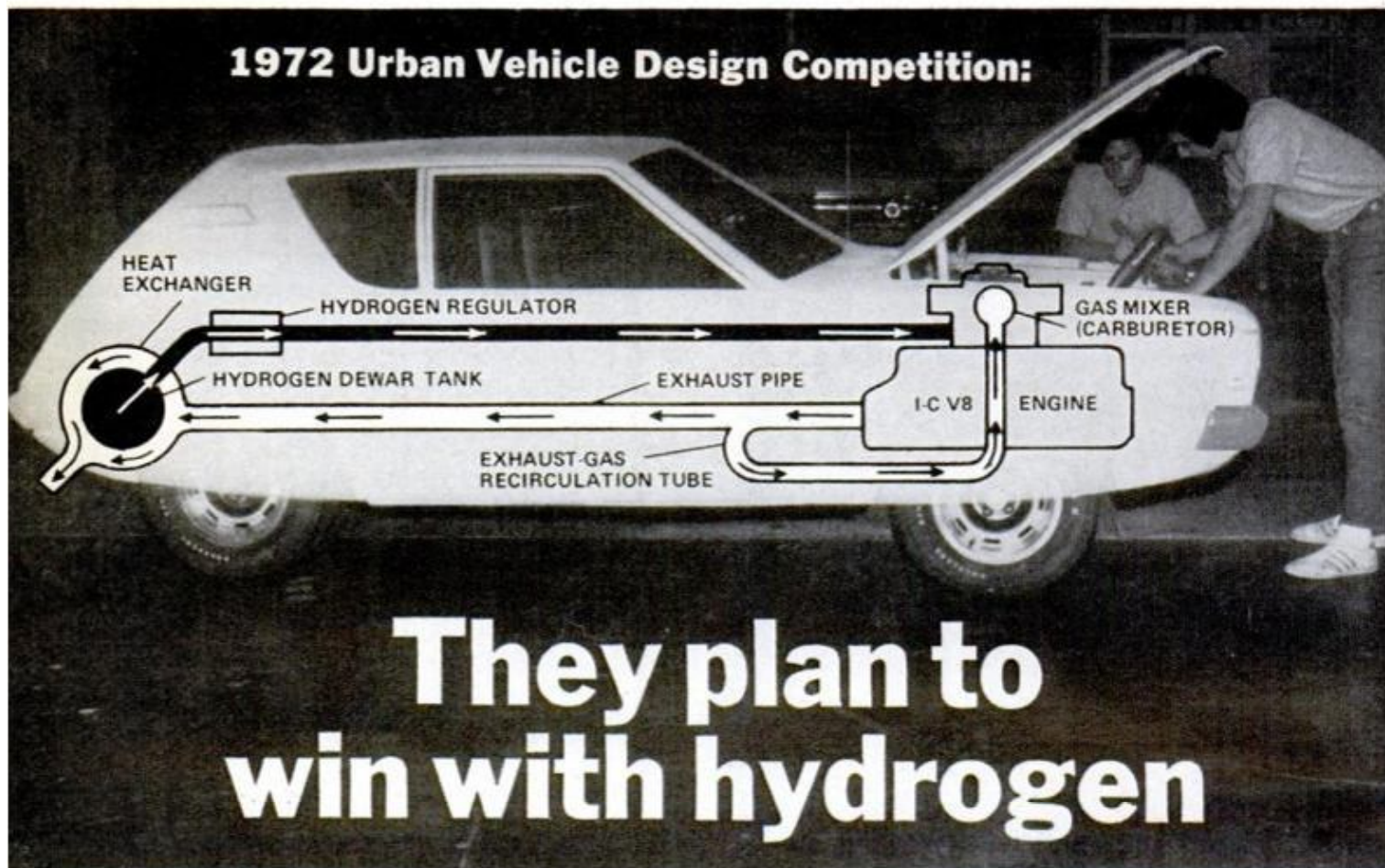
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AUGUST 1972

39

1972 Urban Vehicle Design Competition:



They plan to win with hydrogen

UCLA TEAM is betting that its hydrogen-fueled Gremlin X will run away with low-emissions honors

IT ALL BEGAN in the summer of 1968 as the Clean-Air Car Race between MIT and Caltech (See *Across the USA With MIT's Electric Car*, page 52J, Nov. '68, *PM*). The race captured the imagination of students across the country, and in 1970 there were over 50 entries (See, *Who Really Won the Clean-Air Car Race?* page 40, Nov. '70 *PM*). This year, on Aug. 9, at the GM Proving Grounds in Milford, Mich., more than 1000 ecology-tuned engineering students from 80 colleges and universities will pull the wraps off 93 of their own creations in an enthusiastic attempt to help the nation, and the auto industry, find feasible answers to urban congestion and pollution.

The three-day competition won't be a race or a styling contest, but a hard-nosed scientific look at students' solutions to urban problems of congestion, safety, and pollution. As such, the Clean-Air Car Race has been renamed the Urban Vehicle Design Competition. UVDC entries will be judged by professional drivers, engineers, and scientists on exhaust emissions, safety, estimated consumer costs, handling,

When the cars are ready to run on Aug. 9, four of the teams will be high on hydrogen—as the fuel that will burn up the opposition!

By **WILLIAM L. PETERSON**



EMISSION LEVELS of hydrogen system are checked in UCLA dyno lab by team co-captain, Frank Lynch

POPULAR MECHANICS

acceleration, braking, noise, turning radius, "parkability" and "drivability."

As a fuel, hydrogen has gained acclaim in only the aerospace industry. Yet, four schools plan to run with hydrogen—the University of California at Los Angeles, Arizona State, Southern University, and the University of Miami.

Well along in hydrogen research is the team from the University of California at Los Angeles (UCLA). Under the supervision of Prof. Albert F. Bush, a full professor in both engineering and public health, team members Ned Baker, Joe Takahashi, Johnny Lu, and co-captains Joe Finegold and Frank Lynch will enter a hydrogen-fueled 1972 American Motors Gremlin X incorporating a liquid hydrogen supply system and powered by a Ford 351 "Boss" engine. Intrigued with the properties and potential of hydrogen, the UCLA team chose the fuel for two reasons: the natural abundance of hydrogen and its clean burning.

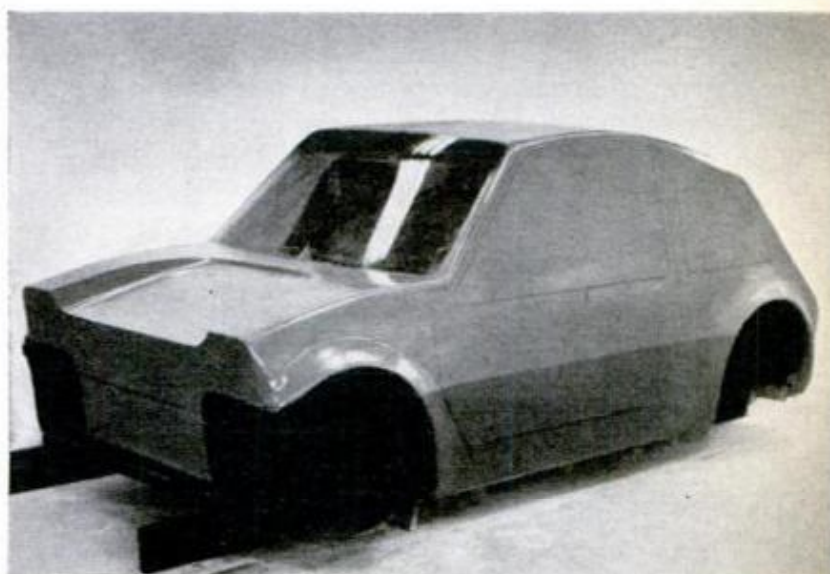
Hydrogen is found in all water (the H in H₂O), and in all present fossil fuels (oil, coal, methane). It is odorless, lightweight, nontoxic, and easily converts into heat energy. Presently, it is commercially produced from fossil fuels by a process called steam reforming. With sufficient electricity, hydrogen can be produced with almost 100 percent efficiency by electrolysis—simply passing a current through water.

When hydrogen and pure oxygen are mixed and then ignited, all that occurs is a violent release of heat energy and all

that is formed is pure water! There is no carbon monoxide, carbon dioxides, no lead oxides, and no smoke. This characteristic has fascinated scientists for years, making hydrogen seem an obvious fuel for the internal-combustion engine, but it does have its problems. Because hydrogen burns so readily, it often causes premature combustion and a diesel-like knocking or rattling. Some solutions include cooling engine hot spots with "colder" plugs, using sodium-filled valves, reducing excessive valve overlap, and attempting to control fluffy carbon deposits by stricter oil control. Burning hydrogen in an i-c engine also produces unacceptable levels of nitric oxides (NOX) and NOX is the major smog-builder.

UCLA's team has solved most of these problems. Early in their research they found by flowing 100 percent excess air through the engine, they could reduce NOX levels to barely measurable parts per million (ppm). After researching several engines, they selected the Ford 351 "Boss" engine. As Frank Lynch explained, "It is such a beautiful breathing engine. It is lightweight and noted for its high volumetric efficiency."

They installed an Impco two-barrel propane carburetor (altered slightly to accept hydrogen), dropped the compression ratio from 11.7:1 (stock) to 7.8:1 by fitting low-compression pistons, machining out the combustion chambers, and polishing all edges on both to minimize hot spots. Sodium-filled exhaust valves and precision guides were substituted, and



DESIGN FROM THE GROUND UP is the approach of Western Washington State College. Car uses a chassis of lightweight tubular construction, with ex-

treme Ackerman steering for getting in and of tight spots; polyester body is designed in sections for easy replacement, and i-c engine is propane-powered

cold, retracted-gap sparkplugs installed. A 32° overlap cam was used, the manifold heater eliminated and the passage plugged. Finally, the thermostat was removed to permit low coolant temperatures.

A simple exhaust gas recirculation (EGR) system was designed to tap off, cool, and reroute relatively inert gases back into the induction system to slow the combustion process by decreasing the excess oxygen in the mixture.

The effect of all these changes is impressive. With the EGR system operating, backfiring and preignition have been eliminated. Thermal efficiencies have risen to values more than 50 percent greater than those of gasoline. Originally, knocking began with coolant temperatures of 160° F. or more, but with the EGR cutting the intake by 25 percent, the "Boss" operated smoothly at 212° F.

True, power is reduced by 16 percent, but as Lynch points out, "The volumetric efficiency of a given engine can be in-

With EGR system operating, backfiring and preignition have been eliminated.

creased to give maximum power levels equivalent to gasoline operation. Such increases can be effected by polishing or enlarging manifold passages (fuel condensation is no problem with hydrogen), or by enlarging intake valves. Another solution is to choose a larger than necessary displacement engine. For the UVDC we plan on using two four-barreled Impco propane carburetors just to help the volumetric flow."

Emission levels have been one of the most exciting parts of UCLA research. With the EGR system operating and a lean 45 percent hydrogen mixture being burned, the NOX levels become immeasurably low—less than 100 ppm under all load conditions experienced. Practically an emissionless exhaust.

Transportation and storage of hydrogen is considered by the team to be crucial. They know their 100-liter, "thermos-type," Dewar liquid-hydrogen cylinder (2 feet in diameter by 5 feet in length) will give only 160 miles and is not the answer, but it is the best alternative to gaseous storage. Exhaust-activated hy-

drides (hydrogen-releasing metal compounds), once-promising, are not yet capable of producing enough demand hydrogen.

Then there is the *Hindenburg* syndrome: The team feels that people unnecessarily fear hydrogen. They argue that hydrogen will not autoignite as readily as common propane. The team refers to hydrogen "dumping" tests performed by NASA on the California desert, and underlines the conclusion that although hydrogen flame velocities are higher than those of other fuels, it will not detonate even when completely mixed with air at perfect ratios unless it is compressed or touched off with a blasting cap. The *Hindenburg* did not explode, it burned—and that is a great safety difference.

Overall automobile safety is a big part of the Milford competition, and the team feels it is ready. Although its internal passive restraints are not certain the UCLA Gremlin will have a heavily padded interior to cushion the forgetful passenger who does not fasten his seat belt. Outside, the team will use foam-backed energy-absorbing body panels, a five-mph barrier device, and a roll cage extending through the roof to cleverly form a luggage rack. The liquid hydrogen tank will occupy the usual fuel tank position and will utilize the passing exhaust flow as a heat exchanger to help vaporize the liquid.

One of the team's strongest reasons for converting to hydrogen-fueled vehicles is economic and sociological. The petroleum industry, producing fossil-fuel hydrogen, could survive the changeover by gradually altering its refineries and distribution network for production and distribution of hydrogen as demand increased. Adjustment by the automotive industry would merely result in a slightly modified engine in a slightly modified vehicle.

But the best reason for considering hydrogen comes from L.D. Conta, dean of engineering at the University of Rhode Island, when he says, "Regardless of what is done to develop substitutes for internal combustion engines, at least 100 million more (i-c) engines will be built over the next 10 years, and the kind of air we breathe 10 years from now will depend more on how these engines are built (fueled) than on anything else we might do in the vehicle propulsion field." ★★★

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42A

"I've had complaints with other brands of gasoline.

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Excerpts from an interview with Jim Herlinger. A man who knows cars, races them, and believes in Shell gasolines.

SHELL: What do you do for a living, Jim?

HERLINGER: I'm working at Hewlett Packard. I'm market manager for systems sold to the auto industry.

SHELL: And in addition to that, you race? How long have you been racing?

HERLINGER: Since 1964, when I went through SCCA drivers school in a Porsche Speedster. For one reason or another, mainly expense, I gave up on the Porsche and got in the Formula Vee just as the class was getting started. I ended up the Northern Pacific Champion a couple of times, San Francisco Regional Champion once. Went to the National Championship with the car twice. In the National Championship they take the top 21 drivers out of 3,000 Formula Vee drivers, so that's kind of a prestigious thing—to be invited.

SHELL: What made you take up motor racing?

HERLINGER: I've always had an avid interest in automobiles and have been playing with cars in one form or the other since I was 13 years old.

SHELL: I see you have also been racing dune buggies. Do you still do that?

HERLINGER: I still own one. I haven't been racing it. We've raced in the Mexican 1000 several times in Baja, California. That's really an adventure, Baja—untouched territory. You

really get out of the way and off the beaten track. You follow a prescribed route and they make it as tough as they can. That's always been fun. But this year I've decided to go a little faster and I bought the Brabham BT-8 which is a two-seater sports racing car, very much like a Can-Am car, only a little smaller. We're putting a six-cylinder Porsche en-



"This is me with my Formula Vee. SCCA rules stipulate that a Formula Vee is a single seat, open wheel racing car based on Volkswagen 1200 sedan components with restrictive specifications that emphasize driving ability rather than design and preparation of the car."

gine in it. On a road course it should be able to reach 160 mph.

SHELL: Do you consider yourself an expert on engines and things, transmissions?

HERLINGER: Reasonably so.

SHELL: Do you do your own work on the race car?

HERLINGER: Yes, I do all the chassis work and transmission work. I do need some help with the engine.

SHELL: Have you owned any other foreign cars?

HERLINGER: This will be my second Porsche and probably seventh or eighth German car. Lots of Volkswagens and Volkswagen buses.

SHELL: Do you have pictures of those cars?

HERLINGER: Some of them. Not too many pictures of the passenger cars. (*Ed. Note: Some of Jim's own pictures are shown here.*)

SHELL: I understand you drive quite a few miles in your personal cars. What's your estimate?

HERLINGER: I have a Pontiac and we drive it about 15,000 miles a year. The Porsche we drive 20,000 a year.

SHELL: What brand of gasoline do you use most often?

HERLINGER: Most often I use Shell products.

SHELL: Why do you use Shell so much?



"I've owned seven or eight German cars, lots of Volkswagens and Volkswagen buses."

HERLINGER: I've always been happy with Shell products. When I first got out of school I applied for about five credit cards and Shell was one of the two that gave me some credit. It's been a good relationship. I've always used Shell products. I've been happy with the

products. The local dealer here is probably the best station I've ever encountered.

SHELL: How about the performance of the gasoline? Do you have any comments or experience with that? Or any comparisons?

HERLINGER: You know it's hard to judge relative performance in a road car, but I've never had any complaints. I've had complaints



"With my older car, I was Northern Pacific Champion in 1967 and 1968."

with other brands of gasolines. Never a complaint with Shell.

SHELL: No trouble with Shell? You've used Shell in most of your cars and been satisfied with it?

HERLINGER: I've probably used Shell in all my cars at one time or another.

SHELL: What grade of gasoline do you usually buy?

HERLINGER: We use Super Shell in the Porsche and Regular Shell in the Pontiac.

SHELL: Would you recommend Shell to a guy with a sports car?

HERLINGER: Yes, very much so.

Ask our customers.

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APPLIANCE CLINIC

By PAUL MANN

Sh-h-h-h

What can I do about a terrible clatter that comes from our KitchenAid Superba KDS-16 dishwasher when it runs? Other than this, the machine works perfectly.—Peter Pearson, Birmingham, Ala.

You have to appreciate that it's tough for me to pinpoint the cause of noise without examining the appliance, but I looked at this machine and found that the main solenoid and drain valve are mounted directly on a metal frame. This provides a solid metal path for sound. Try loosening the mounting screws and inserting small heavy cardboard shims between the solenoid and frame.

Sputtering spray iron

I own a Westinghouse Steam-N-Spray iron that has started to spit and sputter. Why?—Raymond L. Early, Bloomfield, N.J.

The temperature is either excessive, internal parts have become coated with oil or grease, or the soleplate steam cavities aren't coated sufficiently with wetting agent. What do you do?

First, fill the tank about half full of water, turn the control to LINEN (dry) position and let the iron heat in a horizontal position for one hour. This will get rid of any oil or grease that may be causing the trouble.

If this doesn't solve the problem, mix a quarter teaspoon of sodium silicate in eight ounces of water and steam this through the iron with the iron set at its lowest steam setting. Be sure you do not operate the spray mechanism with the sodium silicate solution in the tank; allow the tank to drain thoroughly—that is, make sure that all the sodium silicate solution steams itself out.

Sodium silicate can be obtained in a hardware store or an appliance store where steam irons are sold.

Finally, if the problem persists, the thermostat probably has to be recalibrated, though I doubt that the trouble lies here. But if it does, a temperature check

of the iron should be made to the specifications for your model.

Dragging hair dryer

I have a model 202 Oster air-jet hand-held hair dryer that is about 10 years old. For quite some time the motor has run as if it were under an unusual strain. I've also noticed a reduction in the output of air. I have oiled the unit, but that doesn't seem to have helped. Do you have any suggestions?—Nora Sue Collins, Enfield, N.C.

You're on the right track with your remedy, because the one major cause of trouble with simple hair dryers is lack of oil in the bearings.

However, to be sure that oil-less bearings are the problem in your case, spin the impeller with your finger. If it stops after only a few turns or doesn't spin freely, get an oil can that has a long, thin spout and fill it with a lightweight household oil.

Put a couple of drops of oil on each bearing and turn the motor on for a few seconds to get the oil inside the bearings. Apply another drop of oil and do the same thing.

If the bearing is very dry or dirty, you may see oil come bubbling back out of the bearings, and it will look black. This is okay. It means that dirt is being flushed out by the oil. Wipe off the dirty oil and continue to apply the fresh oil, a drop or two at a time, until the bearings hold the oil and the hair dryer runs without drag.

Care of nonstick appliances

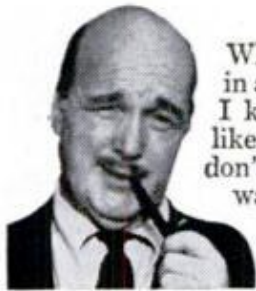
Is it really necessary to use special utensils with Teflon coated appliances?—Mrs. Cynthia Brock, Atlanta.

By "special" utensils I take it you mean such things as rubber, wood or Teflon coated spatulas or spoons for turning or mixing food in nonstick appliances and pans. The answer is no. This is a misconception. Teflon is soft enough to be damaged if you dig into it with a metal utensil, such as a spatula or fork. However, if you employ a little care in handling such utensils, you can use them.

No heat in the warmer

Our Tappan Gallery range has a warmer (Please turn to page 42F)

TOM McCAHILL says: "If your pay check's thinner than a 10 cent hamburger...fatten it up by earning extra money repairing appliances."

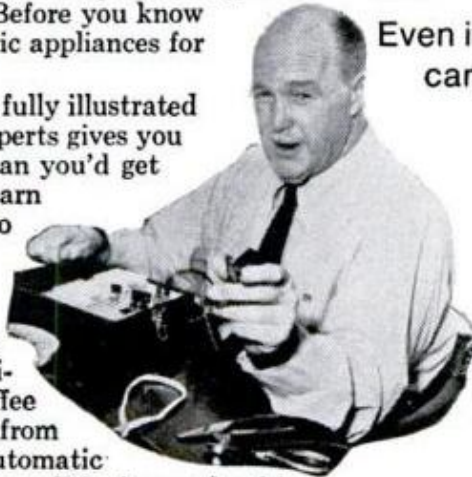


When a fellow tells me his wallet's in about the same shape as my hair, I know how he feels. Salaries are like \$50 Caribbean cruises . . . they don't go very far. But I know one way a guy with get up and go can make himself some real money . . . by learning Appliance repair.

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APPLIANCE CLINIC

(Continued from page 42D)

ing shelf for keeping food warm until we're ready for it. That's our problem. All burners work, but not this shelf. It doesn't get warm nor does its indicator light come on. What do you think is wrong?—John C. Woodworth, Lansing, Mich.

Obviously, this is a localized condition or none of your burners would be working. Electric ranges are wired with a three-wire cable consisting of two 220-volt mains and a ground. If you look in back of your range you may spot this wiring. You'll see three terminals. In most installations, the two outside leads are "hot," and the middle one is the ground connection.

If anything were wrong at this point, nothing would be working. However, the warming shelf, which is turned on and off by a switch, has an element beneath it that is "fired up" by a lead coming off a main lead. Most likely this wire is loose or has burned off, although it's also possible that the switch controlling the element is defective.



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Maintenance tips

● When you disconnect wires on a timer, switch or whatever, mark them so you know where they belong. Small swatches of adhesive tape marked by a ballpoint pen with the terminal number, letter or a code of your own will work nicely.

● Want to save your fingers? When you turn a motor pulley or test drive-belt deflection, such as on a washing machine, pull the plug from the wall first. People have gotten their fingers mashed when a machine accidentally started.

● In an appliance workbench setup, where you'll be working with electricity, remember for your own safety that the floor must not be grounded—that is, of cement or earth. A dry, wood floor is a good insulator as is one that's covered with either vinyl tile or linoleum. You can build a wooden platform to stand on. ★ ★ ★

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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SEPTEMBER **Preview** OF POPULAR MECHANICS



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PM-69

SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Floundering engine

I have an aggravating problem with a Ford Torino. I'll be driving at normal speed when the engine will quit as if it had run out of gas. After a few minutes it will start, but soon the same thing will happen. Can you help?—A.J. Roberts, Rochester, N.Y.

You haven't given me much to go on, but let's try it. If the engine just shuts down—bingo—without so much as a sputter, look for a kink in the fuel line where it comes out of the sending unit at the fuel tank. Some models came from production with lines longer than needed, leading to a kink at the connector. You may have to shorten the line to make sure that it stays straight.

If the engine sputters before it dies, suspect a short in the secondary wiring of the coil.

A solution to every problem

Allow me to share an experience I had with my 1970 Chevrolet Malibu with 350-cu.-in. V8 engine and Turbo-Hydramatic. The car, bought new, has been driven 15,000 miles. From the first day, the engine wouldn't idle properly, even after tune-ups. The transmission shifted late and unpredictably. And when it did shift the jolt was severe.

After two years of tolerating this nonsense, I was ready to trade in the car when a sharp mechanic at a service station found a vacuum leak in the carburetor-to-transmission line. The car now runs beautifully.

I wonder how many poor owners suffer with a similar problem spoiling the performance of a car that costs several thousand dollars?—Robert Lupoff, Miami Beach, Fla.

Thanks. You (and that sharp mechanic) certainly have put other car owners on the right diagnosis of a tricky problem.

Try it—you'll like it

Both of my 1972 Mercedes-Benz automobiles—280 SE and 350 SL—have squeal-

ing noises when the disc brakes are applied. My dealer says it is normal. Can the trouble be corrected?—Dr. Fred Chasan, Torrance, Calif.

Disc brakes are known to do this on many cars. The squeal is caused by the hardness of the pads. If softer pads were used, they would wear out faster. Some service shops I know have been successful in quieting the squeals by removing the pads and applying a product called Brake Silencer, which is made by Kent Industries of Cleveland.

Power politics

I bought a new Dodge Demon in 1971 that has now been driven 6000 miles. In that time, the power-steering unit failed three times. Twice a seal went bad and started leaking; the third time, it was the reservoir. Each repair lasts about 2000 miles, but the dealer refuses to install a new unit. Is he justified?—Robert A. Krieg, Valley Stream, N.Y.

I can't understand his attitude. By this time he should have concluded that the unit was improperly machined to begin with or has some sort of surface warpage. You should demand a replacement. You may have to write the Chrysler New York Regional Office in White Plains, N.Y., and have it referee the dispute.

When partially empty equals full

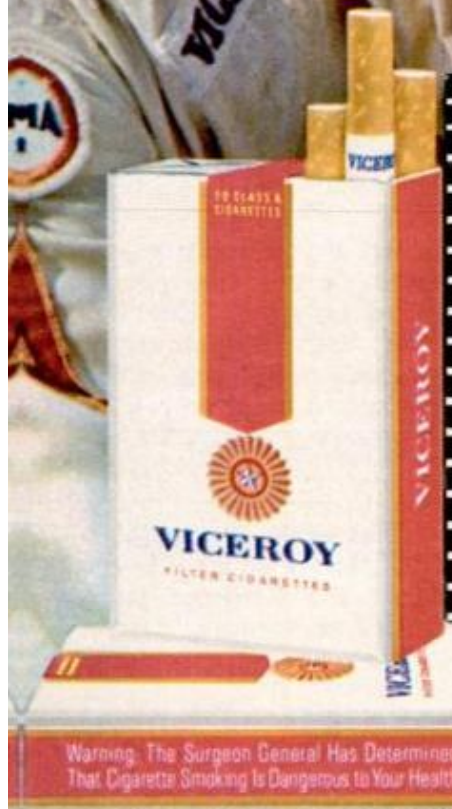
I have been having trouble with the automatic transmission of my 1967 Buick Wildcat for years. Fluid is thrown out the breather pipe. I thought that maybe the transmission was running too hot, so I installed a transmission oil cooler, but that hasn't helped. What can I do?—C.L. Strom, New England, N.D.

It's possible that a malfunction exists in the transmission, such as a stuck priming valve, but I doubt it. The two main reasons for this problem are a plugged filter on the valve body and overfilling of the transmission. Put in a new filter if it hasn't been replaced for some time.

More important, you should consider the

(Please turn to page 48)

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PM

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AUTOMOBILE CLINIC

(Continued from page 46)

way the transmission fluid has been added. When you check the fluid level, it should be at the FULL mark on the dipstick, but only after the transmission has been warmed to its normal operating temperature of 180° F. This requires at least 15 miles of highway driving. If the transmission is not being checked under these conditions and fluid is found to be below the FULL mark, you will be overfilling the transmission by raising the level to this mark. Check with shift lever in PARK.

If the transmission is being checked without being warmed up—that is, at a room temperature of 70° F.—the fluid level should be ¼ inch below the ADD mark on the dipstick. If fluid is required, do not bring up the level beyond this point.

Believe it or not, automatic transmission fluid in your Buick needs this much space to expand as it warms up.

Searching for a hot spark

I have a 1968 Chrysler New Yorker with a 440-cu.-in. engine and four-barrel Holley carburetor. Would it be possible to adapt the electronic ignition system being offered by Chrysler for its 1972 440-cu.-in. engines?—Dr. Louis F. Stigliani, DeKalb, Ill.

Yes, you can do it. A good Chrysler dealer can give you the details.

Insidious injector

The car is a 1969 Volkswagen fastback with fuel-injection system. Gas is getting into the oil, forcing me to change oil three times as often as called for by the manual. Why?—W. Rudolph, Warren, Ohio.

For one thing, one or more of the four injectors may be malfunctioning. A little particle of dirt may be preventing an injector from closing completely when it's supposed to. Fuel, under great pressure, may be pushing itself into the crankcase, diluting the oil. Other possibilities include excessive fuel-pump pressure and a faulty injector-system pressure regulator. Unless you have somehow voided your warranty, how come you haven't asked a VW

dealer to correct the trouble under the terms of the two-year or 24,000-mile warranty?

Gassed out

I have a 1970 Oldsmobile 98. When I fill the gas tank, gas runs out if I park on a hill until the gauge drops to three quarters full. Cold or hot weather is not a factor. Can this be corrected?—W.C. Brenneisen, Corapolis, Pa.

I'm surprised it hasn't been. The first thing to be determined is where the gas is coming from. Is it coming out the filler neck? If so, you may have a defective gas cap or filler pipe. Is gas leaking from the fuel tank? If so, a grommet into which the fuel and return hoses fit may have broken loose or the fuel tank sending unit which sits on top of the tank may not be seated properly. Perhaps the gasket beneath the sending unit is defective.

Service tips

● **1972 Plymouth Duster owners:** To keep the tail-lamp socket and bulb of a 1972 Plymouth Duster from falling out, have your dealer add a screw to the base of the housing below the socket. The fix is outlined in service bulletin 08-09-72C.

● **Volkswagen says** that wet weather starting problems with Beetle models may be caused by arcing between the braided, green vacuum hose from the carburetor, and the terminal on the ignition switch side of the coil. Push the hose away from the terminal as far as possible. The hose is stiff and will stay where you place it.

● **1971 Camaro owners:** If you don't believe you're getting sufficient air from the air conditioner ducts, you may be right. Situations have occurred where Vega air conditioner blower motors, which look like those of the Camaro, have been installed accidentally in the Camaro. The Vega motor revolves in the opposite direction.

● **Oldsmobile warns** that when you install a battery in a '71 or '72 Model 88 or 98, you should make sure that the left-front park-lamp wiring harness isn't accidentally caught beneath the battery.

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.

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THE BICYCLE SHOP



By EUGENE A. SLOANE

This month Gene catches up on some of the many cards and letters from readers and answers their questions about bike repairs, tools and touring

Q. *This summer I want to bike from Tampa to Washington, D.C., on my Raleigh Triumph-10 speed. My question is: Will this bicycle or a more expensive one make my trip easier and more enjoyable? I paid \$80 for my present bike. What is the point of diminishing returns on a bicycle used for a long trip?—M.F., Tampa, Fla.*

A. The Raleigh people make fine bicycles, but some are better than others. You get what you pay for. An \$80 bicycle is going to be heavier, more cumbersome and harder to pedal than a lighter machine in the \$300 to \$400 price range. Personally, I'd trade in the \$80 model for a Raleigh Super Course, selling for around \$155, or a Raleigh Gran Sport, around \$210. Anything that costs much less than that is really good for around-town riding only. If you really get into cycling, though, you'll probably wind up paying \$440 for the Raleigh top-line Professional Mark III. The better the bike, the more enjoyment you'll get from it. Other bikes are good, too, but so long as you have a Raleigh you may want to stick with that line.

Q. *I am a "bike freak" who would like to start a basement bicycle repair shop at home. What tools would you advise me to buy?—A.J.D., Chicago*

A. First, be prepared to invest several hundred dollars. The following tools, with approximate prices, will get you started: bike stand, \$150; cone tools, 13, 14, 15 and 16-mm, \$12; set metric box wrenches, 5 to 25 mm, \$25; set metric open end wrenches, 5 to 25 mm, \$20 to \$35; adjustable crescent wrenches, 4, 5 and 6-in., \$30; assorted screwdrivers, \$12; metric allen wrenches, 5 to 17-mm, \$12; Campagnolo, Stronglight, T.A. and Sugino crank tools, \$35; bottom bracket tools for above cranks, \$35; Atom, Schwinn, Regina, Shimano, Maeda freewheel



PHOTO BY BILL HARTFORD

HAPPY LANDING! After the flight, comes the fixin' removers, \$12.50; tire tools, \$3; tire patch kits, \$5; chain-rivet remover, \$3.50; pedal wrench, \$3.50; Campagnolo "T" wrench, \$3.50; spoke wrench, \$2; Campagnolo seat-post tool, \$3.50; plastic-headed mallet, \$3.50.

Q. *I've tried all over Tupelo, but none of the bike shops here carry a chain-rivet-removing tool I need to get the chain off my 10-speed bike. Where can I buy one?—B.N., Tupelo, Miss.*

A. I am surprised that no bike stores in your city carry this tool. Considering the number of 10-speeds being sold today, this is a major item. You can buy one from the bike mail-order store: Wheelgoods Corp., 2737 Hennepin Ave., Minneapolis, Minn. 55408, which also puts out an excellent catalog of bikes and bike parts for \$2.

Q. *Why the terrific price gap between Campagnolo and other good bike parts? If 8.5 million bikes were sold in the United States last year, why aren't more U.S. manufacturers making their own parts? Why isn't it okay to dunk your chain in paraffin after cleaning with kerosene, instead of oil? Paraffin is cheaper.—G.A.L., Onchiota, N.Y.*

A. Three very good questions. In order: Campagnolo parts are simply the very best in terms of precision machining, finish and design. However, the differences can sometimes be minute. For example, the top-line Shimano and Maeda derailleurs are almost as good as the Campagnolo derailleurs, and

(Please turn to page 52)



A special offer for the guy who knows what the underside of a car looks like.

If you've been under a car, you know what's connected to what and why, and you've probably got more than a little Missouri in you. So when someone starts up about his shock absorbers, stop him with a "Show me." We will.

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the more you'll want Delco.



THE BICYCLE SHOP

(Continued from page 50)

cost considerably less. It comes down to getting about 10 percent more quality for about 50 percent more money.

As for U.S. manufacturers making their own caliper brakes, derailleurs, chainwheels and pedals for good bikes, the economics of tooling up the machinery and the bricks and mortar investment, plus the fact that no U.S. firms make all the bikes, rule out their making components in competition with foreign suppliers tooled up for some time.

Lastly, paraffin is too gummy and sticky, would attract dirt. Your best bet is Lubriplate Chainlube spray.

Q. Recently I bought a bicycle with coaster brakes. The instruction manual is for a Sturmey-Archer rear hub, but the bicycle has a Shimano hub. Where can I find the Shimano firm to get a manual?—G.M., Niagara Falls, N.Y.

A. You can reach Shimano by writing Shimano American Corp., 1133 Avenue of the Americas, New York, N.Y. 10036.

Q. I have recently become interested in cycling, and have read your book, *The Complete Book of Bicycling*. This book lists several magazines on biking, one of which is *Bicycling!* A letter to this publication was returned. Can you give me its new address?—J.M.R., Syracuse, N.Y.

A. The new address is 15 Sir Francis Drake Blvd., East Greenbrae, Calif. 94904.

Q. I would like some do-it-yourself plans for building a bike carrier. Are any available?—D.R., Rockaway Beach, N.Y.

A. A dandy roof carrier that carries up to five bikes and that you can also use for your boat has been designed by Chick Mead, 137 County Rd., Marion, Mass. 02738. Send him \$1.50 for complete plans and bill of materials.

Q. I would like to buy a Bobet C-34 but cannot find a dealer. Can you tell me where to find one?—T.F., Deerfield, Ill.

A. Sorry to report the Bobet is no longer imported into this country. However, a Mercier bicycle, made by the same French manufacturer, is available and you should be able to find one at your Deerfield bike shop. But be prepared to spend at least \$200.

Q. Can you tell me what Cantiflex tubing is? I heard of this some time ago via a label on a bicycle made in England.—P.O.S., Albany, N.Y.

A. "Cantiflex" bicycle tubing is made by Reynolds Tubing Co. for Horace Bates Cycles, Ltd., 479 London Rd., Westcliff-on-Sea, Essex, SSO 9LG, England. This patented tubing has twin-radius thickness. The thickness is greater (1¼-inch o.d.) at center sections, slightly thinner (1½-inch o.d.) at ends. Bates says this makes a stronger, more rigid design that is resistant to whip and bending strain. Whip is undesirable in a bike frame (or at least too much of it is) because it robs the cyclist of pedal power by absorbing his pedaling action to some extent. Seat springs do the same thing.

Q. Are there such things as hop-up or speed shops for bicycles? You know, places that soup up bikes with real low-friction parts and things like that.—D.R., Wantagh, N.Y.

A. No. No speed shops yet, but many precision parts are available for bikes. For example, there's a set of precision hubs that feature a sealed design; they're good virtually for the life of the bicycle. Bearings are precision-made so that the rolling resistance is said to be less than that on even the best of conventional hubs. The aluminum alloy hubs are either wide-flange (3 inches)



or standard (2¼ inches). The wide flange retails for about \$44 for front or rear hub, low flange for \$40 each. If you're a bike fanatic, you'll be satisfied with only the very best, which is what these hubs really are. From Phil Wood & Co., Box 1729, Los Gatos, Calif. 95030. ★★

GOT A PROBLEM WITH YOUR BIKE? Ask Gene about it. Send your question to Bicycle Shop, *Popular Mechanics*, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in this column.

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Drivin' with Dan

How do you boost pressure on a turbocharger? What will improve racing coverage by television? Would a small station wagon do well in stock-car racing? Dan Gurney answers these and other automotive questions

Q. How do you increase the boost on a turbocharger?—Penny Wallman, Burr Oak, Mich.

A. On most racing applications, there is a pressure-relief valve which can be set to pop off at a given maximum pressure. The adjustment is made with a bolt which acts as a stop. You screw it in for a higher maximum pressure; out for a lower pressure.

Q. After a year of preparation with your amazing new Eagle, after a month of practice at the Indianapolis Motor Speedway, after all that investment and sweat, was it really a broken distributor rotor that grounded high-flying Bobby U. in the 500?—Bob Kattau, Massapequa, N.Y.

A. Yup.

Q. I like to watch racing on TV, but I have never felt it is as good as it could be. If you agree, what

could you suggest might be done?—Al Ostrinski, St. Louis.

A. I agree, although television coverage is improving all the time. I believe that the networks could use cameramen with auto-racing insight to follow the real action—not necessarily just the leader as he goes round and round. Also good would be a few more interviews with drivers and team managers as the race is underway, more pit action, more "inside" stuff.

Q. If you see you can't make a curve, is there any way to spin out a car quickly and safely like they do on a racetrack?—Ralph Simpson, Corbin, Ky.

A. If you did do it, you were lucky. What you
(Please turn to page 60)

POLE SITTER, Bobby Unser, takes his seat for the Indy 500 with team manager, Dan, calling the strategy





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ings. 19 mg. "tar," 1.3 mg. nicotine—
10's. 20 mg. "tar," 1.5 mg. nicotine av. per cigarette, FTC Report Apr. 72

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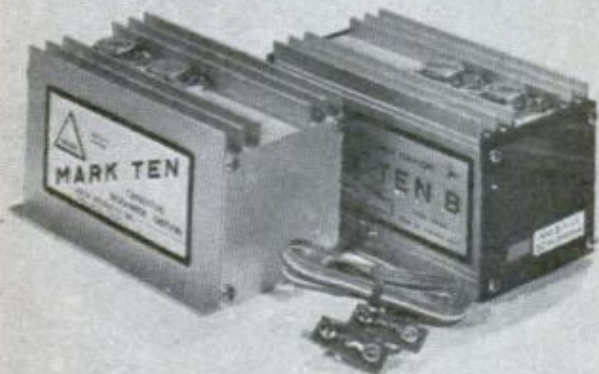
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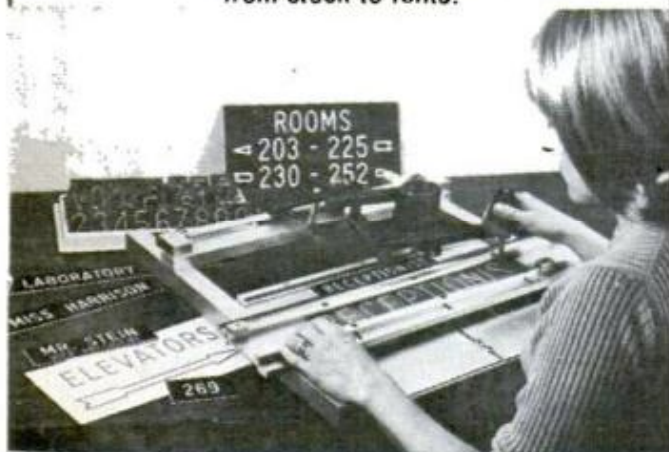
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DRIVIN' WITH DAN

(Continued from page 56)

should do is drive like a road racer, and do all your braking down before going into the turn. You might look at the drawings and techniques for driving through corners quickly in Bill Hartford's story, *How I Became A Racing Driver in 3 'Easy' Lessons*, page 86, Jan. '71 PM.

Q. Mark Donohue has gone NASCAR with his American Motors Matador. It seems like a Javelin would have the edge in aerodynamics, so why doesn't he drive one instead? Also, how do you think a compact station wagon would do in NASCAR races?—John Strain, Kingston, Tenn.

A. The Grand National rules preclude the use of the Javelin in the same way that they rule out the Mustang, Camaro, Firebird, Barracuda and so on. They run in the NASCAR Grand American series.

I doubt if the station wagon's aerodynamics would be as good as the normal sedan's. Too, there'd probably be a weight penalty and the center of gravity would be higher.

Q. I'm trying to improve my Dodge Colt's handling. Do you think helper springs would make the rear end track better, or should I add a stabilizer bar too?—Staff Sgt. K.W. Carpenter, APO San Francisco.

A. I'd go for the stabilizer bar as more helpful than the springs.

Q. What do you consider the greatest race you ever drove and why? I think it was the 1967 Rex Mays 300, where you came back from a flat tire to win.—Tommy Roper, San Bernardino, Calif.

A. Yes, that was a good one! But there were others that were as good or better from the standpoint of pure driving performance, even though I didn't win. There have been many drives that I have been very proud of—I find it impossible to pick just one.

Q. In NASCAR stock-car racing, is there anything in the rules against turbocharged engines? If so, why?—Ted Weydert, Maple Park, Ill.

A. Yes, because there are no "stock" cars offered to the public with turbocharged engines at the moment.

Q. How much cheating on rules goes on in the major racing circuits like USAC and NASCAR? Do many guys get caught?—Ted Skelton, Norfolk, Va.

A. There will always be a lot of "ingenuity"

(Please turn to page 60B)

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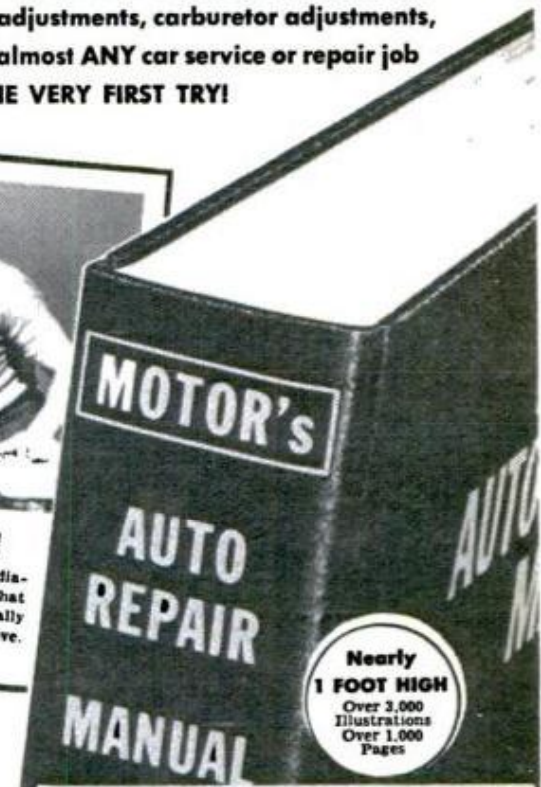
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DRIVIN' WITH DAN

(Continued from page 60)

used in a racing effort. There are some gray areas in the rules that are very hard to define, and racers will constantly be probing the strength of the rules. Not many teams get caught. There are very few blatant cheaters, but many innovators!

Q. *I'm writing a term paper on stock-car racing and wonder how you evaluate that type of racing?—Billy House, Huntsville, Ala.*

A. It is very competitive, very specialized, governed by many rules with restrictions which limit design horizons, but on the whole it is certainly real exciting racing, paying a lot of real money. And, as you know, stock-car racing is the most popular spectator sport in the Southeast.

Q. *At the California 500 in 1971, Mark Donohue ran out of gas. Do the cars have gas gauges? If so, what happened to Mark's?—Chuck Barrett, San Marino, Calif.*

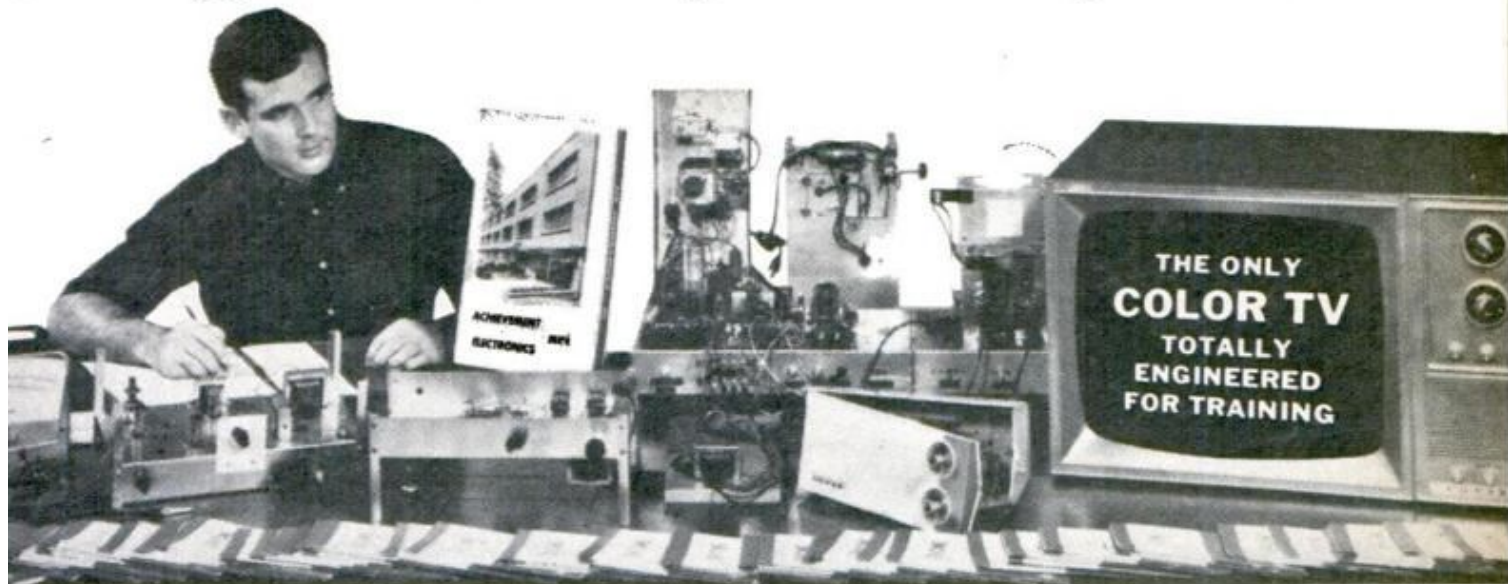
A. No, they do not have gas gauges. They are not used in racing cars because the shape of the tanks does not lend itself to the normal gauge-actuating mechanism. Actually, it seems to me that it would be a big advantage to have a reliable gauge. I shall try to incorporate one. Why, that would be a new invention in racing! Progress! In Donohue's case, I'd say that the dry tank was a mistake on the part of Roger Penske's pit crew, but of course hindsight vision is always 20-20.

Q. *I'm really starting to get worried about the government taking all the fun out of cars. Couldn't you organize a movement to keep it from happening? Or do you agree with me?—B. A. Saltzman, Greensboro, N.C.*

A. I think you are right. Driving should be fun. A good handling car that is light and nimble is also safer because it can avoid accidents rather than survive them. I think we shall see a trend towards smaller, more agile cars which will pollute less by getting more mpg, and be more responsive. As to organizing a movement, I'm ready with my opinions, but otherwise all of my time will be devoted to surviving in this rough racing business! ★★★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 46).

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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Painting new plaster

How long a time should elapse before new plaster (not Spackle) is painted?—J. Horner, Knoxville, Tenn.

New plaster contains moisture which should be allowed to dry out before you paint. Offhand, I'd set 90 days' drying time as a minimum unless the room is heated for part of the drying period. In that case, the time could be shortened to two months.

Tree roots heave sidewalk

Exposed roots from a tree are breaking up the walk in front of my house. Can they be cut away without damaging the tree?—Robert Langley, Little Rock, Ark.

If these are brace roots—and undoubtedly they are if as described—such cutting may expose the tree to infection or insect invasion and weaken its resistance to windstorms. It would be better to remove the damaged walk and relay it, curving it around the exposed roots. This should permit the tree to reach maturity without further damage to the walk.

Cleaning basement floor

My concrete basement floor is dirty—I mean ground-in dirt. Detergents, household bleach or scrubbing just don't clean it. I want it cleaned to the original color. Any suggestion?—E. Roth, Cleveland.

Yes, that you forget it and resort to painting. Ground-in dirt is difficult to remove from concrete. Clean the floor by scrubbing, allow it to dry, then etch with a prepared (paint-store) solution and apply a coat of paint that's approved for use on concrete floors.

Musty books

I keep books in my rec room in a sectional bookcase. When I had to remove them recently, I noticed a musty odor. They seemed to feel damp and in some the edges of the pages were curled. Is there a cure for this condition?—Leo Buss, Gainesville, Fla.

The simplest cure is to air the books outdoors under bright sunshine for several

hours, then operate an automatic dehumidifier to reduce moisture of the room air. While you're at it, air the bookcase sections in the sun along with the books.

Tacky varnish stain

My stair rail was getting worn through, almost to the bare wood, so I used a varnish stain. This didn't dry; it's still sticky to touch. Why?—W.L. Savery, Providence, R.I.

Very likely the rail has been "oiled" for some years by hand and fingerprints which you didn't wipe off with a solvent before you applied the varnish. It's also possible the varnish was too old—far past its allotted "shelf life."

Clear off the sticky mess with a varnish remover of the wash-off type, then sand the area smooth and try again. After this treatment the coating will dry if you give it the required drying time.

'Longer look' with narrow siding

I live in a small ranch house that is sided with wide boards. I'd like to make it appear longer and lower. Can such an illusion be created?—L. Powers, Little Rock, Ark.

In some settings and depending a bit on the architectural detail, a darker-colored paint will give the effect of greater length.

For a better way, apply narrower siding, such as 4-inch widths over the existing 8-inch boards. There are also 8-inch-wide sidings to be applied in such a way that you end up with the appearance of 4-inch siding.

Stain painted shingles?

Shingled walls of my house are painted. Can I use a stain on them?—R. Blanchard, Portland, Me.

No. Stains commonly used on shingles won't "take." You risk flaking of the stain and peeling of the paint. Some homeowners use a chalking paint on previously painted shingles. This gives a rather flat surface similar to stains in appearance, but it has a tendency to run as it chalks, thus discoloring different-colored window trim. ★★★

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.

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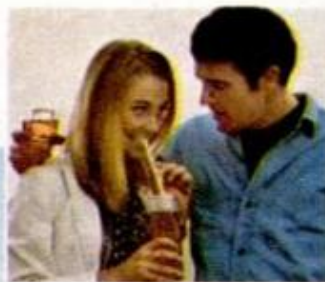
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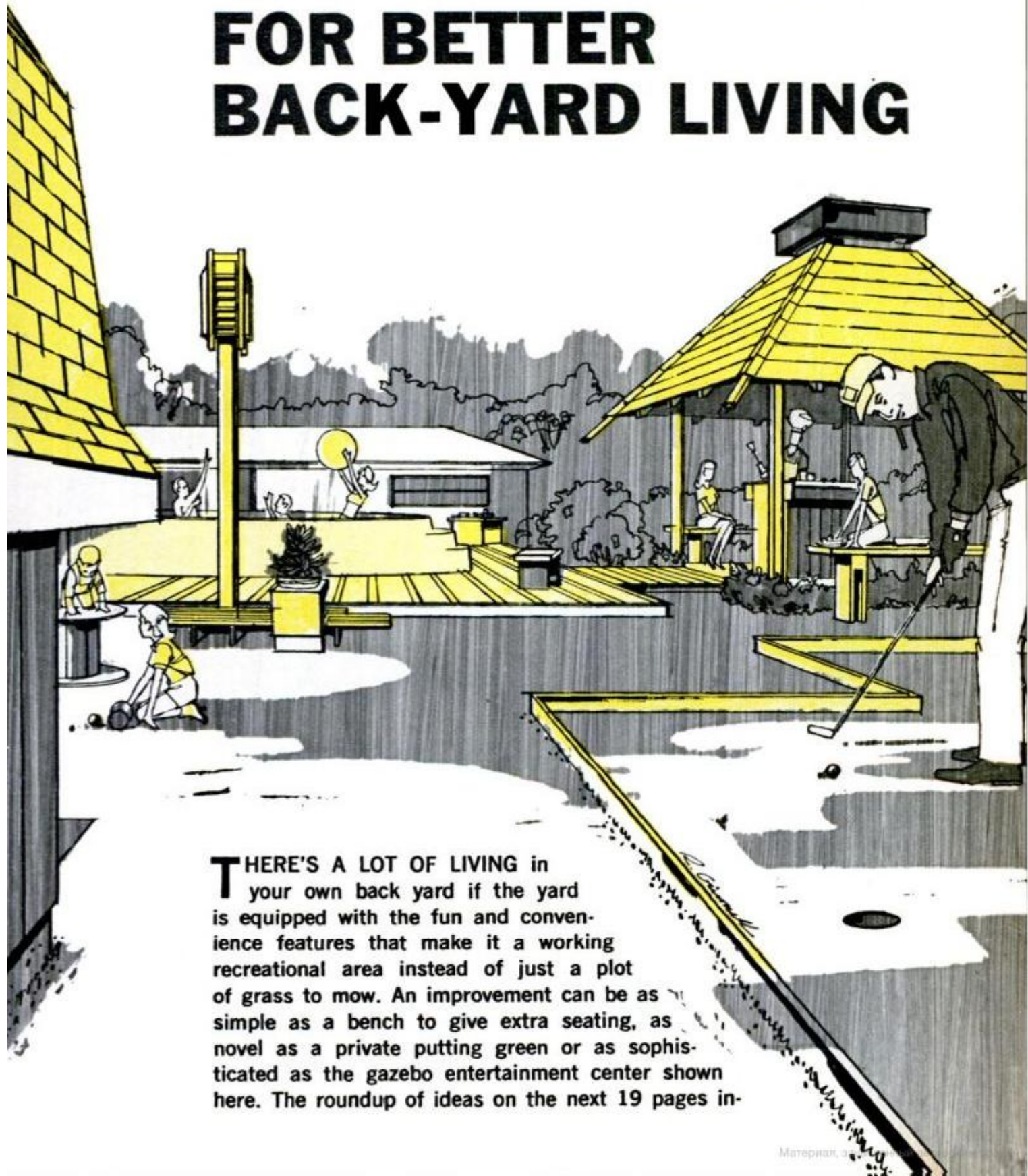
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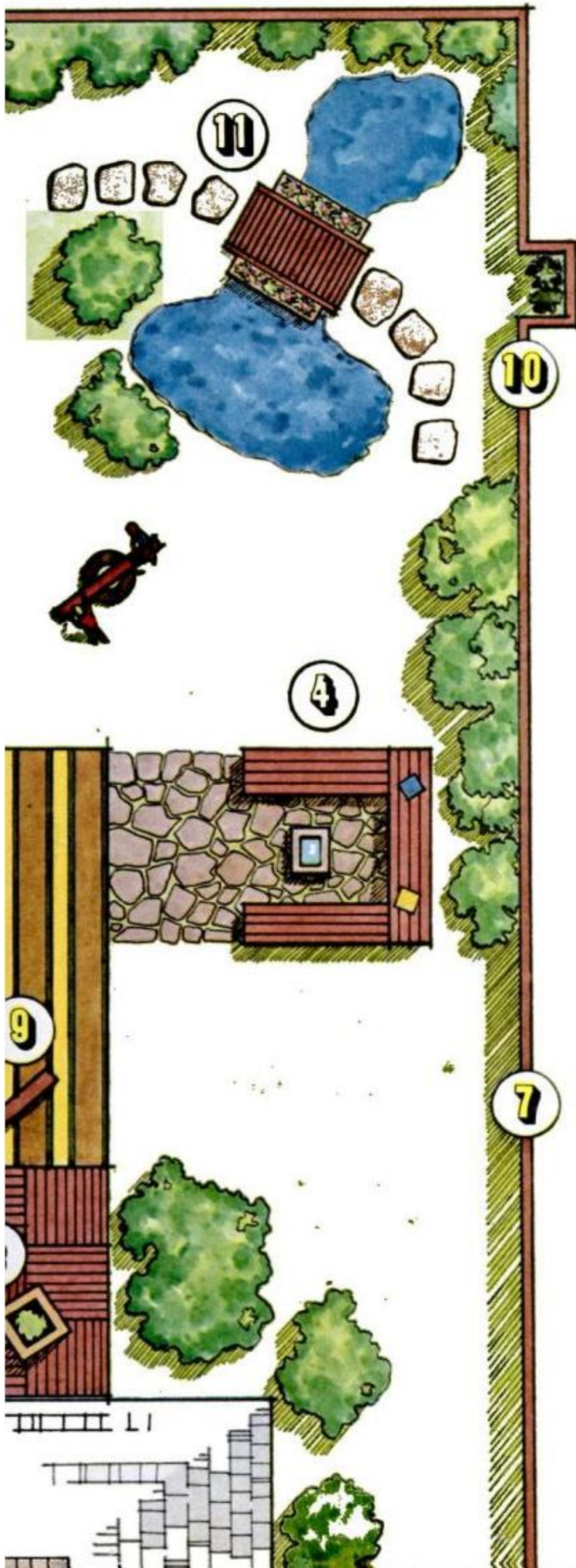


15 GREAT IDEAS FOR BETTER BACK-YARD LIVING



THERE'S A LOT OF LIVING in your own back yard if the yard is equipped with the fun and convenience features that make it a working recreational area instead of just a plot of grass to mow. An improvement can be as simple as a bench to give extra seating, as novel as a private putting green or as sophisticated as the gazebo entertainment center shown here. The roundup of ideas on the next 19 pages in-





cludes these and 12 other practical, eye-pleasing projects that would be welcome in any yard.

Obviously, few properties are large enough to include all of the improvements shown in the "dream yard" at left. Regardless of the number of improvements you decide to add, any of the ideas shown can be installed professionally or handled alone by a do-it-yourselfer. Any one of them will make for better outdoor living.

There are certain points to keep in mind. Depending on locale, for example, permits might be required for certain structures. Thus, before you take on the gazebo or swimming pool, check your local building code. Fencing is often regulated in design, as well as height and proximity to property lines. Frequently an elevated deck requires installation of a minimum-height railing. To save yourself cash and aggravation, after planning your project check with your building department to assure conformance with local codes.

Some products are better than others for particular jobs. Because of its resistance to rot and termites, redwood is best for decking and fence panels. Yet, for fence posts, cedar will last longest. You'll find all this information along with the good ideas listed below.

LEGEND

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Dutch mini-barn

THOUGH the roof design of this little lawn building, designed and built by Martin A. Chomoa, Bay Village, Ohio, is actually somewhere between gambrel and mansard, we've labeled the structure "Dutch" because it reminds us of Dutch colonial architecture. Happily, because of the roof, construction cost is low—the barn shown here was erected for approximately \$397, including the slab and footings.

The sloped roof has a 3-in-12 pitch. In

many localities, a 6-in-12 pitch is required; this slope would result in a more conventional gambrel roof. The building boasts 8-ft. headroom inside. Thus, there is more than enough storage room for bicycles, lawn furniture, garden tools and flammable items such as turpentine, fuels and the like which are best stored away from your residence.

Complete plans are available so that you can start work on the barn as soon as you receive the plans. How-to-order information is given on the facing page.

Materials selected for exterior use were based on practicality as well as economy. The textured cedar siding, for example, is simply stained and left to weather. The



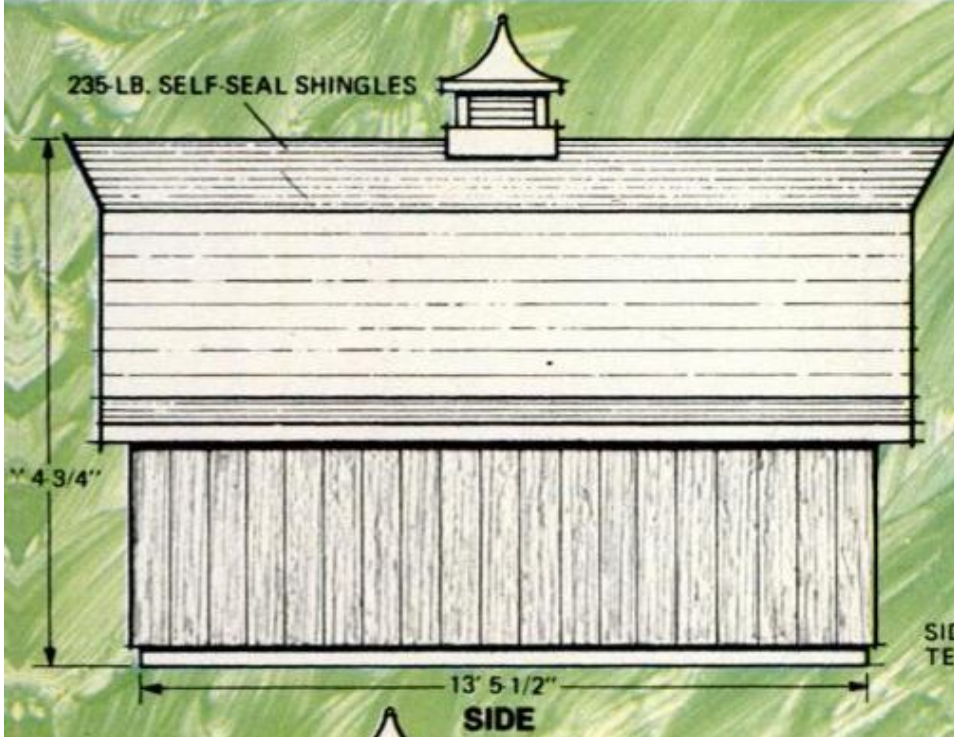
doors and fixed-windows are made on the job. There is adequate ventilation when the barn doors are open because of the cupola.

If you plan to use the barn as a yard "office," workshop or potting shed, you are well advised to install conventional windows to assure sufficient ventilation (and to satisfy building codes for occupied structures). If the barn is for storage only, the interior walls are left unfinished.

The barn rests on a slab which, in turn, is supported by a foundation wall around the perimeter. The latter can be either poured or cement blocks on footings, but regardless of type, the footings should be below the area frostline to avoid chance of frost upheaval.



ROOMY LAWN BUILDING easily corrals bikes, garden equipment and the like, can be built for about \$400



TO ORDER PLANS

For one complete set of construction plans, materials list and a construction guide, send \$3.95 to Popular Mechanics, Dept. DM, Box 1014, Radio City, N.Y. 10019. For two sets of plans—your building department may require one—send \$5.95. Allow three weeks for delivery.

SIDING: ROUGH-SAWN CEDAR,
TEXTURE 1-11, 5/8" PLYWOOD





Putting green

IF YOU'D RATHER spend Saturdays swinging a putter instead of a grass whip, Lawnscape Landscaping is the material that can make your dreams come true. The decorative "carpet" has a fiber facing that closely resembles living grass both in appearance and feel. The beauty of it is that once it is installed, there's no maintenance.

Made of a second-generation polypropylene that is polymerized to withstand aging and the weathering of extreme outdoor conditions, Lawnscape is a product of the Ozite Corp., 1755 Butterfield Rd., Libertyville, Ill. 60048. The synthetic turf is sold nationally through carpet dealers and building-supply centers at about \$6.95 per square yard. The same dealers also stock installation materials.

The material can be installed professionally or by a do-it-yourselfer. Since the carpet comes in 6 and 12-ft. widths, the putting

◀ **IF HE MISSES PUTT**, golfer (left) can't blame it on a poorly maintained green. The Ozite synthetic turf has the look and feel of grass and blends in beautifully when surrounded by the real thing (inset)

greens shown here are designed to utilize those modules.

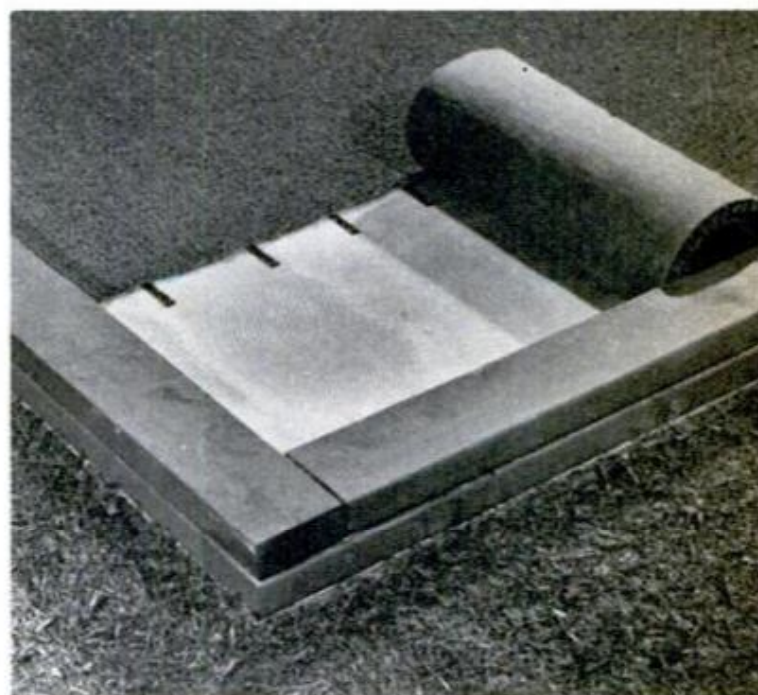
The dirt or soil subsurface of the area to be covered should be shaped and well tamped. The manufacturer recommends either 1½ in. of asphalt or concrete over the compacted base for the Lawnscape to adhere to. (This minimum thickness will vary with load requirements.) Installation directly over earth is not recommended.

The surface finish should be as smooth and nonporous as possible. Because of the latter requirement, the covered area should be pitched slightly to direct water runoff where you want it to go.

The perimeter boards (headers) can be installed as shown in the drawings (page 68) or as in the photos below. The latter method creates shiplap joints by doubling up two-bys. Start by installing the headers because these can also be used for screeding the concrete. Once they are in and secured by stakes, the earth inside can be excavated and tamped. Then the concrete is laid up to the solid header and maintained



USE NOTCHED TROWEL to spread adhesive on area of exposed widths. When almost dry, turf goes down
AUGUST 1972



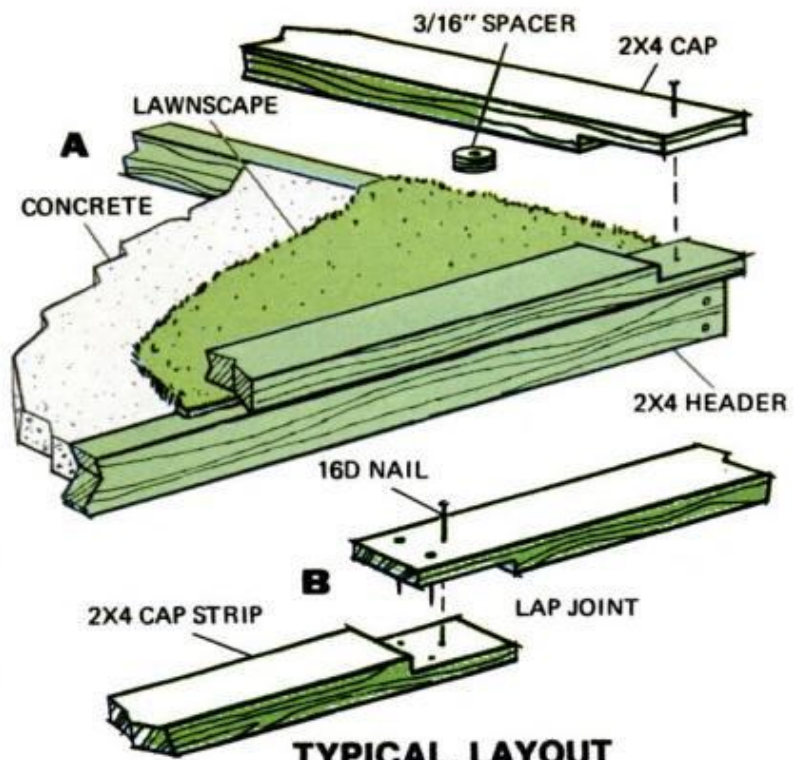
FOR INVISIBLE SEAMS, Seaming Pin-Tape is pressed into adhesive; the turf is then held by the barbs

approximately $\frac{3}{8}$ to $\frac{1}{2}$ in. below the header's top edge. This measurement should be as consistent as possible to maintain a uniform grass height. You can achieve it by using a notched screed on the header boards to level the concrete. If you use asphalt instead of concrete, seal the surface and allow it to dry overnight before installing Lawnscape.

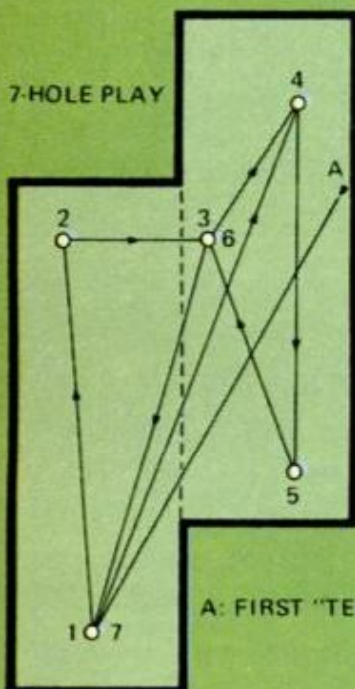
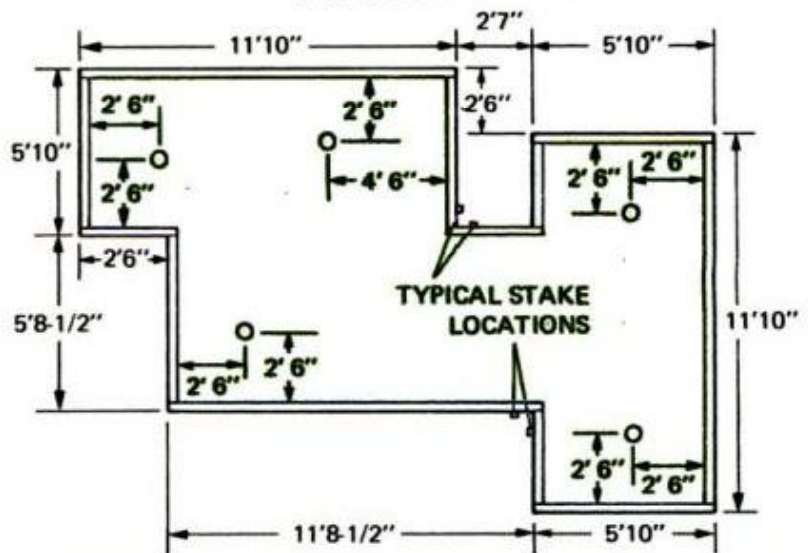
Sweep the surface clean and patch any irregularities. Spread the synthetic turf in the sun to warm it and trim edges to be butted. Then, using a $\frac{3}{32}$ -in. notched trowel, spread Ozite AP 770 adhesive over the area of exposed width. When the adhesive barely transfers to your finger (10 to 20 minutes), the turf can be rolled onto the surface. You can assure invisible seams with Ozite's Seaming System Pin Tape (see photos, page 67). These are positioned astraddle the edge. The grass is simply tapped into place with a hammer.

Lawnscape and related material—flags, cups and instructions—come as a kit. Simply select the layout you want and order that amount of carpeting in the kit.

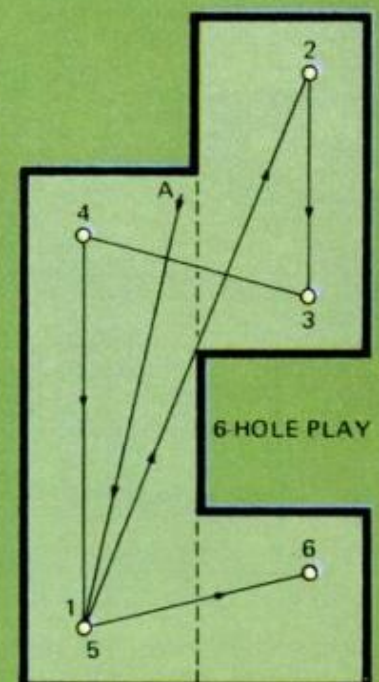
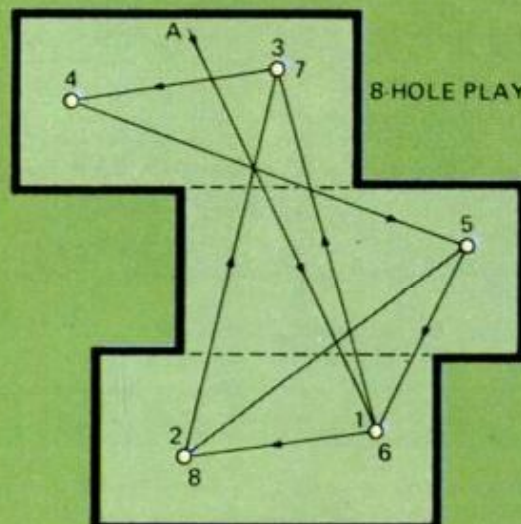
In addition to a putting green, you might want to consider the synthetic turf for swimming-pool aprons, patios, roof decks and the like.

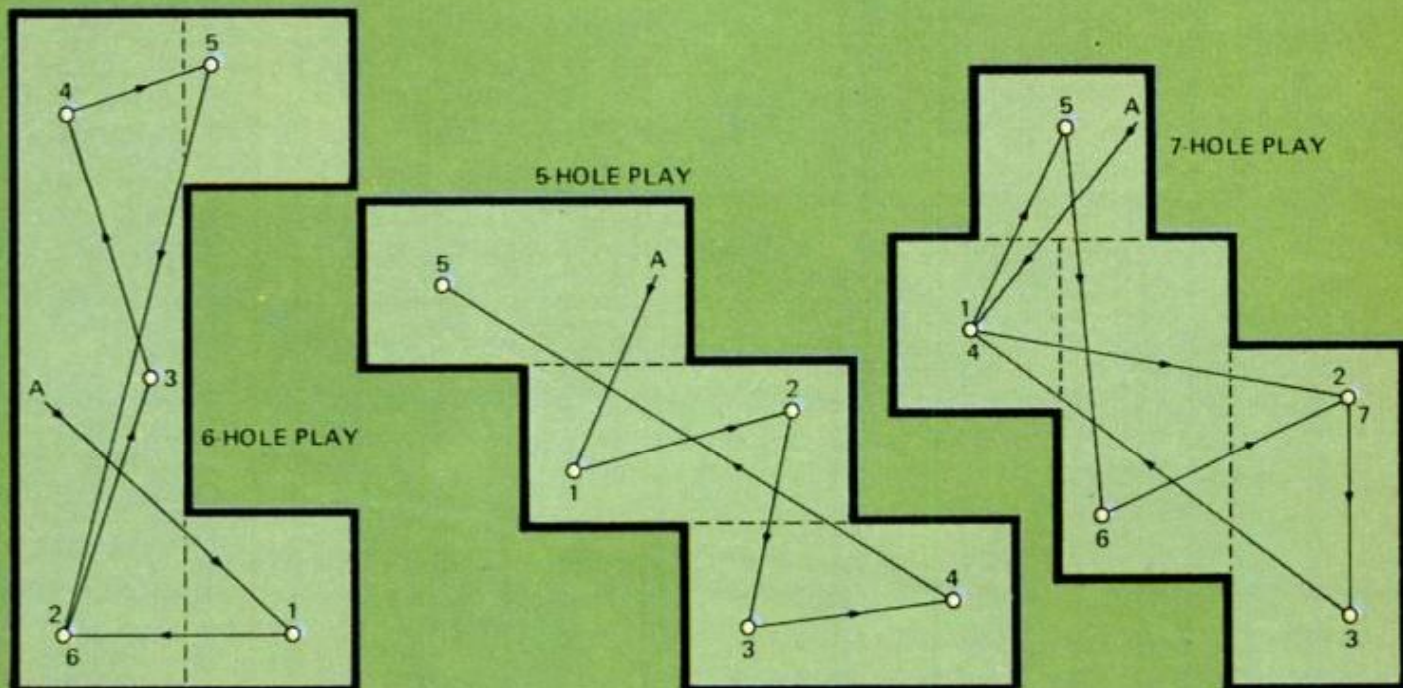
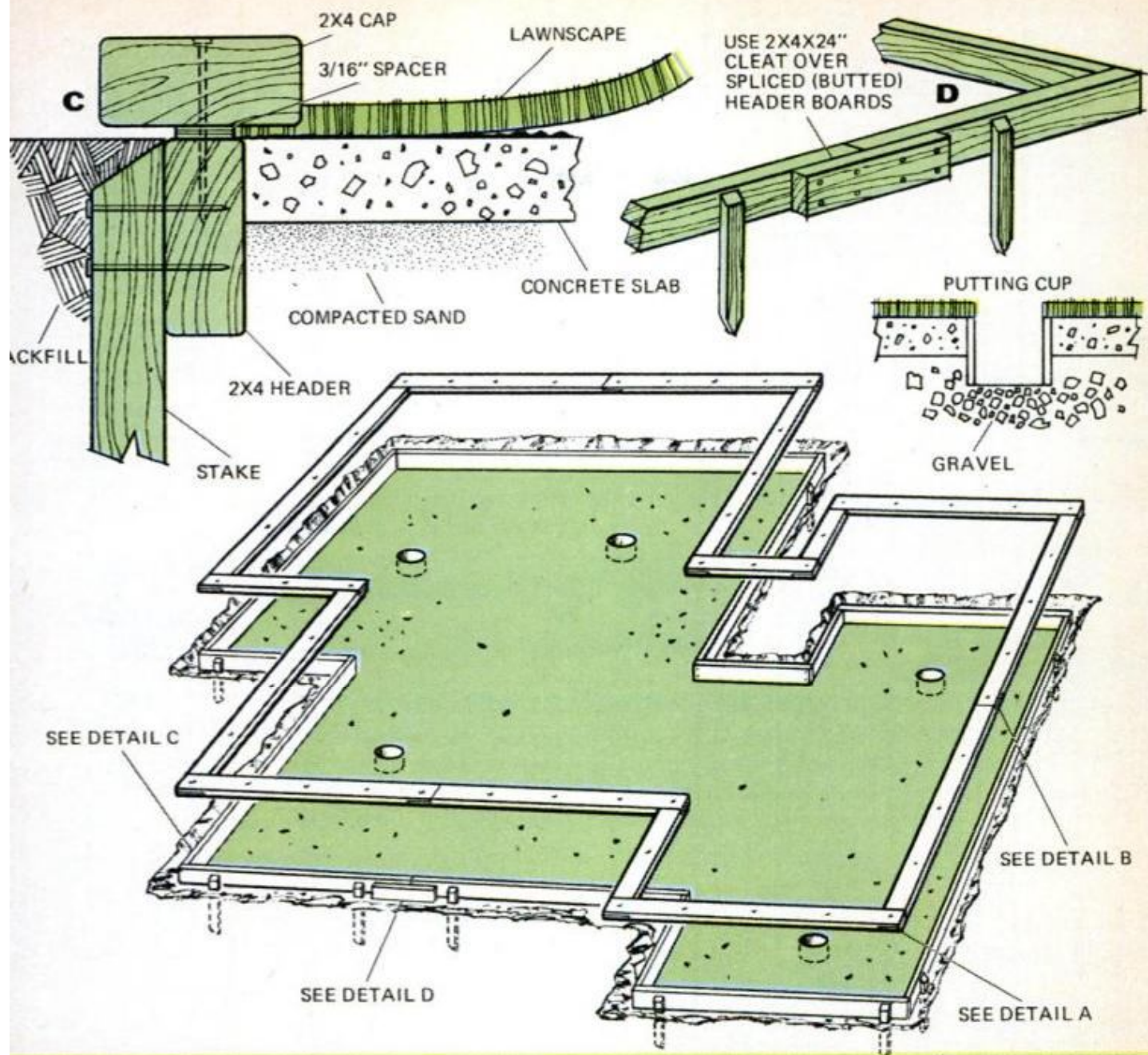


TYPICAL LAYOUT



ALTERNATE LAYOUTS







3 Gazebo

POPULAR as presented in *PM* in March 1970, this Cookout Gazebo enhances any back yard. The design, by Western Wood Products Assn., was adapted (and simplified) by *PM*. To order Xerox copies of the article, send \$1.20 to *Popular Mechanics*, Box 1014, Dept. HW, Radio City, N.Y. 10019.

Conversation corners

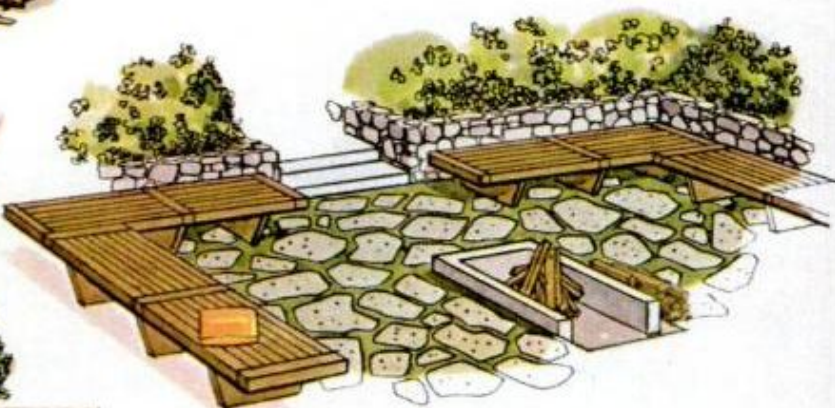


IN ORDER to turn your patio into a real outdoor living room, you will want to incorporate into its design an inviting area for just sitting and talking. In addition to comfortable seats, be sure to provide good lighting and privacy.



CORNER CREATED where a wing or garage meets the house is fine for a conversation center; walls may offer afternoon shade and privacy

CONVERSATION PIT can easily be built by terracing a slope. Retaining walls lend intimacy; fire pit is center of interest



PRIVACY FENCE and bench seating arrangement is ideal for groups of six to eight people. Coach lamps on fence and a fountain add charm



5

Patio cart

WITH this cart on your patio, you're no more the frantic host who must dash back and forth between kitchen and outdoors to prepare food and mix drinks. Everything you need is right at hand. The cart, originally shown in the August '71 issue of *PM*, is designed so that you can carry out electric appliances to the patio and plug them in. And beneath its hinged chopping block is a beverage-chilling, Styrofoam chest to store cold drinks. For Xerox copies of the original article (including the plans) send 80 cents to *Popular Mechanics*, Box 1014, Dept. HW, Radio City, N.Y. 10019.

**6**

Pool and deck carpet

ADD a colorful new pool, deck or patio covering with Ozite's Sunnyside Up outdoor carpet. It can be put on virtually any surface. For the nearest dealer, write to Ozite Corp., 1755 Butterfield Road, Libertyville, Ill. 60048.



Fancy fences

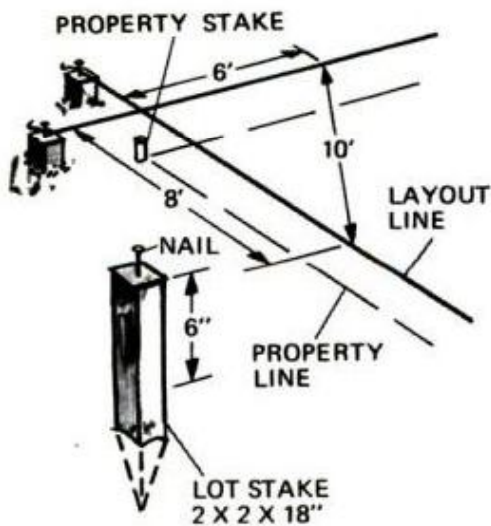


SOAK UNTREATED POSTS in creosote before setting. The treated portion of post should extend at least 6 in. above the grade mark. Use creosote with caution

WHATEVER the truth of the old saying, "Good fences make good neighbors," there are at least four other reasons for building a fence when you improve your back yard. Good looks is one reason of course, but fences can also be laid out to direct yard traffic, to serve as parts of conversation areas or as part of a total concept in patio-planter-bench treatments.

The fence designs shown on these pages were created by the West Coast Lumbermen's Assn., 1410 S.W. Morrison, Portland, Ore.

Rule one when picking a fence for your yard is to



YARD STRUCTURES, pruning, planting, or anything in the garden: Get expert help from PM's new Complete Gardening Guide, a set of 24 plastic-laminated, information-packed reference sheets. Send \$3.95 to Popular Mechanics, Dept. GG, Box 1014, Radio City, N.Y. 10019.

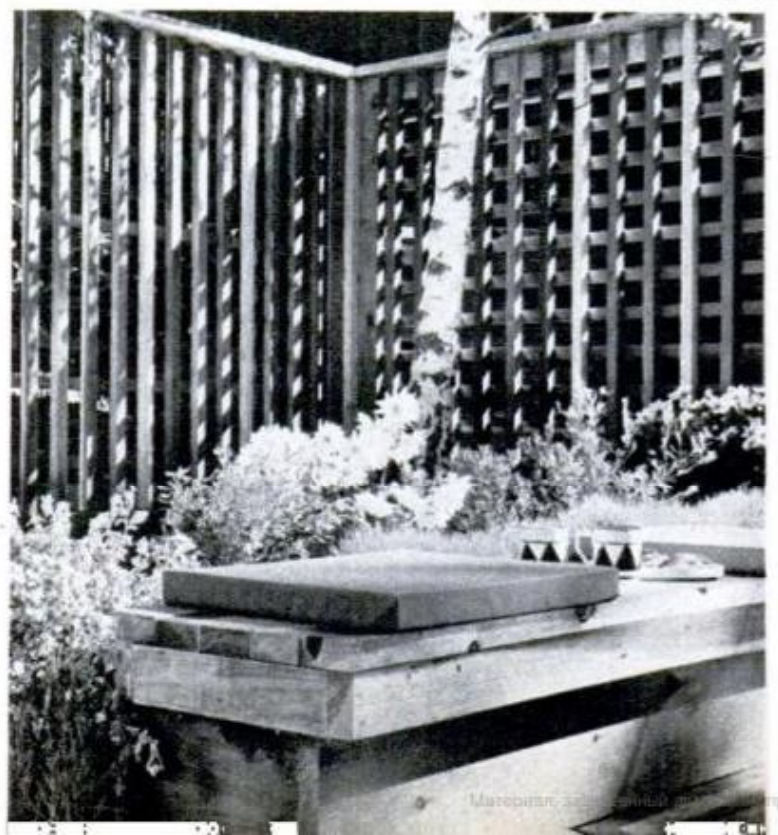
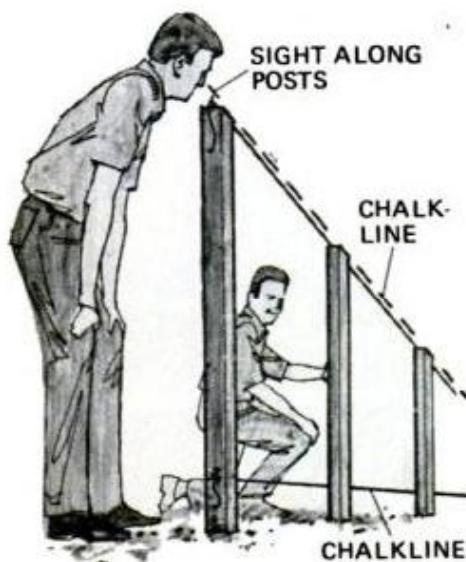
make certain that it blends with both the architecture of your home and the look of the land.

Another good point to keep in mind is that once you have painted a fence, you have imposed upon yourself a periodic repainting chore. Thus, it makes good sense to use stain whenever possible and let

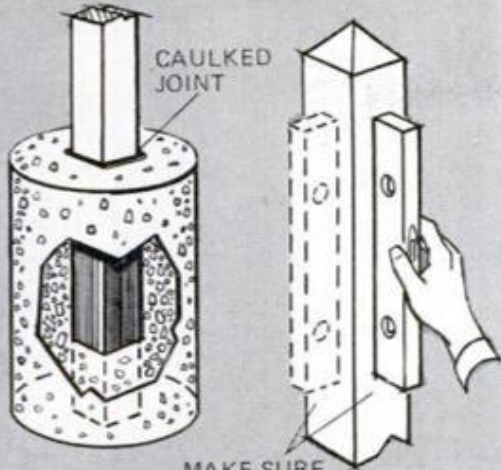
WELL-PLANNED FENCE lets through uninterrupted flow of air for greater warm-weather comfort. Notice careful landscaping

California Redwood Assn. photo

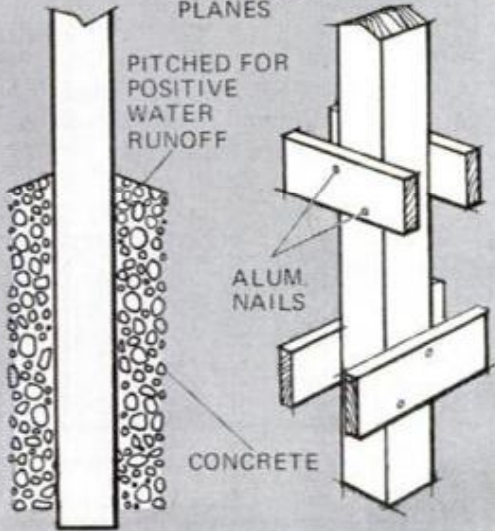
WAYS OF LOCATING fence and of aligning posts are shown above and below. Careful attention to detail (following grade for example) makes a professional-looking job



HOW TO SET POSTS

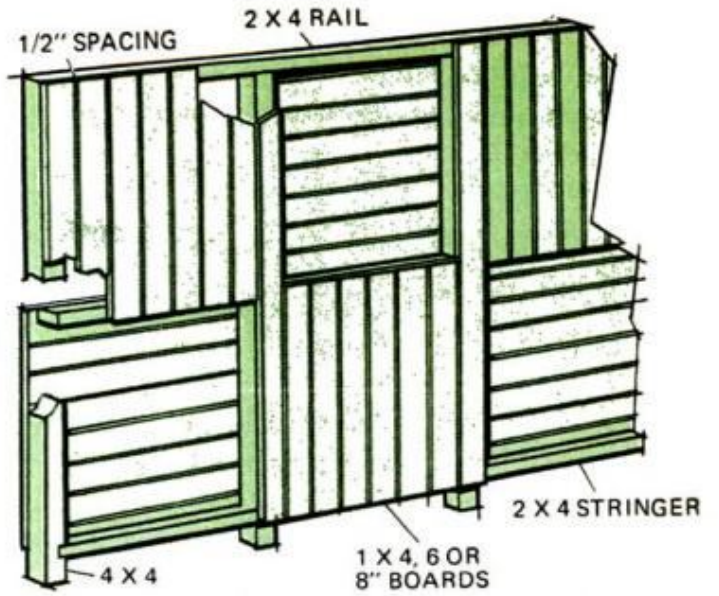


MAKE SURE POSTS ARE PLUMB BOTH PLANES

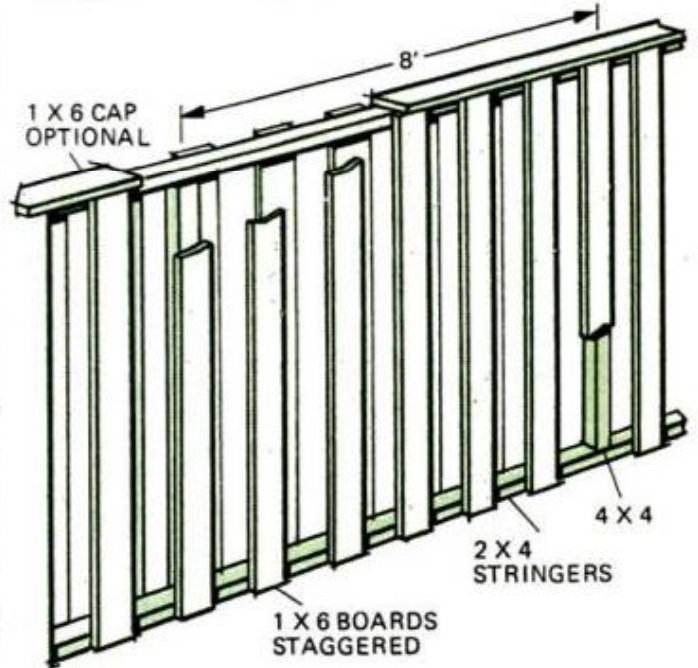


TWO WAYS TO ANCHOR POSTS

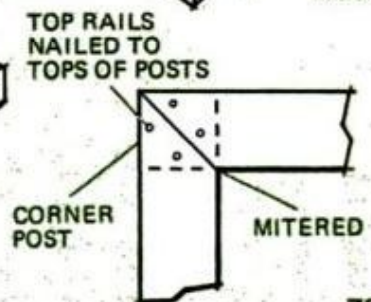
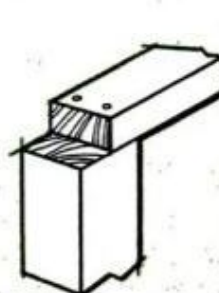
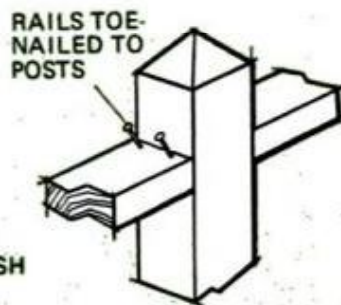
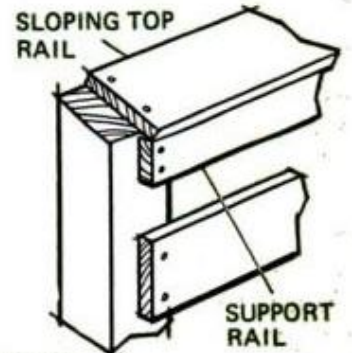
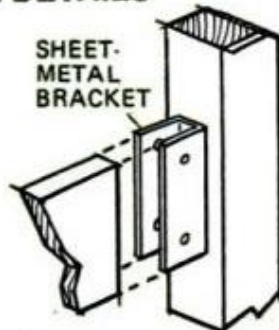
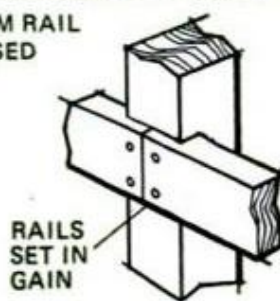
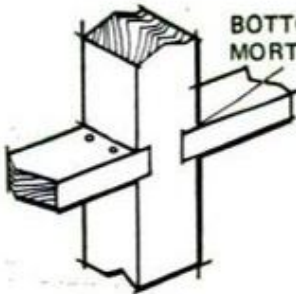
PLANTING 4x4 POSTS is first step in any fence installation. Rail and post details are shown below



CHECKERBOARD DESIGN above has narrow spacing between boards. Staggered boards in fence below are spaced farther apart, and fence can sit on patio



FENCEPOST AND RAIL DETAILS

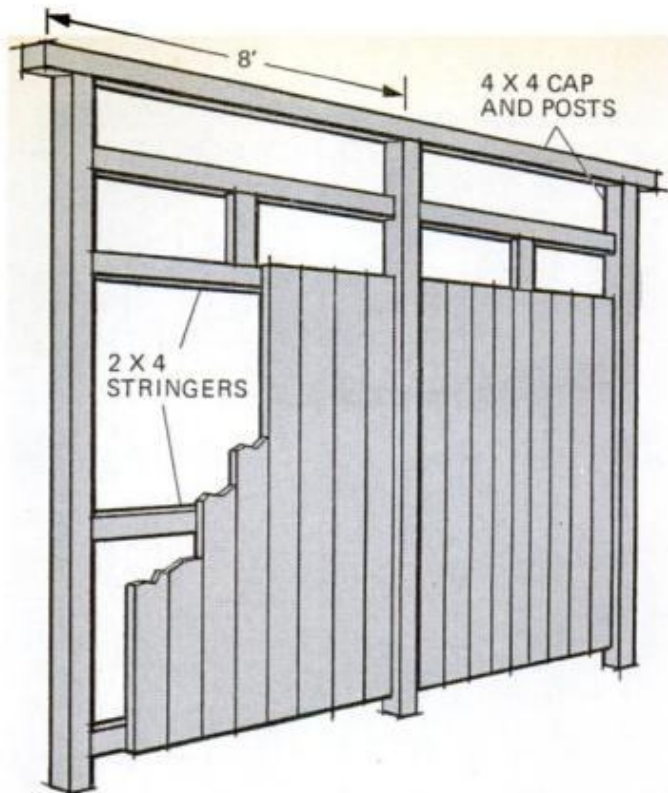


the boards age by exposure. A stained, natural fence blends with all types of architecture and the weathered patina adds to the wood's charm.

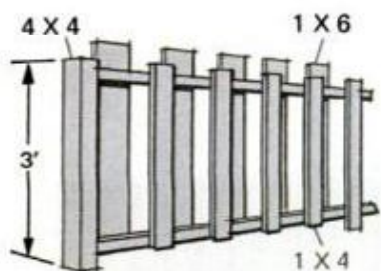
Almost any wood can be used for the in-the-earth posts, but cedar is generally accepted as the best choice. It is not expensive and will last the longest when embedded in soil.

Posts can be placed in a concrete collar as shown or simply surrounded by tamped earth. If you use concrete, make certain that each post runs through the footing. Otherwise, water draining *through* the post will be trapped below and the rotting process will be accelerated.

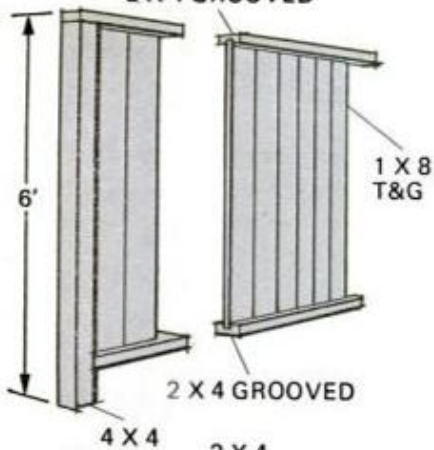
Redwood and pine are the woods usually preferred for above-ground use—the first because of its longevity when exposed to weather and the second because of low price. ★★★



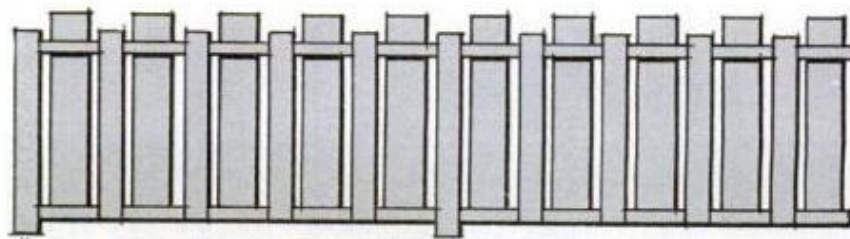
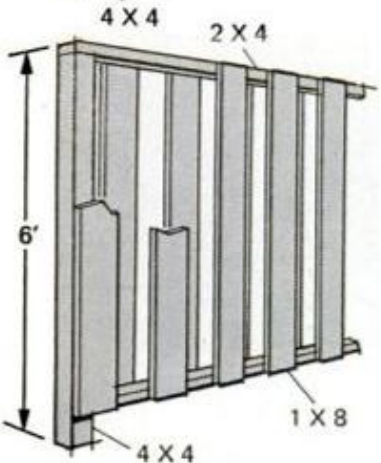
SOLID PRIVACY SCREEN is suited to large yards. Decorative horizontal members above panels are ideal for hanging plants, ivy or ornamental lanterns



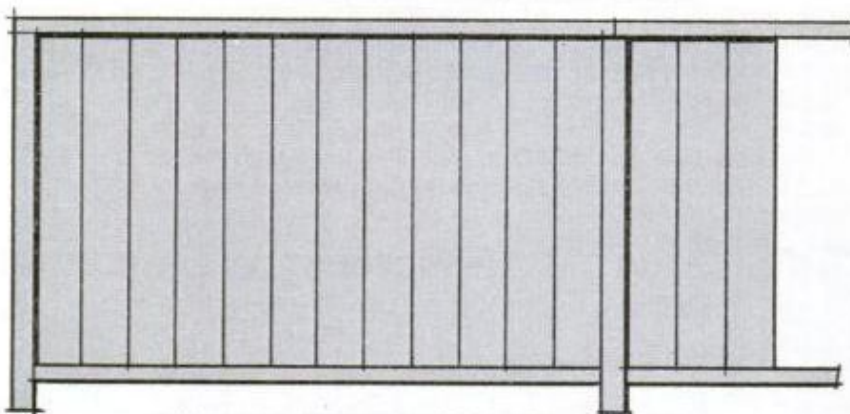
2 X 4 GROOVED



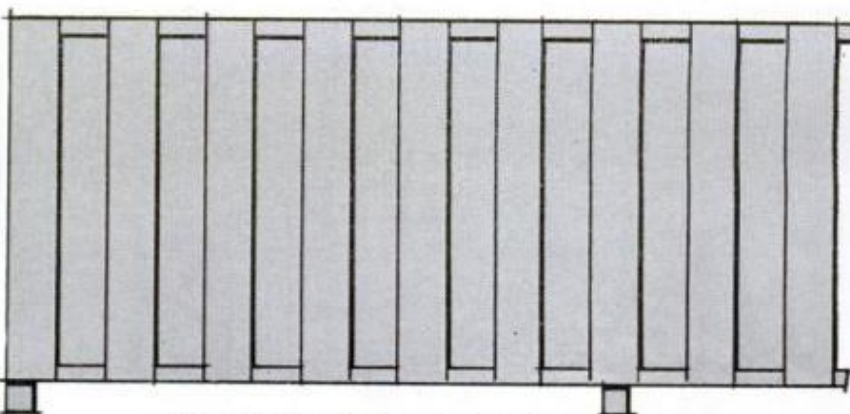
2 X 4 GROOVED



ALTERNATE WIDTHS ON ALTERNATE SIDES

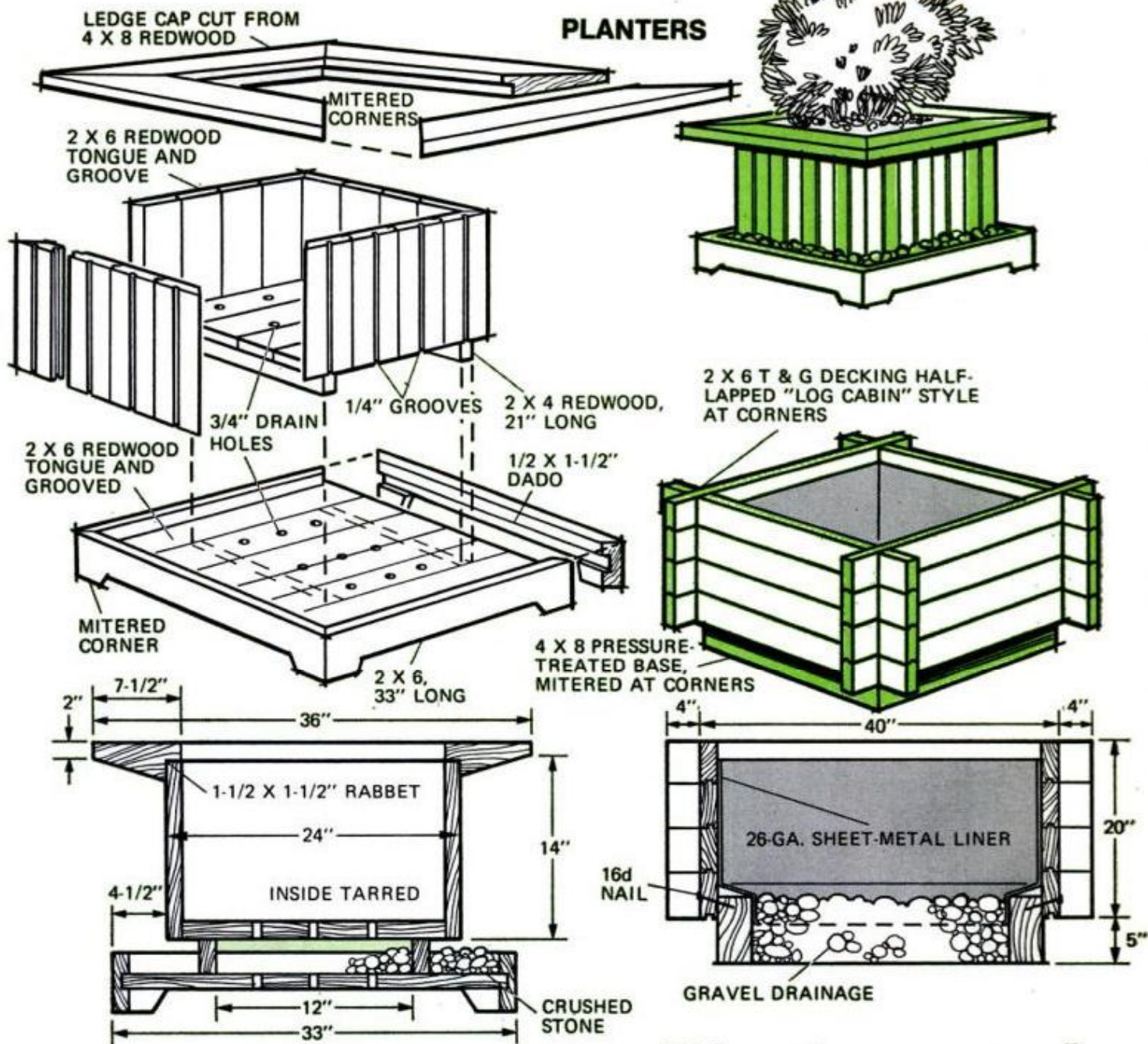


BOTH SIDES OF THIS FENCE LOOK THE SAME

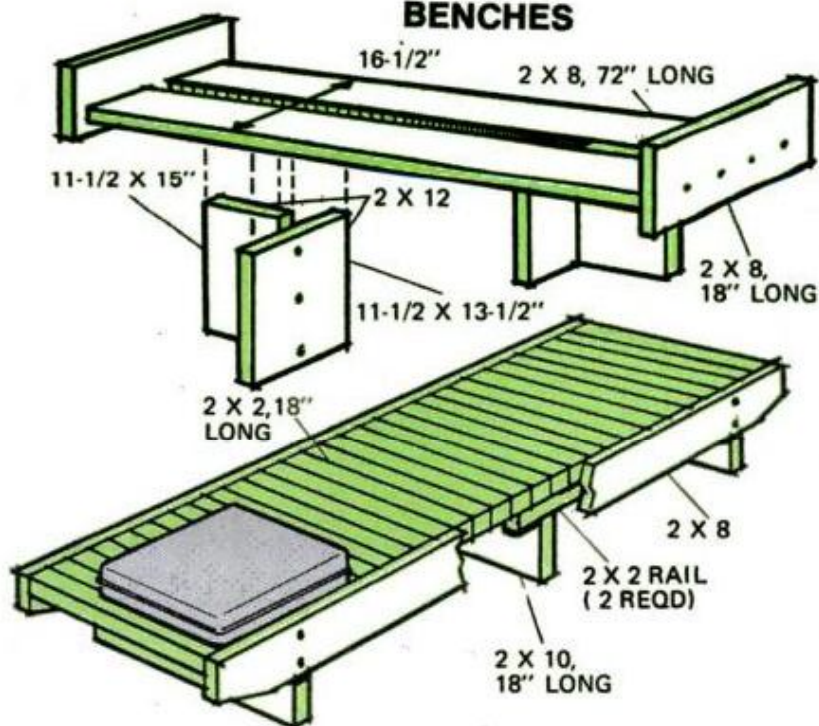


ANOTHER BOARD-AND-BOARD VARIATION

PLANTERS



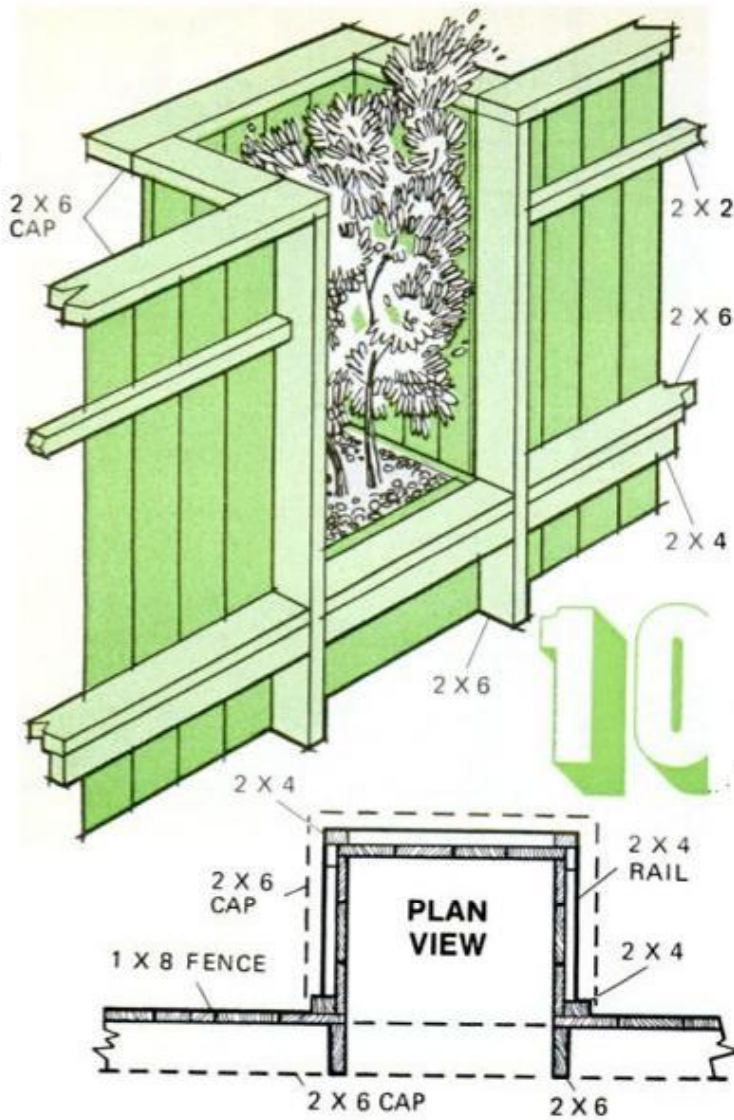
BENCHES



Planters and benches

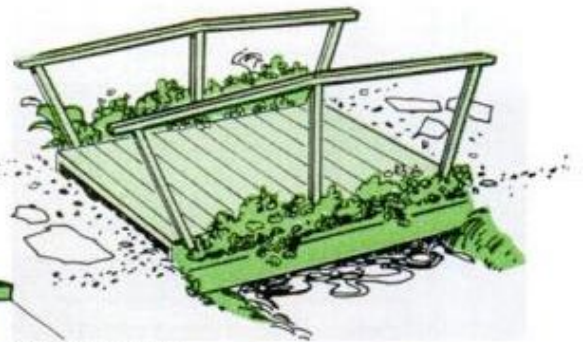
CALIFORNIA redwood is the best wood to use for planters and benches. It contains natural chemicals that resist decay and termites, weathers well and requires little or no maintenance. Top grades of heartwood are best when the bench or planter is to sit directly on the ground. Sapwoods (garden grades of redwood) cost less and are suitable when structures are to be up off the ground. Application of a clear water repellent will help the wood retain its natural redwood color and protect it against dirt and grime.

Fence niche planter

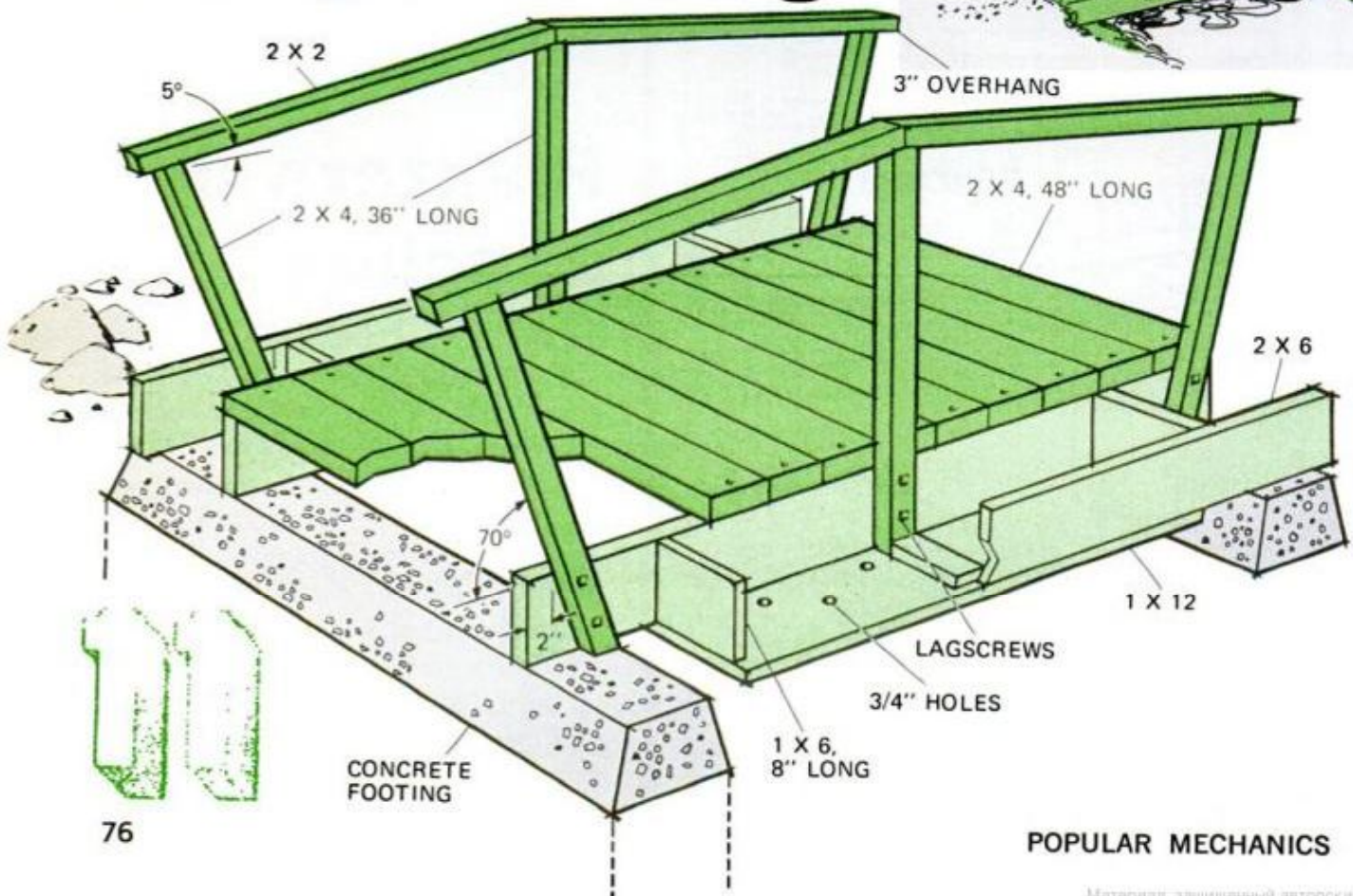


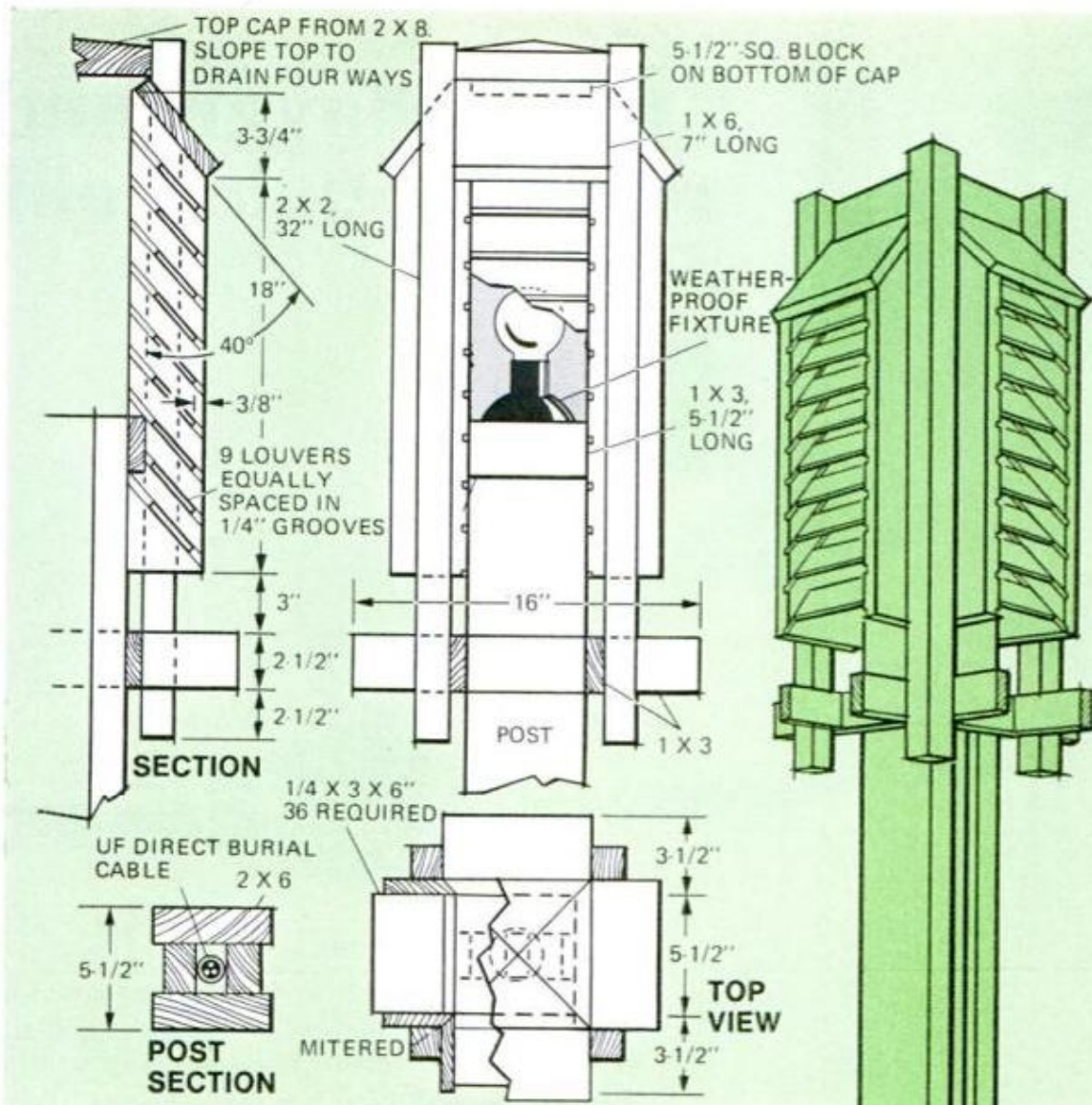
SOMETHING DIFFERENT in the way of planters are these niches that are framed as part of the fence. Besides being a novel feature that serves to break up a long expanse of plain fence, the enclosures actually afford protection to a plant from strong winds and at the same time provide extra bracing to the fence itself.

A small bridge, such as the one below with its built-in planter boxes, will add charm to a fish pond and rock garden. When building both these projects from long-lasting California redwood, use noncorroding nails (hot-dipped galvanized, aluminum alloy or stainless steel) so the nails won't discolor the wood.



Rock garden bridge





Handsome yard light

12

WOOD is always at home out-of-doors. It brings beauty, character and personality to every setting. A good example is this all-wood yard light. A most attractive addition to the yard during the day, it offers a dramatic nighttime effect with its unique louvered "shade." It's made of stock sizes of common lumber, including the built-up post. The shade slides down over the top of the post and is held by screws placed through the crossbars. A weatherproof socket and direct-burial cable should be used. Your local code may also call for conduit and lead-covered wires.



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Playground equipment



Bouncing teeter board

It's possible to add playground equipment to your back-yard "family-fun center" without spending a great deal of money. With a little imagination, you can convert everyday items that no longer serve their original purpose into games for your youngsters. The teeter board, for example, is simply four coil springs from a car attached to an old wheel hub. Use a heavy truck tire for a base and a 2x10 plank for the board. Paint in bright colors.

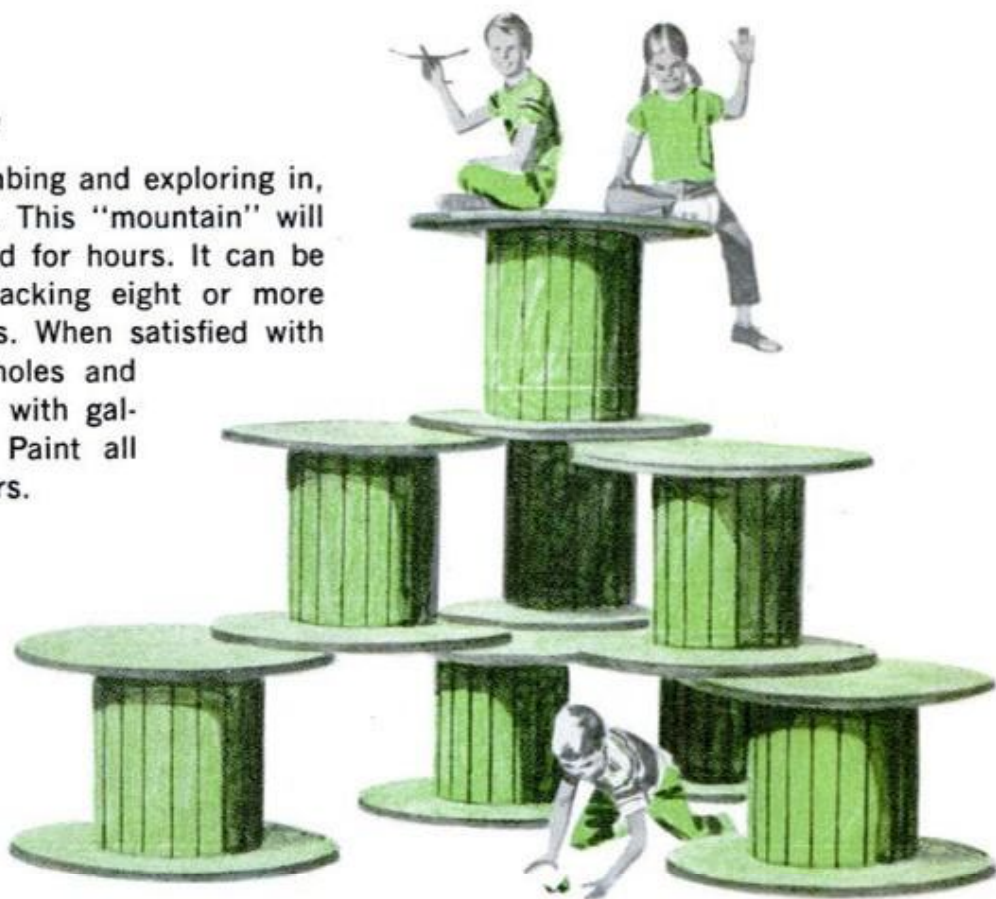
Merry-go-round swing

When you lay out the location for this toy, allow plenty of room so the kids can swing and twist on it in all directions. For a base, cut a 3-ft. disc from $\frac{3}{4}$ -in. exterior plywood. Bore four holes equidistant around the circumference 2 in. from the edge. Secure with short hemp ropes knotted below and fasten to a length of rope attached to an overhead horizontal cross-piece between two trees.



Wire-spool 'mountain'

Kids never tire of climbing and exploring in, over, under or wherever. This "mountain" will keep youngsters occupied for hours. It can be quickly fashioned by stacking eight or more large wooden wire-spools. When satisfied with the arrangement, drill holes and bolt the spools together with galvanized carriage bolts. Paint all parts in a variety of colors.



Stand-up swing

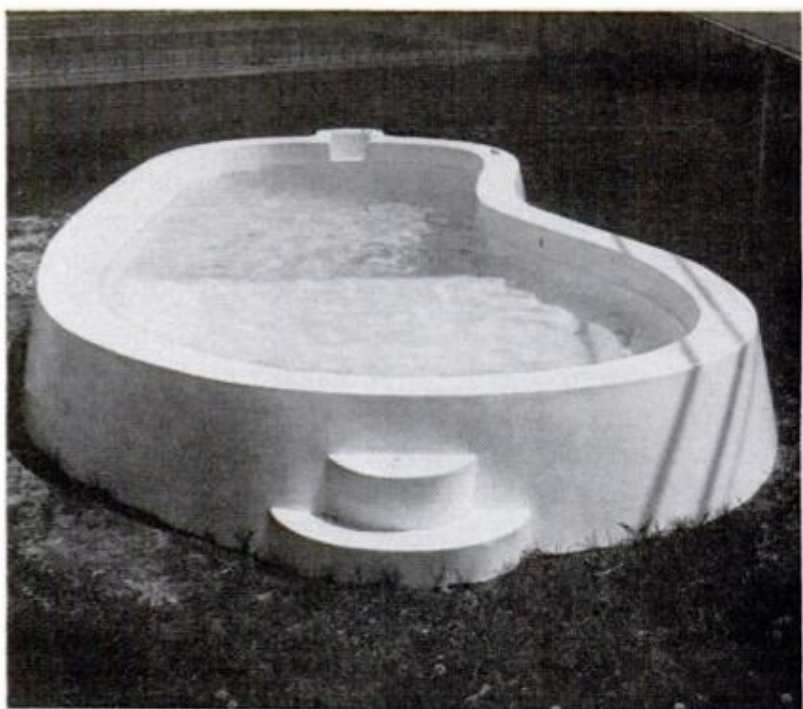
The whole gang has fun on a swing made of 2x6s, chains and posts. Plant the vertical posts at least 3 ft. in the ground, then notch and secure the crosspieces with strap iron and hefty hardware. Though most of the equipment shown on these pages should be painted bright colors, the wood parts on this one should be treated with preservative only. The plank, under any circumstance, should not have a slick surface.



14

One-piece fiberglass pool

RESEMBLING a giant bathtub, this one-piece, above-ground fiberglass swimming pool has a mirror finish that never needs painting and no leak-producing seams. Claimed to be stronger than concrete, it has outside and inside steps, with built-in skim-filtering system. The 12x25-ft. kidney-shaped pool is 2½ to 5 ft. deep, can be installed in as little as 72 hours. White or aqua pool weighs 2000 lbs., sells for \$3395 f.o.b. Swim-Gard, Inc., 950 Cooper St., Box 70, Deptford, N.J. 08096.

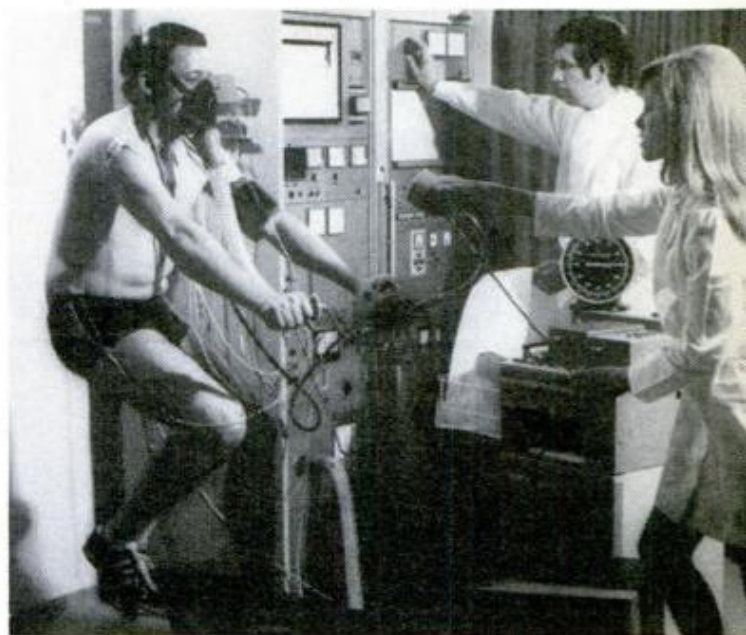


15

Prefabbed deck modules

FACTORY assembled and prestained Reddi-Deck patio sections are ready to install on level ground, gravel, sand or concrete. Durable redwood 2x4s in new 3x3 or 4x4-ft. packaged units interlock without nails in checkerboard or striped pattern, can be picked up and rearranged at will. Units are priced at \$12 and \$15. For more information, write Georgia-Pacific Corp., 900 S.W. Fifth Ave., Portland, Ore. 97204.





Electronics at the Olympics

Behind-the-scenes technical achievements will be almost as amazing as athletic prowess at the 1972 Summer Olympics in Munich this month. A "superlexicon" for fans and reporters, for instance, gives personal data concerning 15,000 athletes, officials, coaches and the like at the touch of a key (upper left). The Siemens system even provides lists of records, wins and rankings for all Games since 1896. A spirometric device (above), which instantly analyzes the physical condition of an athlete, is part of extensive medical facilities. And mobile relay stations (left) will allow television and radio signals to be transmitted from anywhere in the area.



GMC shows prototype of its 1973 motor home

Front-wheel drive and tandem rear wheels with independent air suspension are features of an experimental prototype motor home shown recently by GMC Truck & Coach Div.

The 26-foot recreation vehicle will be marketed in early 1973. Other features include an aluminum-and-fiberglass body, 455-cu.-in. V8 engine and automatic transmission.

PM **DODGE CHARGER** OWNERS REPORT

A nationwide survey based on 2,000,000 owner-driven miles

Blinded by style, owners overlooked rear visibility!



By MICHAEL LAMM, West Coast Editor Photos by the author

DODGE WENT to two wheelbases for its intermediate Coronet line in 1971. That model year all two-door Coronets became Chargers. It's the same for 1972—if you want a two-door Coronet, you buy the Charger.

Charger coupes and two-door hardtops now span a 115-inch wheelbase, as against 118 for Coronet sedans and wagons. Sheet-metal differences distinguish the Charger and leave it looking quite a bit flashier and more sporting than the Coronet.

Styling, in fact, became *the* reason most owners went for the Charger—nearly 68 percent said that the car's flowing design and sleek lines convinced them that this was the car they had to have.

On the other hand, it was this same factor—looks—that brought out owners' single strongest gripe: lousy rear visibility. The combination of smallish, back-angled side windows plus a steeply slop-

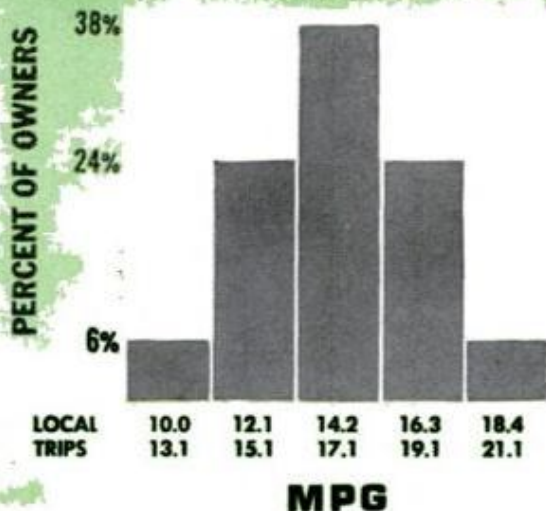
ing, boxed-in rear glass makes backing up or switching lanes a moment of truth. From the horse's mouth:

"Backing up is like driving with a paper bag over your head. This type of defect is stupid and dangerous." "Can't see the trunk out back—too many blind spots." "Rear window should wrap around roof because it's impossible to see what's coming at a Y intersection." "My rear passengers can't see out, and it's tough enough for me."

The Charger comes with Chrysler Corp.'s long-faithful, economical slant Six as basic standard equipment. Yet only 0.8 percent of our owners reported driving six-cylinder cars. Most chose the two-barrel 318-c.i.d. V8. This engine delivers good performance, they say, between 14 and 17 mpg. We'd estimate that the Six will better the 318's fuel economy by about two mpg all around, although data were

DODGE CHARGER FUEL-MILEAGE CHART

318-cu.-in. V8



EXCELLENT DRIVING POSITION and convenient reaches to all controls, report owners. Tach is available in Special Edition and Rallye packages. Huge doors make getting out a bit tough in tight spaces; some say doors are heavy when car is parked on slant



OWNERS WAX RHAPSODIC about Charger's looks, name it their primary reason for buying. Some, though, say high bumper and grille get dinged easily in parking, especially without optional guards (at \$16 additional)

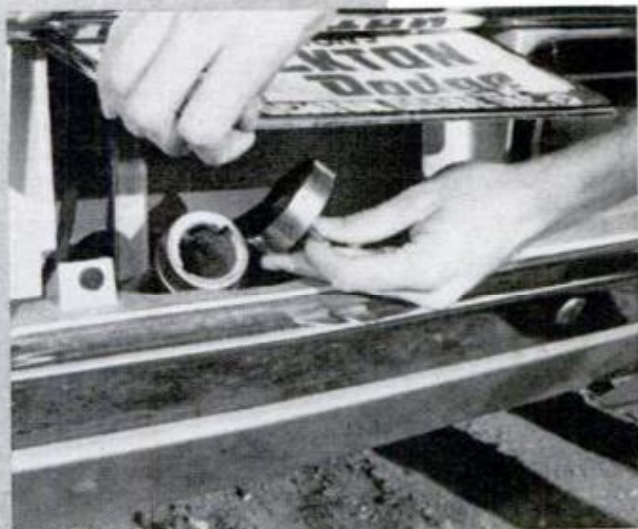
insufficient to verify this. The new-for-1972 400 c.i.d. V8 gets approximately two mpg less than the 318. Poor gas mileage cropped up as a notable complaint among only 7.2 percent of Charger owners, so most feel they're getting what's expected. Some aspects owners appreciate the most:

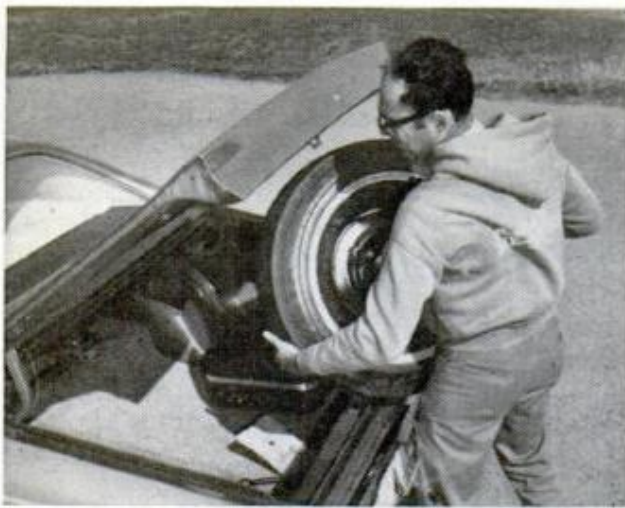
"Best-looking sports-type car with adequate room in rear seat and trunk." "Gets a lot of compliments." "Good handling with torsion bar suspension." "Goes like a rocket, and girls love it." "With the complete set of instruments, I can see what's going to happen instead of what happened." "Comfortable and lots of room." "Body is constructed like a high-performance aircraft fuselage." "Limited-slip differential makes my Charger handle well in winter."

As often happens when we ask about a car's workmanship, opinions vary: 57.3 percent rated workmanship "good to excellent," but only 6.0 percent voted the straight "excellent" ticket. Random jottings on that topic:

"Workmanship unsurpassed by any other car manufacturer." "For the price it should be better built." "As a police

AWKWARD POSITION OF GAS CAP makes it hard to tighten, slops out fuel. And a recurring complaint (as in many cars) is lack of vent panes





HIGH LOADING SILL makes spare heavy. In place at front of trunk, it takes up valuable cargo space



GOOD HANDLING, roadholding, but wide pillars and small rear window make backing a time for prayer



officer, I drive many different makes of cars, and I find the Charger better than most in nearly every area. If the factory would pay a little more attention to small, not readily visible things, I feel the car would be about perfect." "What happened to the 50,000-mile warranty I had on my 1967 Coronet? They don't make them like they used to."

As to handling and comfort:

"I like the way the car handles in tight situations. It feels at home at any speed, and that doesn't change with road condition. Very pleasant to drive and ride. It also has quick acceleration necessary for entering expressways."

When we asked Charger owners what they would like changed, the overwhelming cry was for better rear vision. After that:

"More legroom in back." "Better bumpers; front one gives no protection, and guards are useless." "A better rear-window defogger. It's the blower type, and I much prefer the wire ones." "Better quality tires as standard equipment." "A flow-through ventilation system that works." "Go back to vent windows."

One nagging complaint centered on the Charger's being hard to start (7.7 percent of all owners mentioned this, with about half of them saying it happened only in cold weather; the other half got it only in trying to restart a fully warmed-up engine). It's a puzzler that's cropped up in other Owners Reports of Chrysler Corp. cars and a few other makes. No one seems to know the precise cause. Opinions range from "stuck choke" and "smog junk" to "that's the way it is."

What about dealers and dealer service?

"I am treated like a best friend." "Sales

MOST OWNERS CHOSE 318 V8, found it tough, economical, but a few mentioned some starting problems

HORN'S HARD TO HONK while turning, mirror sometimes blocks view, but dashboard is well laid out



Summary of 1972 Dodge Charger Owners Reports*

| | |
|---------------------------------|-----------|
| Total miles driven | 2,036,997 |
| Average miles per gallon | |
| 318-cu.-in. V8: local driving | 14.2 |
| long trips | 17.1 |
| 400-cu.-in. V8: local driving | 12.4 |
| long trips | 15.1 |
| Engines: | |
| 225-cu.-in. Six | 0.8% |
| 318-cu.-in. V8 | 65.5 |
| 340-cu.-in. V8 | 3.0 |
| 400-cu.-in. V8 | 28.4 |
| 440-cu.-in. V8 | 2.3 |
| Transmissions: | |
| Automatic | 95.8% |
| 4-speed manual | 2.7 |
| 3-speed manual | 1.5 |
| Body styles: | |
| 2-door coupe | 11.2% |
| 2-door hardtop | 88.8 |
| Models: | |
| Charger SE | 85.7% |
| Charger 500 | 14.3 |
| Why the Charger? | |
| Styling | 67.8% |
| Past experience | 16.7 |
| Price | 8.5 |
| Size | 6.6 |
| Specific likes: | |
| Styling | 62.1% |
| Handling | 50.2 |
| Comfort | 24.9 |

| | |
|-------------------------------------|-------|
| Ride | 21.0 |
| Economy | 19.8 |
| Performance | 16.2 |
| Specific dislikes: | |
| Poor rear vision | 30.0% |
| Rattles | 13.2 |
| Low gas mileage | 7.4 |
| Harsh ride | 5.8 |
| Poor workmanship | 5.9 |
| Poor dealer service | 4.3 |
| What changes would you like? | |
| Better rear vision | 32.0% |
| More rear legroom | 6.5 |
| Change styling | 5.6 |
| Had any mechanical trouble? | |
| Yes | 54.5% |
| No | 45.5 |
| What kind of trouble? | |
| Carburetor | 15.4% |
| Transmission | 14.7 |
| Airconditioning | 8.4 |
| Windshield wipers | 7.7 |
| Electrical | 7.7 |
| Cold starts | 7.7 |
| Did you repair it yourself? | |
| No | 94.5% |
| Yes | 5.5 |
| Dealer repairs satisfactory? | |
| Yes | 63.4% |
| No | 36.6 |

| | |
|---------------------------------------|-------|
| Is the Charger your only car? | |
| No | 52.6% |
| Yes | 47.4 |
| Other cars owned: | |
| Dodge | 28.0% |
| Ford | 23.2 |
| Chevrolet | 16.1 |
| Plymouth | 9.9 |
| Chrysler | 7.8 |
| Accessories/power options: | |
| Automatic transmission | 95.8% |
| Power steering and brakes (both) | 70.4 |
| Airconditioning | 55.2 |
| Radio | 46.2 |
| Rear defroster | 29.5 |
| Power steering | 24.0 |
| Vinyl top | 21.5 |
| Tinted glass | 15.9 |
| Rear speaker | 15.5 |
| Bucket seats | 13.9 |
| Stereo tape | 12.8 |
| Age distribution of owners: | |
| 15-29 | 47.7% |
| 30-49 | 32.0 |
| 50-plus | 20.2 |
| Would you buy another Charger? | |
| Yes | 76.0% |
| No | 24.0 |

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

department good, service department fair." "The man understands how to get along with people—isn't pushy." "Slow to make repairs; discourteous sales personnel." "Had to make five trips to one dealer because the hidden wipers wouldn't park correctly. He never did fix them. Took it to a second dealer who put it back like new." "Was completely pleased with every aspect of my transaction with this dealer."

Charger owners tend to be young, with nearly half of our respondents under 30. Contrast this with Saab owners (see pages 46-49), who are evenly divided in all age groups. Since younger owners logically expect changes in their lives—in family size, situation, income, status—nearly a quarter said they probably

wouldn't buy a Charger next time. This probably isn't so much a reflection on the car itself as on the fact that it's a young person's choice.

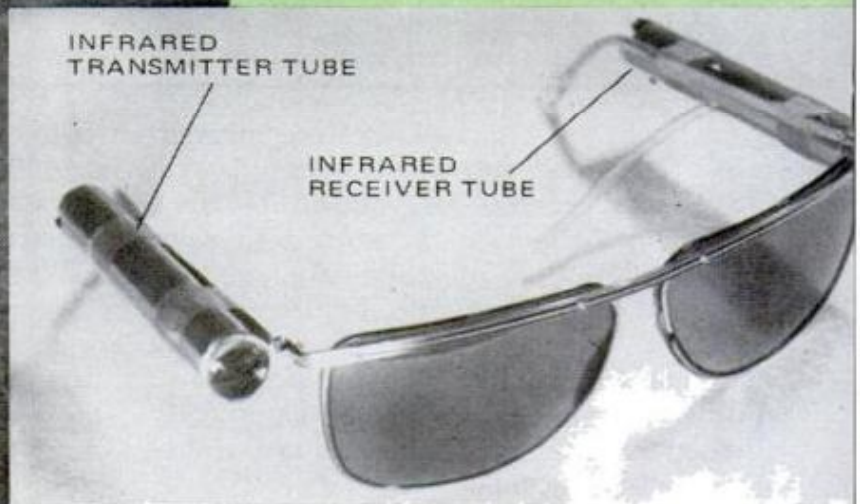
We'll leave the final summation to a 25-year-old Philadelphia technician, who writes: "This is my second Charger, my first being a 1968. I drove the '68 almost four years and 65,000 miles and had no major problems. I've had this 1972 Special Edition about seven months now, and it's performing as good as, if not better than, my previous Charger. If Dodge continues to build Charger this well, then I don't think I'll ever buy any other kind of car. I like to go for long rides in it on my days off. The Charger is very relaxing. My only complaint is that I cannot drive it all day, every day! ★★"

CHARGER ROOFLINE is one of the styling elements that captured highly style-conscious buyers of the car





GLASSES THAT "SEE" for the blind are among many ingenious innovations enabling the sightless to move about with newfound freedom and confidence. The electronic detection system is based on the use of invisible infrared rays beamed forward from a tiny light-emitting diode housed in a small tube along one side of the eyeglass frame. If the rays strike an obstacle in the user's path, reflections bounce back and activate a photo-diode receiver in a similar tube on the other side of the eyeglass frame. This triggers an alarm circuit that sounds a warning tone in the user's ear, telling him that an obstruction lies ahead. Advantage of the system is that it detects objects above waist level like a tree branch, as shown in photo at left and in drawing on facing page. Photo on facing page shows how circuit boards, diodes and batteries all fit into the two slim, 1/2-inch-diameter tubes



Electronic 'eyes' let

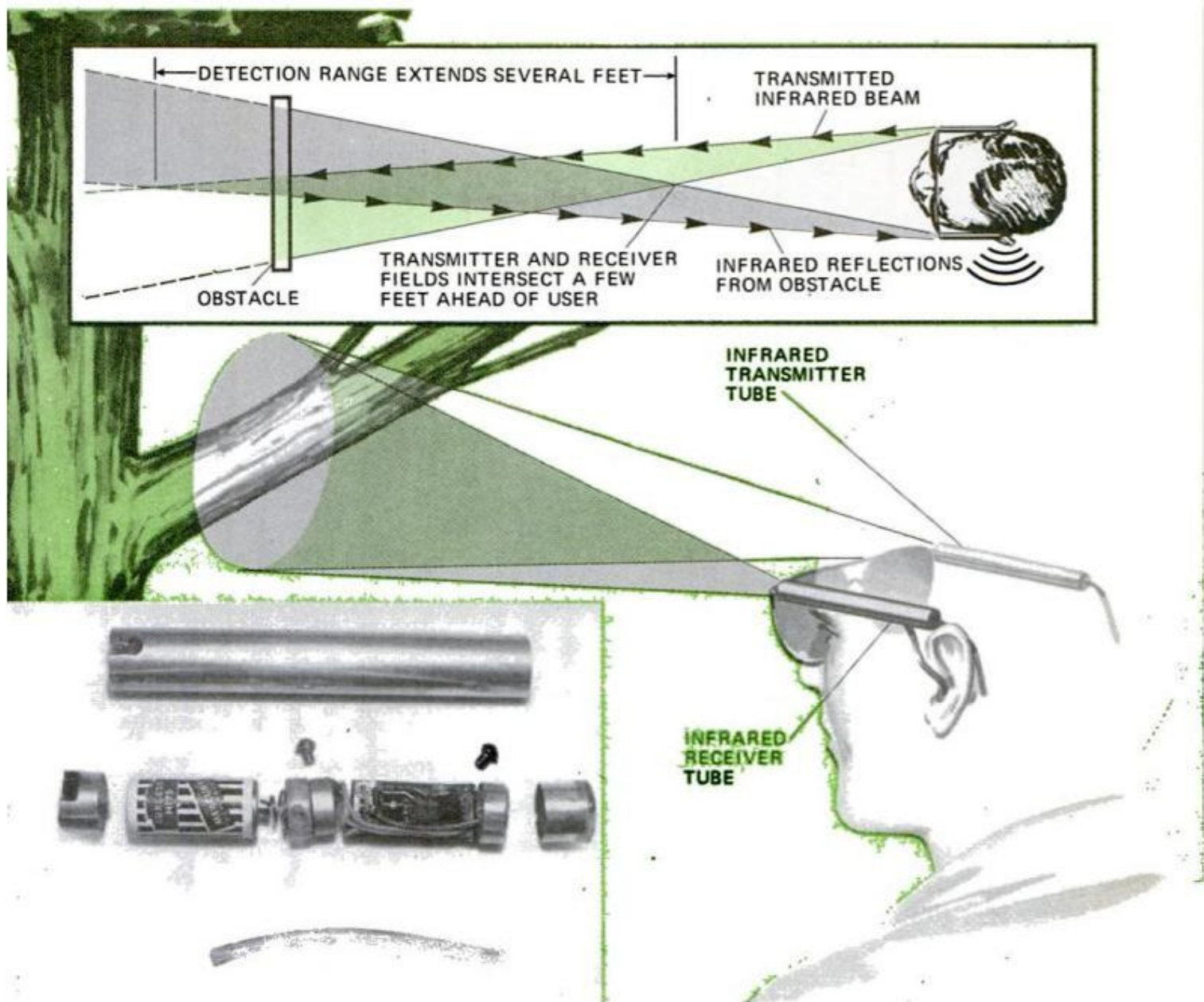
Radarlike glasses, portable reading devices, even artificial eyes that screw into place like a camera lens, are among miraculous new aids for the blind

By **SHELDON M. GALLAGER**

THE OLD EXPRESSION "as blind as a bat" will soon be a thing of the past. Not only do bats get around better than most people with perfect vision, but their remarkable built-in sonar-like guidance system may well serve as the model for similar aids to help the blind navigate almost as well as a person with full sight.

One such aid is a clever electronic detection system invented by Forrest M. Mims, a young electronics engineer from Albuquerque, N.M. The Mims system, shown on this and the facing page, works something like sonar and radar except that invisible infrared light rays are used in place of sonic pulses or radio waves.

POPULAR MECHANICS



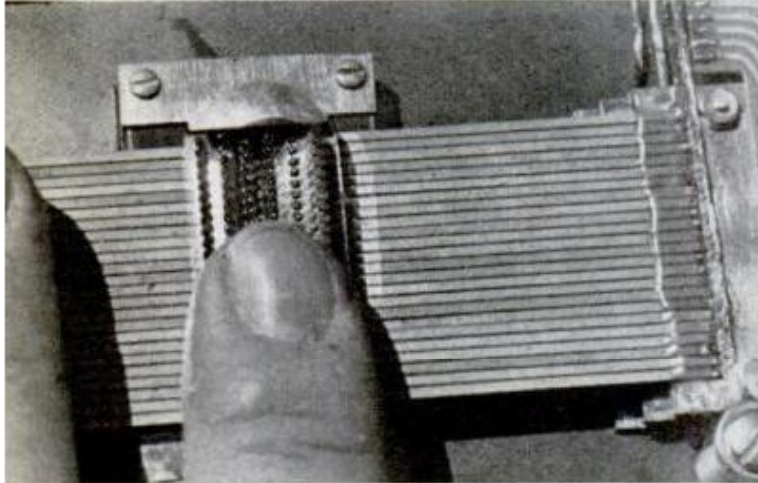
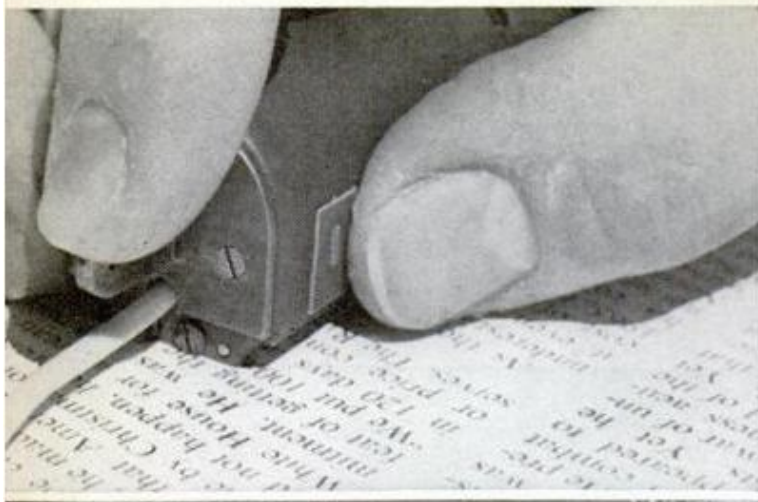
the sightless 'see'

The device consists of two slender tubes attached to a pair of ordinary sunglasses, one on each side. From one tube, infrared rays are transmitted in a pulsed beam from a light-emitting diode (LED). When the rays strike an object, some of the light is reflected back and picked up by an ultrasensitive photo-diode in the second tube on the opposite side of the eyeglass frame. This triggers an alarm circuit that sounds a 300-cycle warning tone heard through a tiny tube inserted in the user's ear. By moving his head slightly up, down and sideways, the user can readily "scan" the obstacle to tell if it's something narrow like a post or tree that

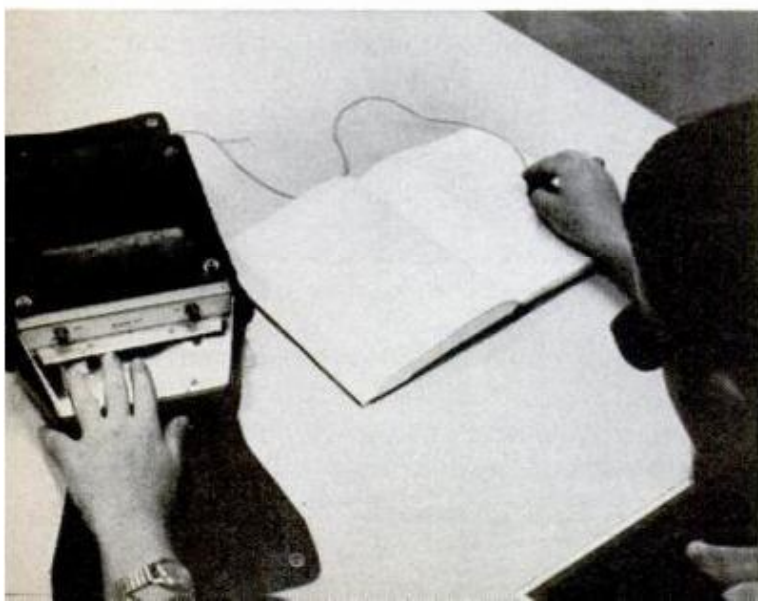
he can step around, something with an opening in the middle like a doorway that he can walk through, or something broad and flat like a wall or fence that he must turn away from.

Unlike guide dogs, canes and other hand-held detection devices, Mims's "electronic eyes" have the advantage of closely approximating the location and movements of a person's real eyes—they "look" wherever the user looks, simulating normal vision. They also detect objects above waist level, such as low-hanging signs, awnings, tree branches and the like, that a cane might easily miss.

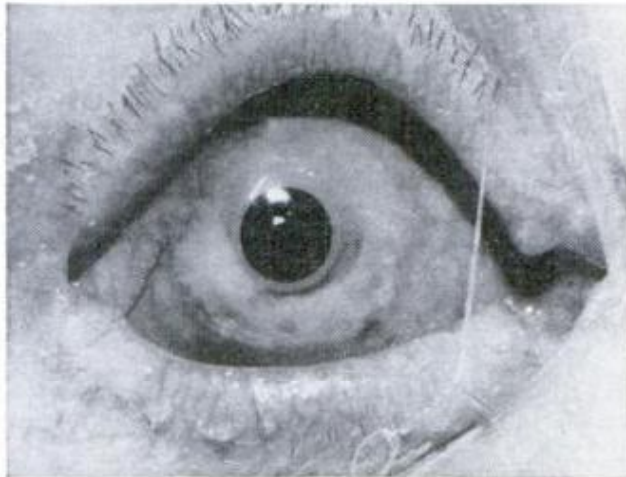
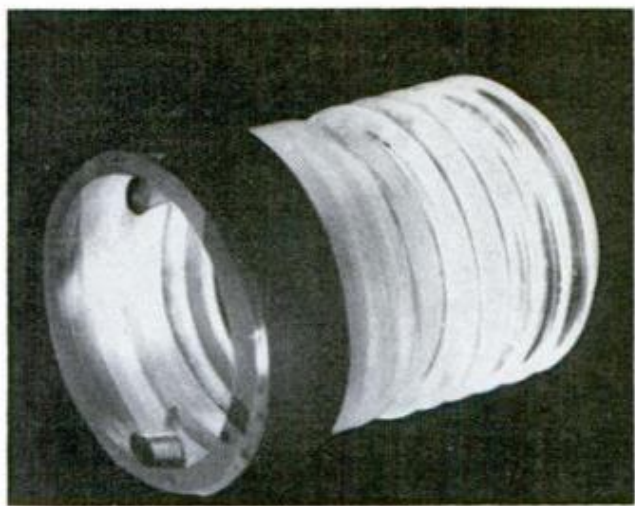
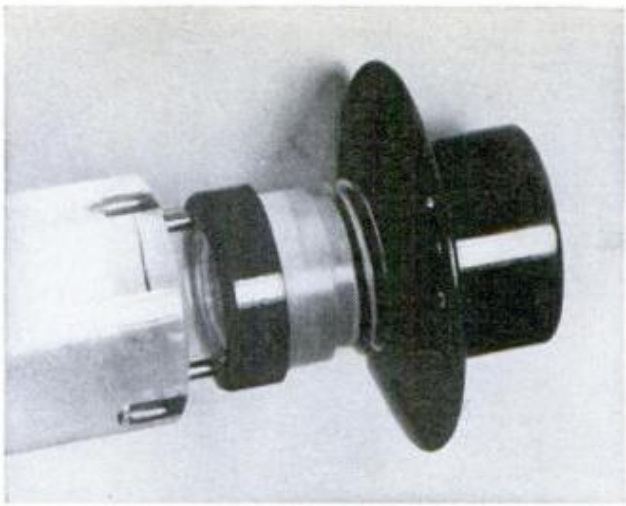
Although the system is capable of spot-



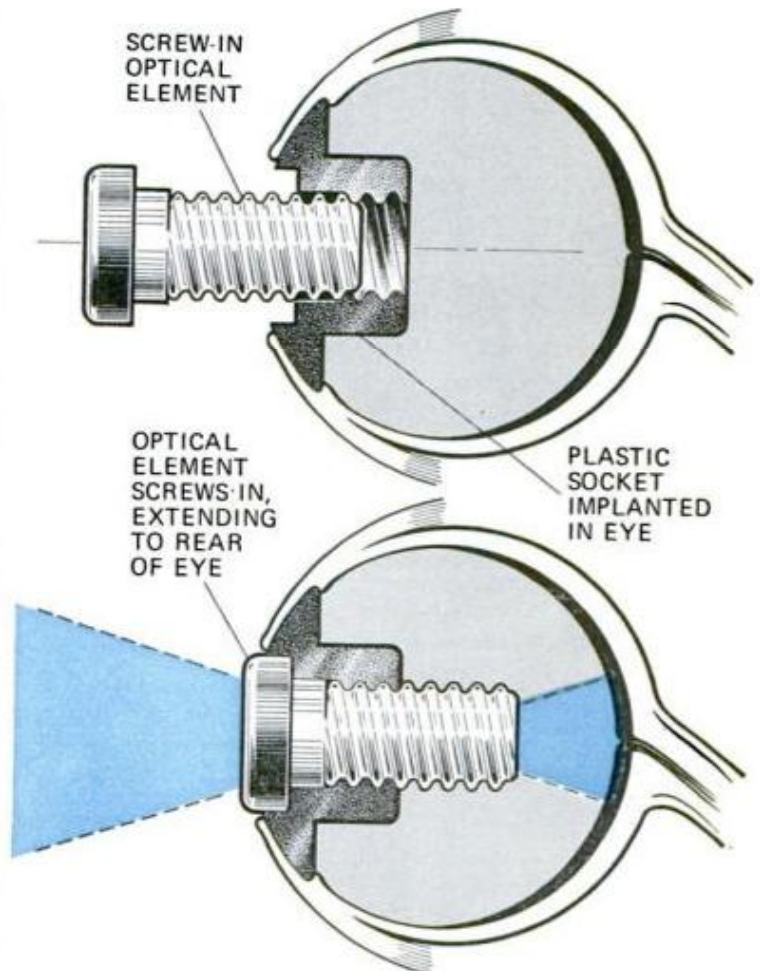
NO BIGGER than a portable tape recorder, this remarkable aid enables the blind to read any ordinary printed type without need for a braille translation. A photoelectric sensor on the end of a cord is simply moved across the printed page (upper photo above), while the user holds a finger lightly against the rows of tiny vibrating pins (lower photo above). The optical images picked up by the sensor are transformed into similar shapes by the vibrating pins. The tingling sensations that are produced by the pins thus permit the user to "feel" one letter after another as the sensor scans the printed type. Photo at the right shows a blind Berkeley, Calif., student using the portable Optacon device to "read" a notice posted on a school wall. This aid is now under development at Stanford University



ting objects up to 50 feet away, the transmitter and receiver tubes are deliberately angled so their fields of view converge a few feet ahead of the user. This restricts the coverage to obstacles within immediate range. Mims points out the arrangement is also helpful in locating desired objects. A person entering a room, for instance, can find a chair to sit in merely by scanning the area briefly until the signals indicate something resembling the shape and size of a chair. With practice, users soon can tell different objects by recognizing familiar signal patterns.



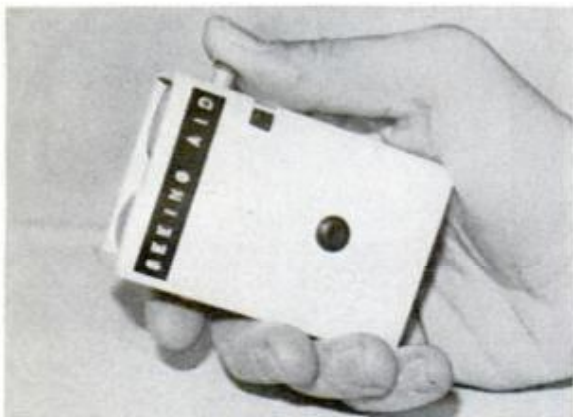
ARTIFICIAL CORNEAS are restoring sight to many blind persons in cases where live corneal transplants either have failed or can't be performed. The technique, developed in England, consists of first implanting a threaded plastic socket into the eye, as shown in the drawing at right. A barrel-shaped plastic lens (top photo at right) is then threaded into the socket with a special "screwdriver" (top photo at left). The photo immediately above shows actual eye implant after operation is complete (tiny post at right is used to prop eye open during surgery, will be removed.) Because eyes normally reject such foreign bodies, method was thought to be impossible until surgeons, removing shattered canopy fragments from the eyes of injured fighter pilots, found that the special windshield plastic used in the planes would not react harmfully with eye tissue



At present, the system provides only a single signal for a fixed range, but Mims is now at work on more sophisticated versions that will contain two or more infrared beams pulsed at different frequencies and aimed to converge at different distances. Each infrared frequency would cause the receiver alarm circuit to emit a different warning tone. Thus a user would hear one tone at, say, 8 to 10 feet, another at 4 to 5 feet and a final one at 1 to 2 feet. Such a system would tell not only how far away an obstacle is but also how fast it's approaching.

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The Mims device is not the only electronic detection system being developed, but it is so far one of the smallest and least expensive. The twin transmitter and receiver tubes are only a half inch in diameter and 3½ inches long. Together, they weigh less than three ounces, including batteries and eyeglass frame. Mims thinks the elements can be further miniaturized to fit right inside the eyeglasses themselves and thus be virtually unnoticeable. Prices are expected to range around \$300 to \$350—not much more than the cost of a good-quality hearing aid. The Veter-



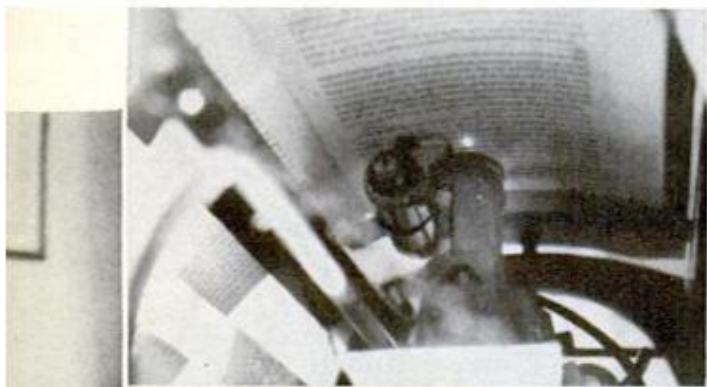
HAND-HELD DETECTOR is based on same system as infrared eyeglasses. It's handy for some situations, but most users prefer eyeglass version because it follows head movements automatically

ILLUMINATED VIEWER above allows legally blind persons with very low vision to read books, magazines, newspapers and other printed matter by displaying a greatly enlarged image of the type on a 9 by 14-inch rear-projection screen. Called the Optiscope, it can also be used to provide magnified views of pictures and drawings (left, above). Device is made by Opaque Systems, Ltd., of Hempstead, N. Y., and it sells for \$295

ans Administration is testing two of the aids, and the American Foundation for the Blind has expressed a strong interest in the device.

Meanwhile, research in the use of laser-actuated detection devices has also taken a giant step forward. Such detectors work somewhat like the Mims aid except that laser beams are used instead of infrared radiation. A laser beam is directed toward an obstacle, and its reflections are picked up by a light-sensitive receiver spaced

(Please turn to page 178)



READING A BOOK is easier for the blind with this novel Optophone device that converts printed type into audible sounds. The book is placed face down on top and a moving beam of light underneath scans the page, a line at a time, at a rate that can be controlled by the user. The beam is made up of six tiny points of light whose reflections form light and dark images corresponding to the shapes of the letters scanned. These images are then translated electronically into patterns of musical tones, one for each letter of the alphabet, something like the dot-dash patterns in Morse code. A person using the device memorizes the tonal patterns, learning to distinguish entire words almost at once

90



8000 miles in a Model T camper

Photos by Dick Barney



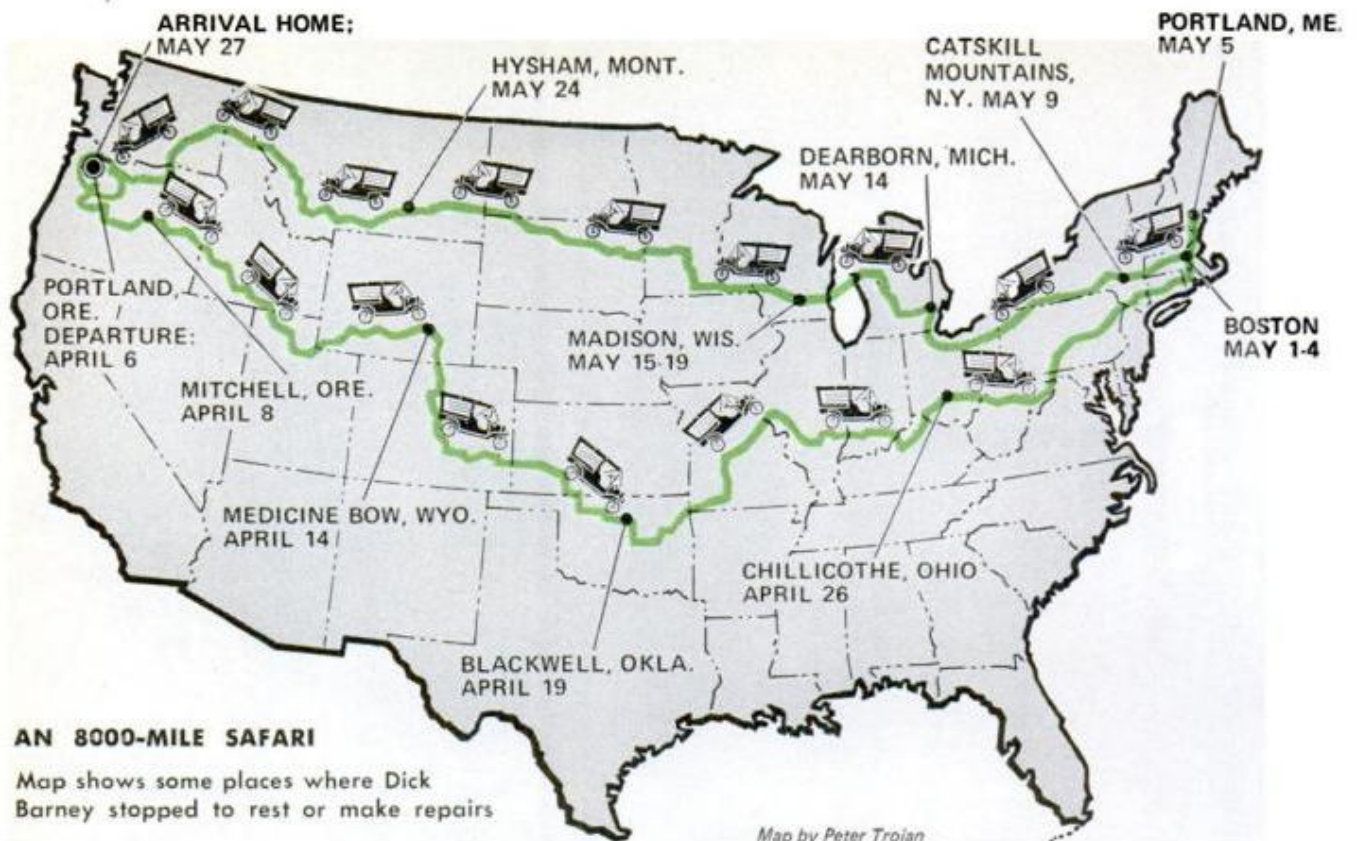
BACK IN '35 Dick Barney got a 1916 Model T at a good price—in exchange for replacing brake linings on the owner's other car. When friends asked Barney what he wanted with such an old buggy, he'd reply: "I'm going to drive it across the continent some day."

Thirty-five years later, on Apr. 6, 1970, he pulled away from the city hall in Portland, Ore., on the first leg of a trip that would take him to Portland, Me., and back. On the way, the 58-year-old proprietor of a music and camera shop would visit sons in Wisconsin and Massachusetts.

First, he had to rebuild the old car. He mounted a camper body on the chassis and installed a 12-volt electrical system to provide juice for lights, wipers and a refrigerator. He overhauled the engine, replacing piston rings, valves, springs and timing gears. Critical parts, unavailable 25 years ago, are back on the market to meet the needs of old-car buffs. But not all parts, Barney warns.

As his experience shows, you don't take a lengthy junket in an antique unless you're a pretty fair mechanic. Most of today's gas station attendants can't even find

DICK BARNEY GETS the feel of his Model T after inspecting chassis. He repaired a rusted-out wheel rim with plastic, replaced ball bearings in wheels
AUGUST 1972



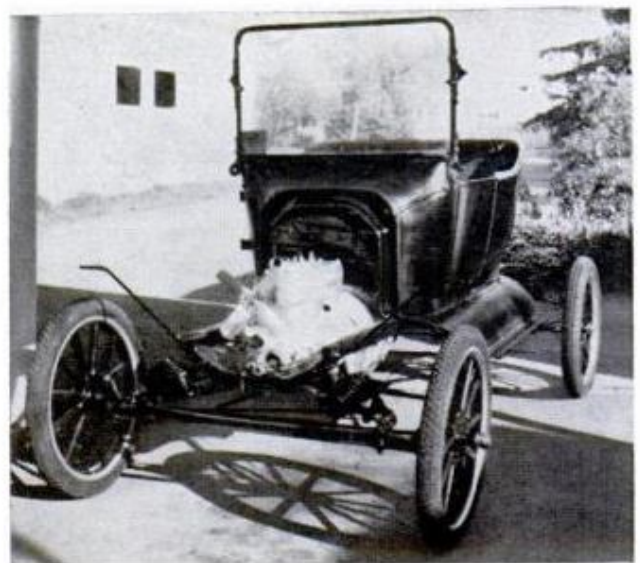
the gas tank on a Model T (under the driver's seat) or oil level indicator (two petcocks on the transmission housing).

Barney made a number of repairs en route. Typical was the way he replaced a broken coilbox contact plate that was keeping the No. 3 cylinder from firing. Since he could not lay his hands on a replacement, he fashioned one from the lid of a grapefruit-juice can. It held up for the next 4500 miles.

He chuckles when he recalls an experience on a steep grade in New York's Catskill Mountains. He was behind a heavily loaded truck grinding toward the top of the hill. Though the "T" could do about 35 mph on a level road, it wasn't much on hills. In low gear—the Model T has but two gears—the car managed from 7 to about 15 mph.

When Barney found that he was slowly gaining on the truck, he decided to pass. "I pulled into the inside lane," he recalls, "with the throttle wide open. As I crawled abreast of the truck we rounded a curve and came in view of a highway work crew. They saw that a 'race' was in progress and cheered as my Model T pulled into a half-length lead. I felt as though I'd just won the Indy 500." ★★★

READY TO ROLL AGAIN after completing repair in Mitchell, Ore. On second day out, a throw-out collar on clutch had broken, requiring replacement



REBUILT ENGINE did not retain refurbished look for long once trip started. A characteristic of Model T engines, says Barney, is a tendency to leak oil



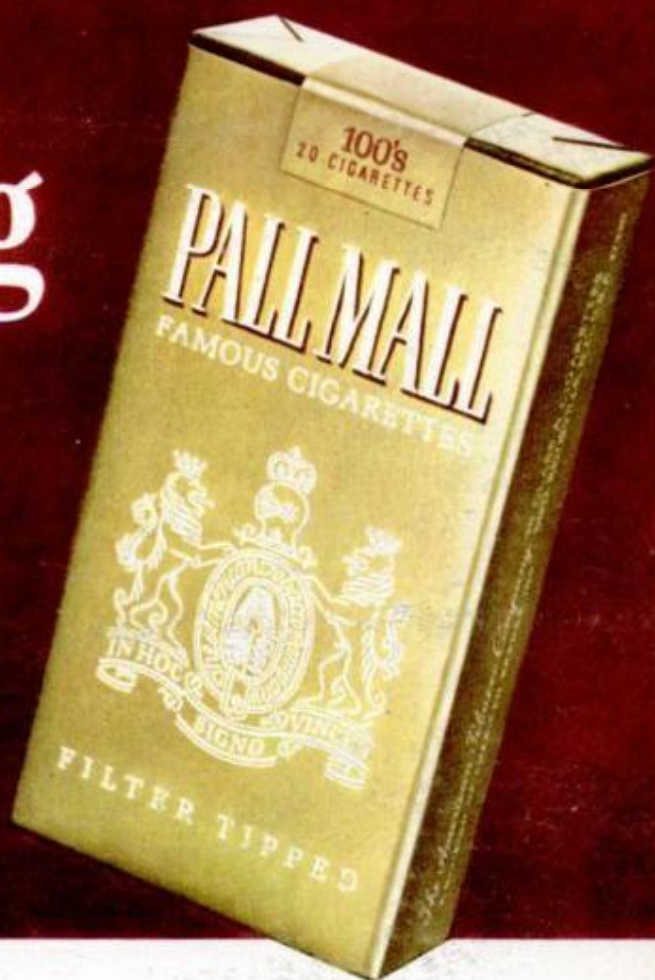
Коллекция автомобилей в музее истории транспорта

Whatever you drive, wherever you go,
Pennzoil is worth asking for.

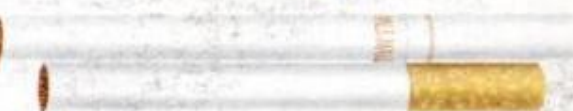


Latest U.S. Government figures show

Pall Mall Gold 100's lower in 'tar' than the best-selling filter king!



Yes, longer yet milder.



PALL MALL GOLD 100's... "tar" 18 mg.—nicotine, 1.3 mg.
Best-selling filter king..... "tar" 20 mg.—nicotine, 1.4 mg.
Of all brands, lowest..... "tar" 1 mg.—nicotine, 0.1 mg.

18 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report APRIL '72.



A LUNG-POWERED "MELODICA" was intended for diversion while driving. But Barney soon abandoned the idea in interest of safety, limiting his musicmaking to stops at gas stations and parking lots



BARNEY'S ANTIQUE CAMPER drew onlookers at almost every stop. Typical was group of men in Buffalo, Mo., who inspected vehicle from high sidewalk

WHEN THE CROSS-COUNTRY DRIVER pulled into the parking lot of the Maine Tourist Information Center at Kittery, he was given enthusiastic greeting by members of MOAL—Maine Obsolete Auto League



LAST OF TRIP'S THREE FLATS was discovered on the morning of final day out. Locating a slow leak in tube called for an improvised water immersion test

THE INTREPID TRAVELER was given an official welcome by Terry Strunk, mayor of Portland, Ore. The slow-paced trip took the better part of two months



A paddlewheel riverboat

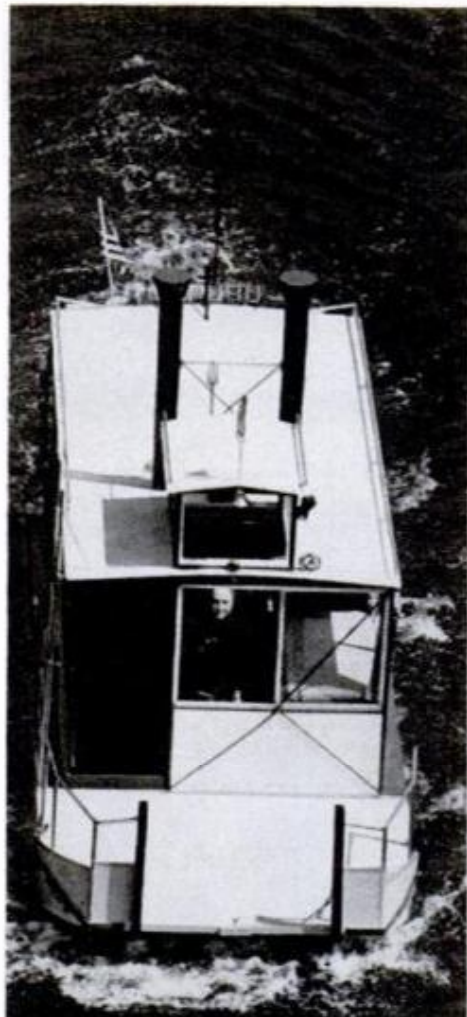
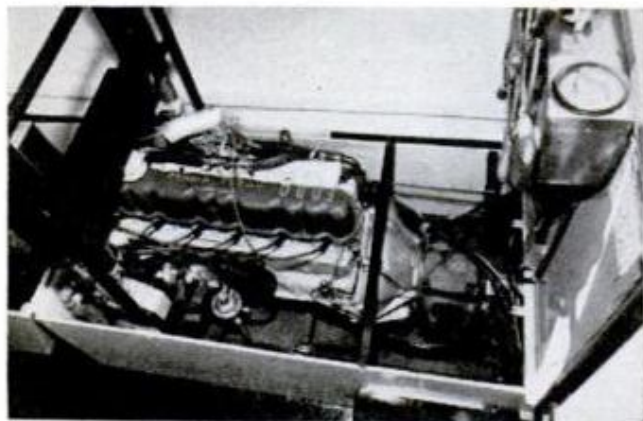
Little Toot is a small version of riverboats once common in America. This beauty of a boat was built under a tree in a yard in Kentucky

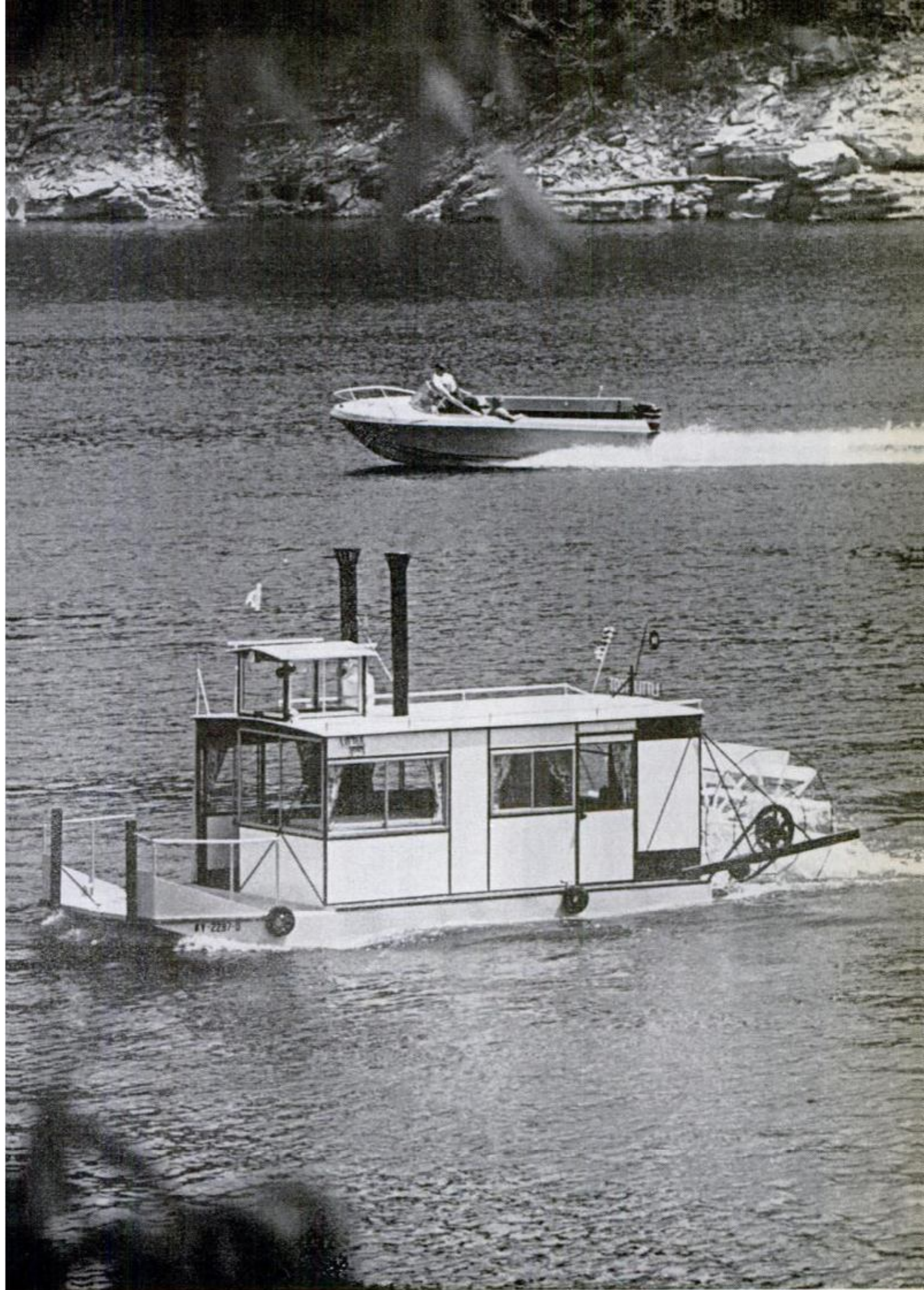
Photos by James Pickerell

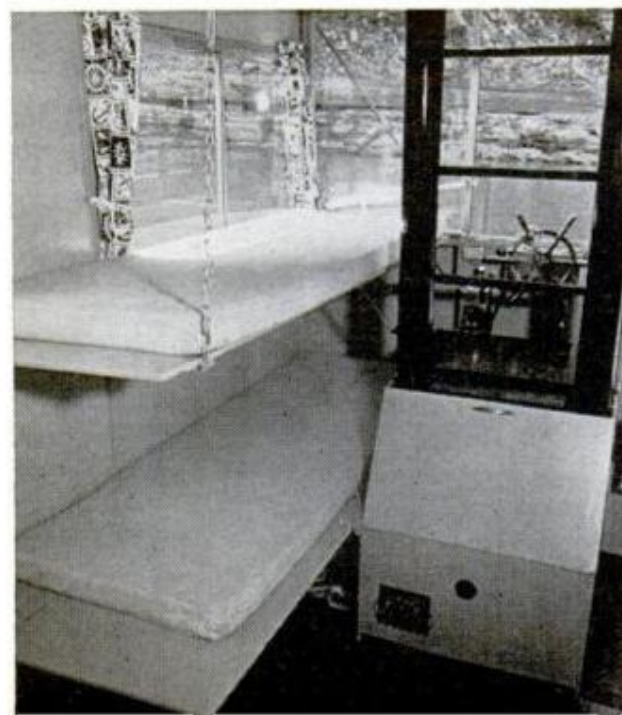
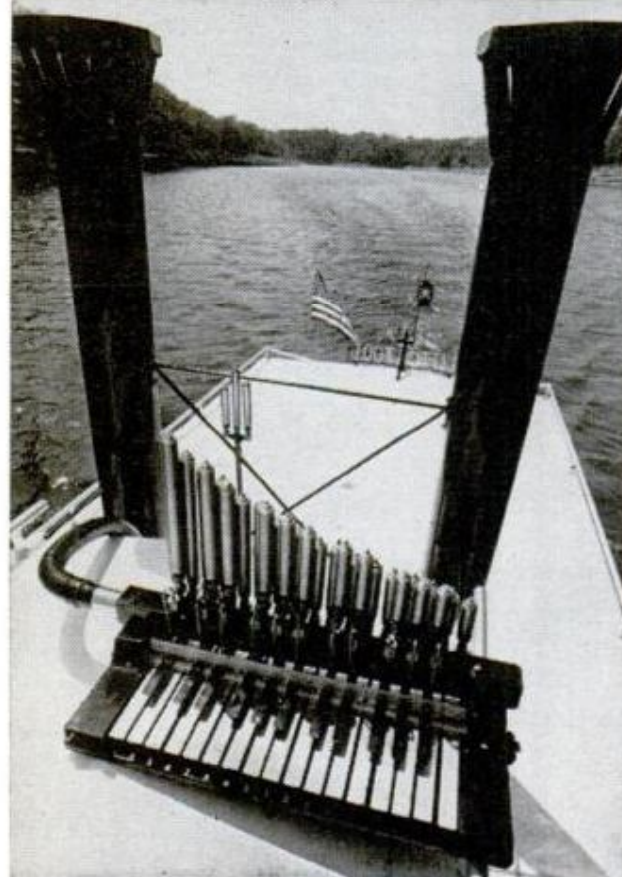
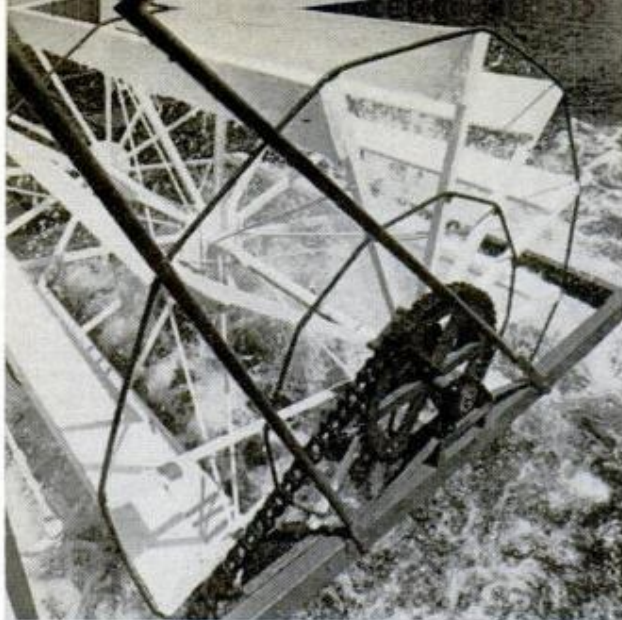
BENNY POWELL is the kind of craftsman who delights in transforming commonplace materials—even junk—into something useful and handsome. Some years back he built a “vintage” touring car from parts salvaged from several old autos (*Right Out of the Roaring Twenties*, page 76H, Nov. '71 PM). A love of paddlewheel riverboats led him to an even more ambitious project—the construction of *Little Toot*. Powell labored for three years before he had the boat shipshape.

What makes the accomplishment doubly impressive is that the inventive

TAKEN FROM '60 FALCON, this 90-hp engine burns about a gallon of gas an hour as it pushes boat at cruising speed of 5 mph. Against after bulkhead (below) are two-burner stove and an oven, fueled by gas from cylinder atop deckhouse. Old-fashioned kerosene lamps provide light







WITH FRIEND AT WHEEL, Benny Powell and his wife sun themselves on foredeck. Cupola atop deckhouse is ornamental. Paddlewheel (top left) is made of six-foot planks bolted to an angle-iron frame. Heavy chain turns sprocket wheel. An array of whistles (left) gives *Little Toot* its name. Compressed air comes from tank that's kept at full pressure by a compressor from an automobile air conditioner. Inside deckhouse, helmsman sits amidships on the forward edge of the engine cover. Twin "stacks" run up through the roof; one of them is a ventilator

craftsman worked without drawings and, mostly, without help. Powell has but one arm, having lost his right arm in World War II.

Powell welded sheets of 12-gauge iron into a hull, framed the deckhouse in angle iron and covered deck and house with half-inch plywood. He built the hull under a tree in his yard, the deckhouse in his shop. He assembled the boat with a chain hoist slung from a tree branch.

Little Toot is 20 feet long and 8 wide, and displaces 2½ tons. Powell hauls it on a trailer built on a mobile-home axle. The engine, a gift, had 94,000 miles on it before Powell had it rebuilt. The storm windows used for the deckhouse were "borrowed" from the Powell home. He estimates his total cost (including the price of new storms for his house) at \$1500.

The Powells enjoy cruising on the Kentucky River near their home in Danville, Ky. Benny is one boater who really earned his hours of relaxation on the water. ★ ★ ★



Australia's jet-powered drone flies at 400 knots

The Turana, newly developed by the Australian Government Aircraft Factories, is claimed to be the most versatile guided target drone in the world. Launched by rocket

motor (that is jettisoned), the craft flies up to 400 knots, powered by a small jet engine. It can execute evasive maneuvers, then parachute to earth for recovery.



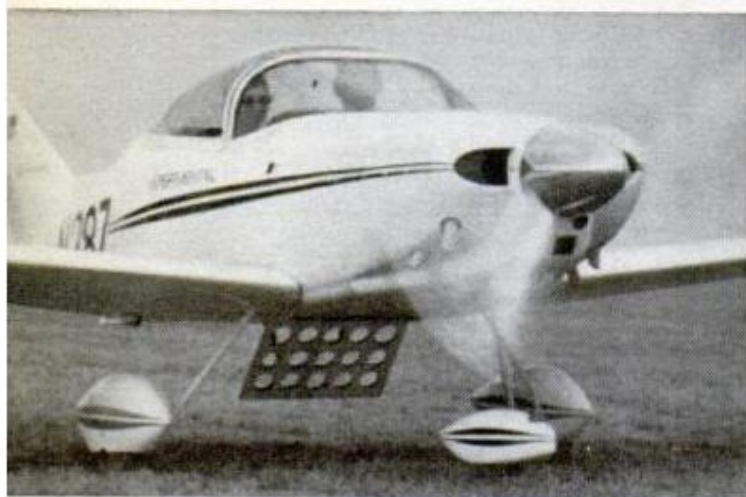
A fountain to walk through

San Francisco's Vaillancourt Fountain, a giant piece of sculpture that emits water and, occasionally, steam, has walkways built into it to enable visitors to walk beneath several arms that are gushing water.





Sidewinder: pretty, perky performer



GOOD LOOKS and performance are incorporated in Sidewinder design. Spoiler hangs down from fuselage

SMOOTH LINES SWEEP back to tail, constructed of steel and aluminum and covered with aluminum skin



This slick two-seater has won several awards for craftsmanship and design. You can build it for about \$3500.

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

Photos by Howard Levy

AS AN EXPERIENCED PILOT, Jerry Smyth knew what he wanted in a homebuilt plane: sleek lines, good speed and the structural strength to withstand the stresses of aerobatics.

After he had completed the design, it took him two years of spare-time work to

turn blueprints into the finished product. In February, 1969, the perky Sidewinder was ready for testing. Since then the plane has won awards for design and workmanship in competitions sponsored by the Experimental Aircraft Assn. The EAA is an international organization that many homebuilders belong to.

The Sidewinder is a side-by-side two-seater of all-metal construction. It is stressed for nine Gs (nine times the pull of gravity).

Tubular spring steel is used in the tricycle landing gear, which is fixed. The nose wheel can be swiveled 70°. Instead of using wing flaps to slow the plane, there is a dive brake, or spoiler, under the fuselage.

With a Lycoming 125-hp engine, the plane has a top speed of 200 mph, cruises at 160 and has a 450-mile range. It can climb at a rate of 2000 feet per minute and has a service ceiling of 10,000 feet. Landing speed is 55 mph.

The plane is almost 20 feet long, has a wingspan of 24 feet 10 inches and stands 5 feet 5 inches high. Its empty weight is 867 pounds and the gross weight is 1400 pounds.

Smyth estimates a cost of between \$2500 and \$3500 for materials. He has sold about 290 sets of plans and knows of several planes that are under construction.

Plans cost \$125. If interested, write: Jerry S. Smyth, 3224 Beaver Ave., Fort Wayne, Ind. 46807. ★★★



THE SIDEWINDER has a fixed, tricycle landing gear with spring-steel supports. For easy maneuvering on ground, the nosewheel swivels as much as 70°



THE PLANE features an exceptionally clean instrument panel layout. There are dual controls—except for brakes—as indicated by two control sticks

SLIDING PLEXIGLASS CANOPY is snug-fitting, easy to open and close. Sidewinder is less than 20 feet long, has a wingspan of nearly 25 feet, can take off

with 800-foot run, land with 1200-foot roll, cruise at 160-mph with maximum speed of 200, climb at rate of 2000 feet per minute to a ceiling of 10,000 feet





HUNDREDS OF PARTS (not all shown here) take about 40 to 50 surprisingly easy hours to assemble

A \$700 receiver in a Heath calls this its finest. PM agrees.

HEATH CHARGES about \$700 for the wired version of its AR-1500 AM-FM receiver, \$389 for the kit. So you get more than just fun from the 40 or 50 hours you'll spend in building it—you save about \$7 per hour.

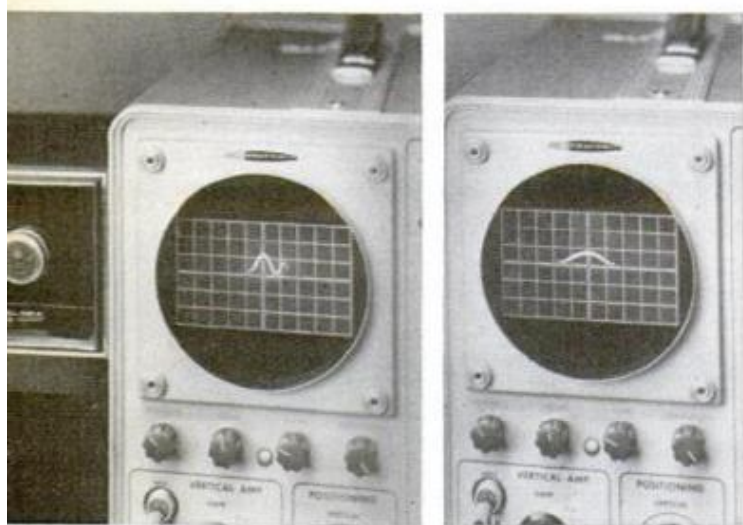
The AR-1500 is one of the most time-consuming kits I've ever built—it took about as long as my Heathkit color TV did. But it's also one of the easiest. That's because Heath divides most of the labor into 10 subkits—the 10 circuit boards,

each packed with its own, manageably small complement of parts, and each with its own section in the instruction manual.

Assembling the chassis—normally one of the easiest parts of any kit—is the hardest part of this one, since it comes in 12 pieces, and wires must be connected to 228 points. Heath simplifies this, too: almost all wires are bundled into one, precut circuit harness. (Nonetheless, I found it helped to number each of the harness's 16 ends with Brady Wire-markers.)

Wiring errors on solid-state equipment can blow transistors faster than you can say "poof!" So the AR-1500 has built-in test leads that let you use its signal-level meter to check resistances and voltages before you actually turn on the set.

Once you have it running, the Heath's performance is sensational. Using only rabbit ears on the second floor of a steel-framed apartment house, I could pull in almost every station in a 40-mile radius—and some as many as 60 miles away. For the weakest stereo signals, I had to cut the noise with the "blend" switch (which reduces separation, mostly at the high frequencies, without eliminating it altogether). Only on the weakest signals—or those with excessive multipath—did I have to switch all the way to mono.



OSCILLOSCOPE OUTPUT JACKS let you aim your antenna to eliminate multipath interference (left), get a strong, undistorted signal (right). Your scope needn't be as fancy as this Heath model, either



IT'S HANDSOME, even without optional wood case

\$400 kit

By IVAN BERGER, Electronics Editor

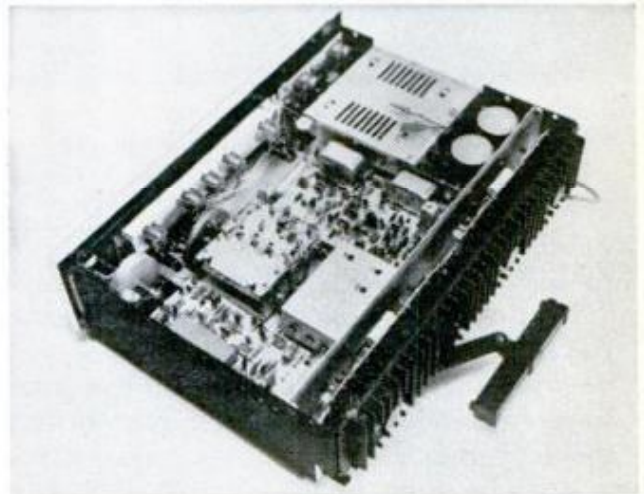
The muting circuit reduces interstation noise effectively, and doesn't cut out till each station is almost perfectly tuned in. That keeps you from hearing the fuzzy fringes of the signal. But it also makes it easy for you to tune right past weak stations if you're not careful. There were no pops or thumps as the stations came in, but I still found the transition from silence to signal annoyingly abrupt. I liked the way the muting could be turned down for reception of weak stations. Heath claims the sensitivity is $1.8 \mu\text{v}$ (IHF), selectivity is 90 decibels (db.) and capture ratio is 1.5 db.; if anything, I'd say they were conservative.

If the FM performance impressed me, the AM performance both impressed and surprised me. Noise and distortion sound almost as low as on some FM units I've used; the only AM giveaway was the limited high-frequency response. The AM antenna rod is jointed, so you can position it for best reception. But, folded in, it covers the rear-panel jacks.

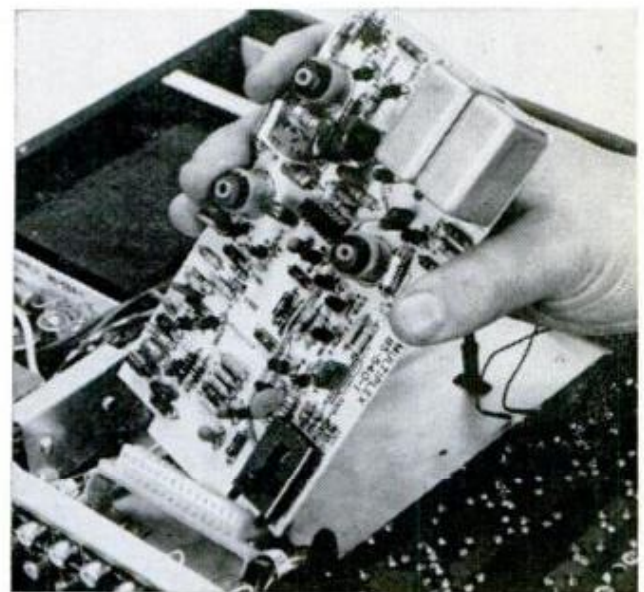
The jacks are inaccessible in any case, because they're deeply recessed beneath the heat sink. But all the jacks you really need are there: PHONO, AUX, TAPE and MONITOR inputs, RECORD outputs, the multipath scope terminals, and jacks to

(Please turn to page 176)

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COMPLEX TOP VIEW shows where some of the work went; equally complex bottom view would show the rest. But each of the 10 circuit boards is a kit in itself, so you don't bog down in wires and components

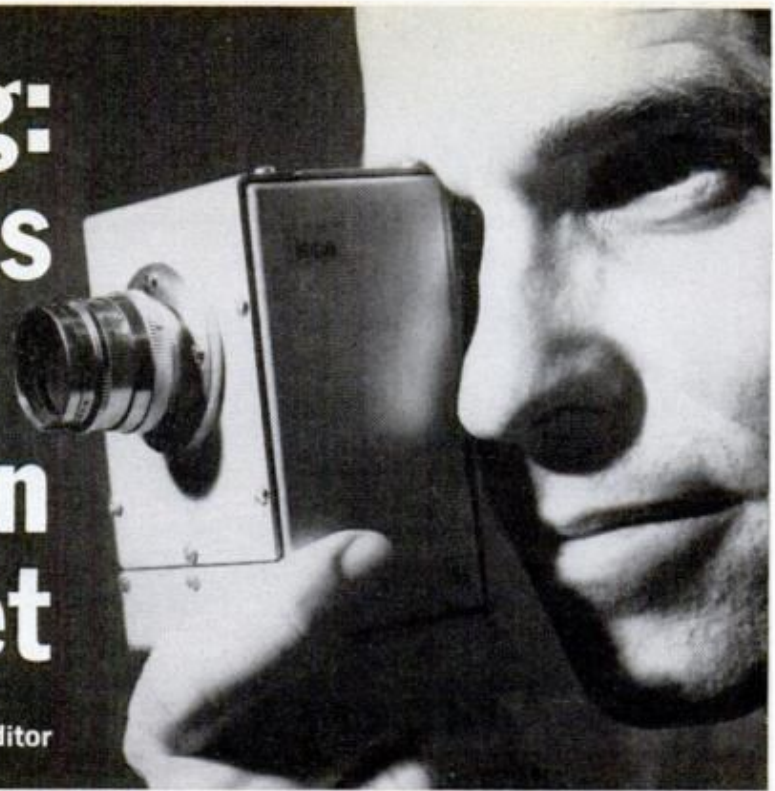


PLUG-IN CIRCUIT BOARDS—four of them in hinged sockets—make the assembly, adjustment and circuit checking easy. Multiplex board shown here has an integrated circuit decoder. Switch is for alignment

101

Coming: TV cameras you can carry in your pocket

By IVAN BERGER, Electronics Editor



TELEVISION CAMERAS so small you can carry one in your vest pocket are on the way. The breakthrough? Solid-state "image sensors" that will replace today's bulky vidicon camera tubes.

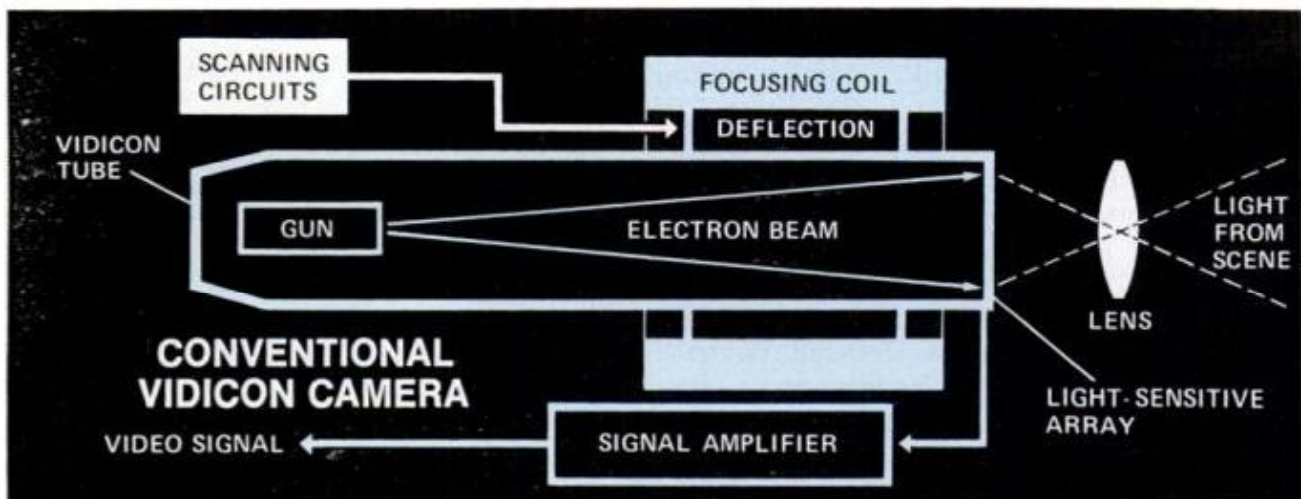
Even vidicon cameras have been shrinking lately. Some of them, using solid-state devices for everything but the camera tube, are about as small as Super-8 home movie cameras.

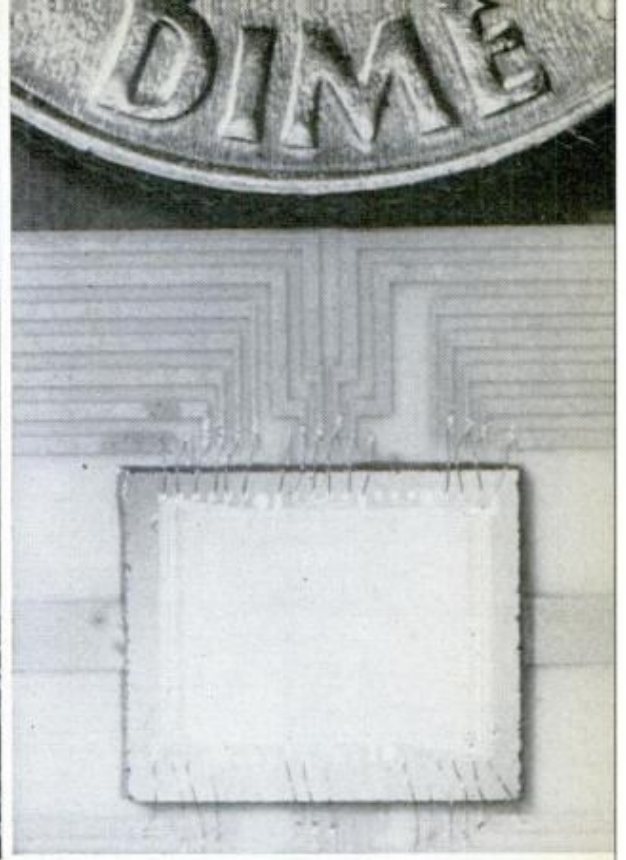
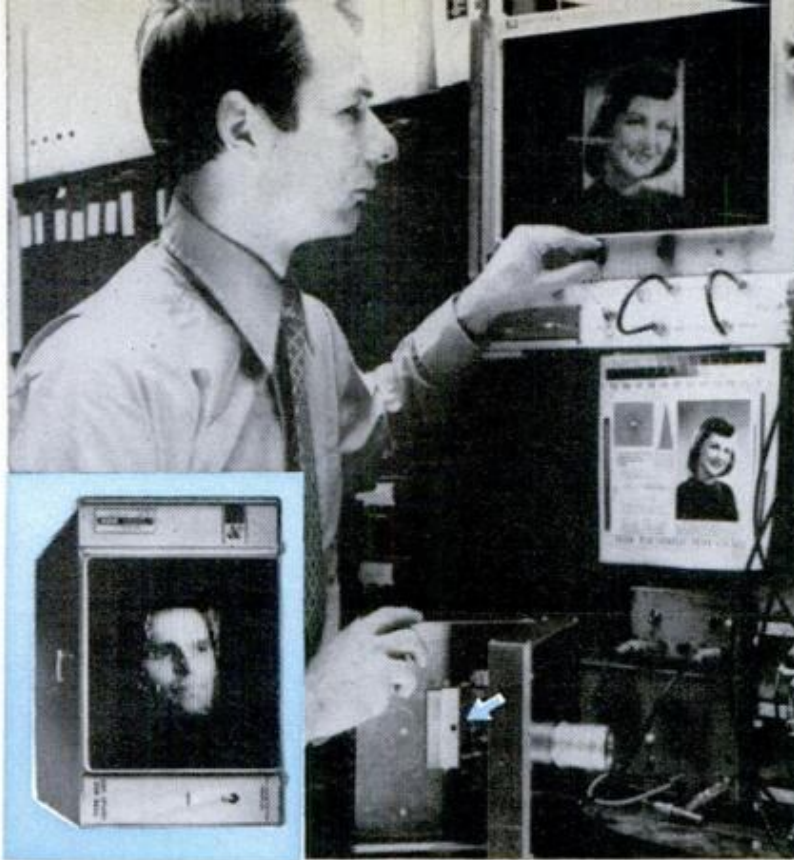
But the new image sensors, requiring no space-consuming electron beam and gun, no bulky deflection and focusing coils, will make cameras smaller still. A single, semiconductor wafer only millimeters thick will hold the camera's "tube" and all its circuitry—just a lens and peep sight will make the camera complete. Such cameras will share the usual solid-state advantages of greater reliability and rug-

gedness, lower power drain, less dangerous voltages and, ultimately, lower cost and better performance.

So far, though, performance is nothing to shout about. When RCA announced its "bucket-brigade charge-transfer" camera prototype (so-called because charges are passed from one sensor element to the next), the major excitement stemmed from the camera's size (2 x 2¼ x 2¾ inches), not its performance. With only 32 rows of 44 sensing elements (1408 total), the picture was far cruder than that of a TV vidicon camera, with nearly 400,000 picture elements.

Within weeks of RCA's announcement, Bell Laboratories showed a silicon-chip camera based on "charge-coupling" techniques—less efficient, so far, than RCA's bucket-brigade technology, but simpler to

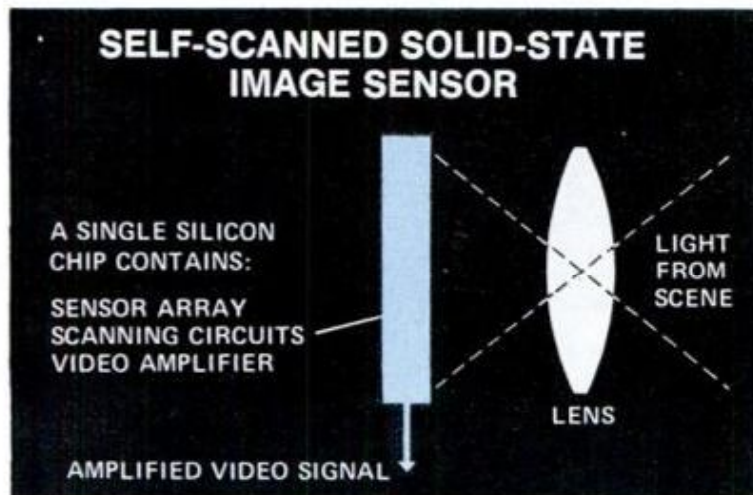
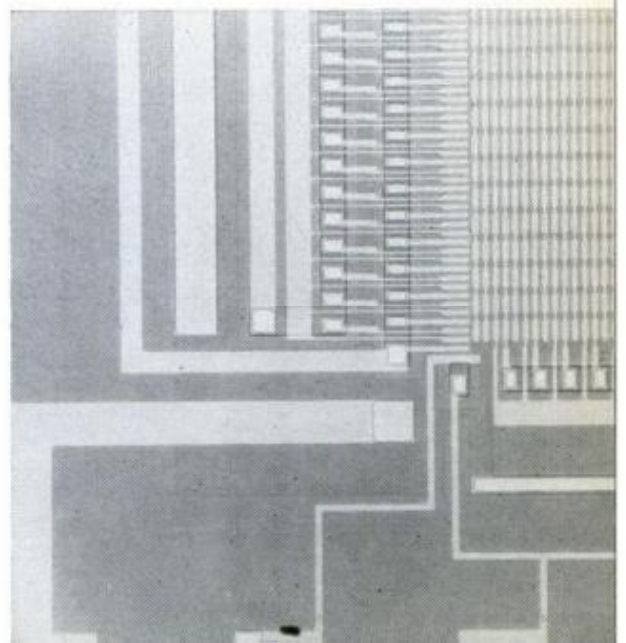




RCA'S SOLID-STATE TV CAMERA PROTOTYPE (facing page) is the smallest yet and could be made smaller. So could Bell Labs' prototype (above)—note all the empty space in its cabinet. The Bell Labs' chip, with more than 13,500 light-imaging spots, gives a more detailed image than RCA's 1408-spot version (inset, above), even though only half of the Bell chip's area is used for imaging and half for storage (right). Enlarged seven times, the chip's small size is obvious next to a dime; RCA's chip is about 13 percent smaller. Chip's complexity shows up in the 90X detail enlargement appearing at lower right

make, and requiring less external circuitry. Bell's chip had 13,568 elements, nearly 10 times as many as RCA's. But because half its elements are used to store the image information till it can be transferred out, Bell's chip is effectively only five times as sharp and detailed as RCA's.

Meanwhile, if you want to build your own wrist TV camera, Reticon, in California, has a 1024-element chip available that uses a more complex "X-Y-addressed, switched-photo-diode" technique. The price? Just \$600 per chip. ★★★



Coming: A 'flying saucer'

THERE MAY BE NO SUCH THING as flying saucers from outer space, but that doesn't mean you won't be seeing them in the skies if Australian inventor Duan Phillips has his way. Phillips has come up with a saucer-shaped flying disc that lands and takes off vertically like a helicopter, but is said to have seven times the lift of a conventional copter. The disc is spun like a top by a centrally mounted engine. At the same time, air is drawn in by a blower and expelled at high pressure across the disc's upper surface. Centrifugal force created by the spinning motion accelerates the air, adding increased speed to the flow. The effect is similar to that of an airplane wing flying through air at high speed. The rapid flow of air over the curved surface of the disc produces a low-pressure area above the saucer, providing tremendous lift. A separate steerable air jet would give forward thrust, control direction of movement and serve the same function as the tail rotor on a helicopter to stabilize the craft and keep the central portion from turning with the disc. Passengers and crew would ride in a circular bubble-like canopy on top of the disc. The spinning saucer would have the natural stability of a gyroscope and be virtually crashproof. Even if the engine failed, the flywheel action of the coasting disc would continue to supply sufficient lift for a safe glide back to earth.

AIR FLOWS OVER WING AT HIGH SPEED, CREATING LOW PRESSURE AREA THAT PROVIDES UPWARD LIFT



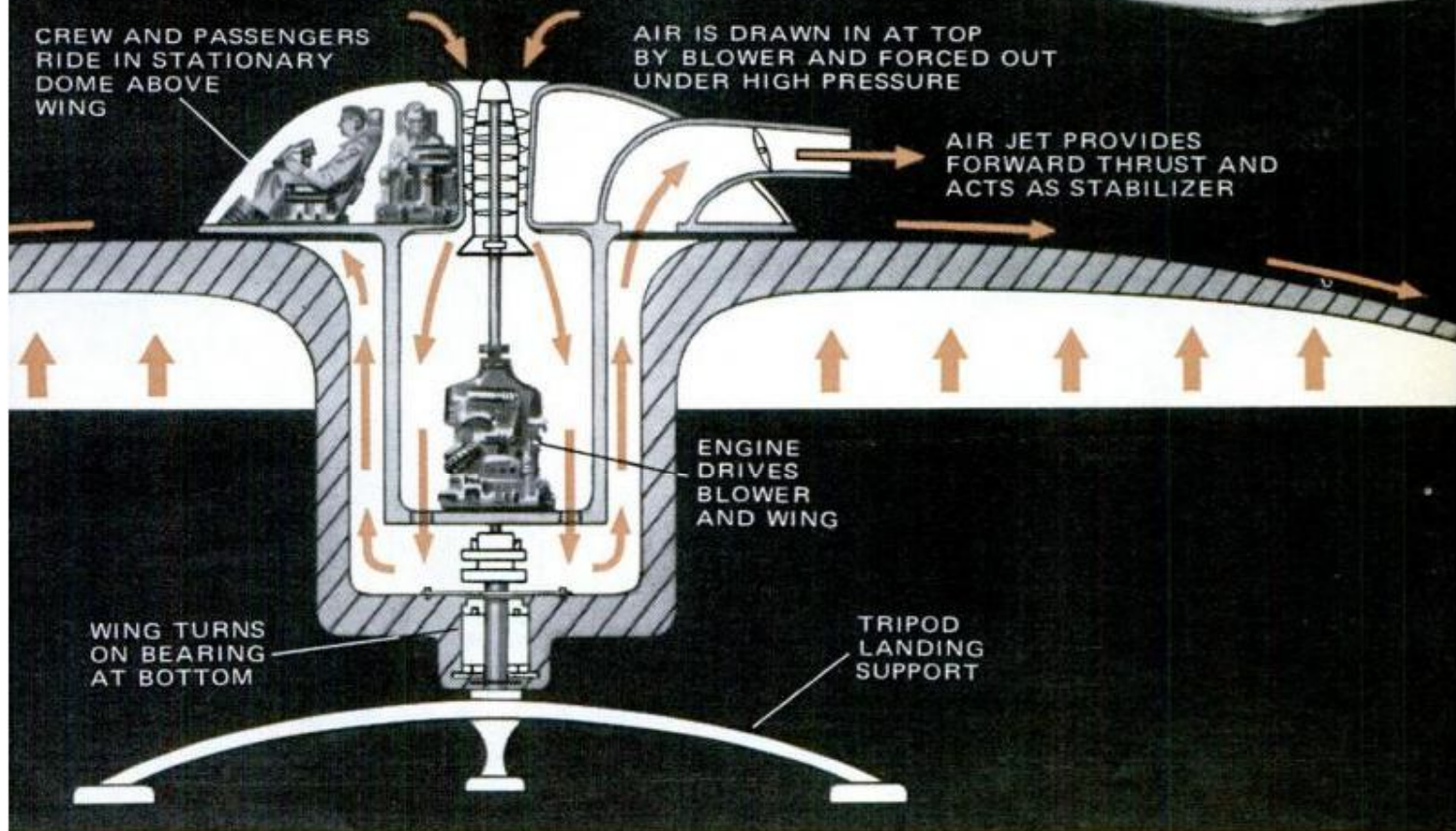
SPINNING DISC-SHAPED WING



Now: water skis with hydrofoils

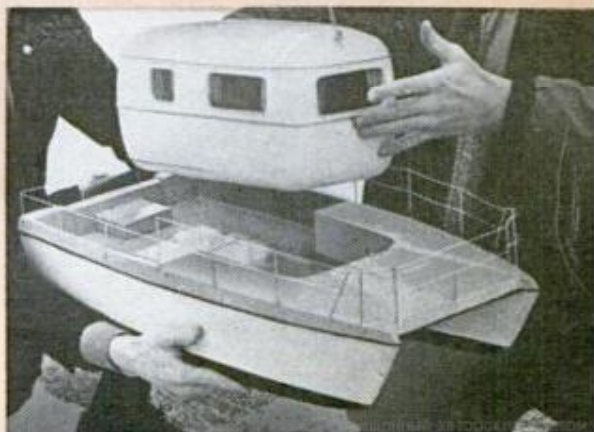
If plain old water skiing isn't thrilling enough for you, you can now do it on hydrofoils. The foils, made to clamp on regular water skis, raise the skis off the surface and permit such exciting acrobatics as diving, climbing, making sharply banked turns and bobbing like a porpoise. They also reduce water drag, enabling you to go faster on less power. They come in several lengths depending on how high you dare "fly" and range in cost from \$50 to \$75. Available from Custom Dynamics, Inc., 119 River St., Waltham, Mass.

that really flies



Rent-a-hull for house trailers

You could vacation on land or water with this convertible house trailer. When you reach a lake or river, you just drive into a special rent-a-hull marina, a crane drops your trailer into a waiting catamaran, and you're off in your own houseboat. The trailer is designed so its body lifts easily off the underframe and wheels and fits into a matching cutout in the catamaran's deck. It's the idea of Danish inventors Leif Smitt and Ole Svendsen.



PM SAAB 99 OWNERS REPORT...

A nationwide survey based on
1,400,000 owner-driven miles



Best car to save your skin, but steering takes too much muscle!

By MICHAEL LAMM, West Coast Editor / Photos by Irv Dolin

PEOPLE WHO BUY SAABS don't do it on impulse. It's a car chock full of safety and engineering features that owners tell us they've evaluated carefully before deciding to buy. More and more have been making the decision since the 99 was introduced here in 1969 (see *Saab's New 99*, page 42, July '69 PM).

Even then, the 99 had many advanced features, but it's much more car today. It's called the 99E, the E for the Swedish word for fuel injection. Displacement of the overhead-cam Four engine is up to 1.85 liters.

The 5-mph bumpers and heated driver's seat are '72 additions to the impressive basics of the car: front-wheel drive, roll-cage unit body, dual-diagonal braking system with four-wheel power discs, radial tires, rack-and-pinion steering and *real* aerodynamic design.

Sensible design, in fact, kept popping up

all over our owner survey. A surprising 32.2 percent chose this car for its front drive, and another 20.2 percent listed *safety* as their prime reason for buying. No other owner group we've questioned has ever ranked safety nearly this high. To let some of the owners tell how they felt about it:

"Front-wheel drive gets me around in all types of weather, safely, because there's no skidding and no loss of traction." "Triple-safe diagonal disc braking system is the best, and fwd gives Saab superior handling." "Very good stability in crosswinds with fwd and weight up front." "I bought the car because I feel it is the safest and one of the best all-around small touring sedans made." "We feel very safe in it." "Sturdy roll-cage body, fwd for handling, four disc brakes for stopping, good size for maneuvering and parking, plus a lot of no-cost conveniences like the

fold-down rear seat, reclining front seats, heated driver's seat, fuel injection for better mileage; in short, what more could a person ask for?"

What more do owners like about their Saabs?

"Excellent vision, hugs the road and curves with a noticeable difference (fwd), and the defrosting system is excellent since it defogs the side windows, too." "I have gotten 25.1 mpg twice on 70-80-mph highway trips." "It is solidly put together. Compared with other new cars I've bought, it's tremendous." "Smoothness of fuel injection over carbureted engine—I pick up customers at the airport 40 miles away, and they usually ask me if it's a Six."

What do Saab owners think of their cars' workmanship?

"As good as my Volvo and better than any American car I've owned." Our questionnaire showed that 88.0 percent of the owners rated the Saab's workmanship as good to excellent, with 36.4 percent giving it a straight *excellent*. That's well above the norm.

We also put in a question that asked whether Saab owners have ever been in accidents with their cars. Some 85 percent

hadn't, but the rest told some pretty hair-raising tales:

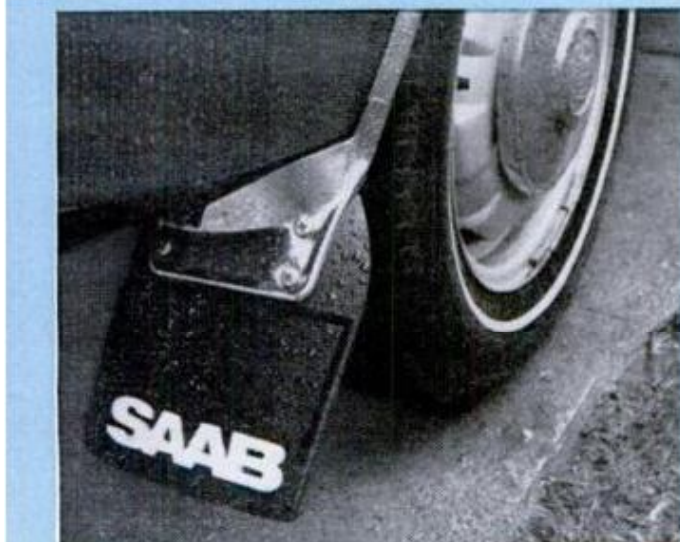
"I was driving 80 mph," recounts a Massachusetts retiree, "and fell asleep for a moment, and when I woke up I was on the tail of a car doing 45 mph. I pulled hard left, rolled over 10 times, skidded, but got out of the car without a scratch, thanks to the shoulder harness. Now there's no other car I'll ride in."

A Pennsylvania vice-president recalls, "Saab talks about its roll-cage construction. In Nov. 1971, on Interstate 81, I had to swerve my Saab to avoid a skidding car. My car spun sideways and backward 100 yards, snapping off a heavy steel snow guard on the highway. Two wheels were bent into an S shape. Impact was just behind the front door. Damage to car; \$970. Penetration into passenger compartment: none. Injuries: none."

Owners who had minor accidents indicated that the bumpers performed well. Exception was about one-fifth of these respondents who collided with objects or cars with bumpers not at the same height as the Saab's! Result was a run on new front grilles for the car. (PM's test car, in fact, received this treatment while it was parked at the curb in New York City—

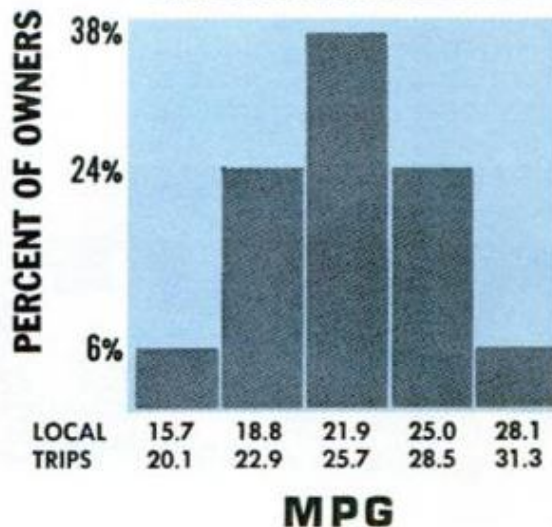


ENERGY-ABSORBING BUMPER of cellular plastic will take genuine 5-mph barrier impacts in stride, but the lack of uprights leaves the grille vulnerable



RADIAL TIRES (below, left) are standard on the 99, and mud flaps keep tires from splattering underside

SAAB 99 FUEL-MILEAGE CHART



| LOCAL TRIPS | 15.7 | 18.8 | 21.9 | 25.0 | 28.1 |
|-------------|------|------|------|------|------|
| | 20.1 | 22.9 | 25.7 | 28.5 | 31.3 |

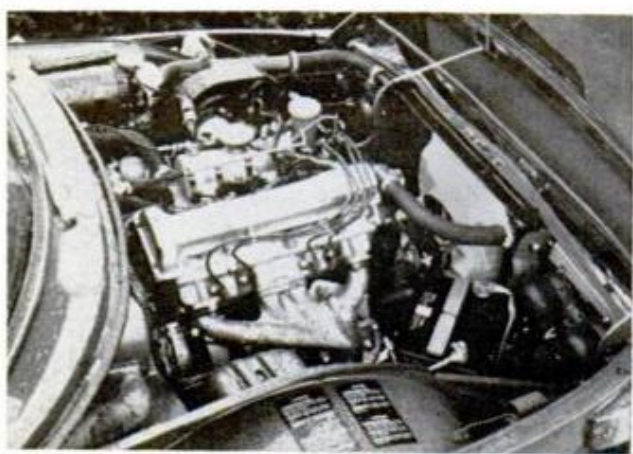
MPG



the victim of a sloppy hit-and-run parker who bashed the grille!)

What do Saab owners think about their dealers?

The comment heard most often is that there aren't enough dealers. Several owners complained of having to drive 60-75 miles to the nearest dealer. Concentration is still thickest in the East. Other than that: "Exceptional service, and on two



FUEL INJECTION and single overhead cam give the 1854-cc (113.1-cu.-in.) Four its 95 hp at 5200 rpm. Still, enthusiastic owners would like even more go



NEW OFFERING is an electrically heated front seat. Seatbacks fold down; headrests allow good vision, as do the tall windows. Pedals are offset to center

occasions my dealer lent me a car while mine was in the shop." Mechanics seem inexperienced at servicing fuel-injection system." "I deal with a smaller dealer—owner is the only salesman and head mechanic all in one; very friendly, courteous, helpful."

What changes would Saab drivers like to see?

"Larger engine if it doesn't affect fuel economy." "Power assist on steering." On this score, two owners mentioned receiving questionnaires from the factory asking whether the Saab's steering effort is too high. This same factory questionnaire asked if owners would appreciate higher horsepower. Both owners concluded that Saab must be considering improvements in both areas. Indeed, a two-liter "EMS" version is for sale in Sweden and will surely be exported to the United States, and a power-steering unit is in the research and development stage now.

How about general comfort?

Says a New Hampshire technical writer: "I find the Saab very comfortable, as do my passengers; also the ride is surprisingly smooth, even with Koni shocks and 30 psi in the radials." And a Colorado contractor: "Comfort is one of the Saab's outstanding features, both front and rear." And, "Never any crowding or squeezing. There's even room in back for three." On the other hand, "Seems they could make a \$4000 car quieter." "Inertia reels on front lap/shoulder belts are comfortable and easy-to-use," says a retired New York driver.

With praise running thick and fast, an amazing 95.0 percent stated they'd buy another Saab; 14.6 percent, in fact, did, owning two at the same time. And a significant number had owned Saabs previously, one man in Vermont saying this was his seventh in 11 years.

What, though, didn't owners like about their cars?

"Hollow headrests." (Push-in plugs are available, but the idea of the hollowness is to aid rear vision.) "Don't like the door locks. If you lock them from inside, you

SPARE IS UPRIGHT at far rear, so deep trunk holds a surprising amount. Beam rear axle means flat trunk floor. Trunk opens to car when rear seat is folded

POPULAR MECHANICS



FRONT DRIVE gives superior traction in wet or on snow. The entire car is designed with safety first

COMFORT FOR PASSENGERS and driver is impressive. Saab is compact outside, but very spacious inside

can't unlock them from the outside. Also, they freeze easily." "Too boxy looking and too expensive for its size and power." "My wife would like power steering." "Wind noise, stiff shifting." "Flow-through vent system doesn't give enough air." "Not enough dealers." "Paint chips easily." "Needs a bigger gas tank."

Parting shots sound like something written by Saab-Scandia's advertising people, but they're not. The following are typical:

"For the size of the car, seating, riding comfort and fuel economy, there is no domestic auto to my knowledge that compares with the Saab."—New York inspector.

"I drive about 35,000 miles a year, am a salesman covering Massachusetts, Vermont and New Hampshire. I truly believe Saab is the safest car to drive, especially in snow. It's economical, fun, rugged and safe. I've owned two before this one, and all have been great." ★★★

Summary of 1972 Saab 99 Owners Reports*

| | |
|---------------------------------|-----------|
| Total miles driven | 1,430,692 |
| Average miles per gallon | |
| Local driving | 21.9 |
| Long trips | 25.7 |
| Transmissions: | |
| Automatic | 38.8% |
| 4-speed manual | 61.2 |
| Body styles: | |
| 2-door sedan | 55.9% |
| 4-door sedan | 44.1 |
| Why the Saab? | |
| Front-wheel drive | 32.2% |
| Safety features | 20.2 |
| Economy | 16.5 |
| Handling | 13.9 |
| Styling | 13.5 |
| Past experience | 12.7 |
| Quality | 11.2 |
| Specific likes: | |
| Handling | 47.2% |
| Comfort | 39.8 |
| Economy | 27.1 |
| Styling | 13.8 |
| Roadability | 13.4 |
| Ride | 12.3 |
| Performance | 10.4 |

| | |
|--|-------|
| Specific dislikes: | |
| Rattles | 13.4% |
| Door locks | 9.5 |
| Poor dealer service | 9.5 |
| Hard to steer | 8.0 |
| Lack of power | 5.7 |
| Have you had any accidents? | |
| No | 84.6% |
| Yes | 15.4 |
| Do the impact-absorbing bumpers do their job? | |
| Yes | 81.1% |
| No | 18.9 |
| What changes would you like to see? | |
| More power | 20.4% |
| Power steering | 19.6 |
| Better door locks | 5.0 |
| Fewer rattles | 4.6 |
| Tach as standard | 4.6 |
| Had any mechanical trouble? | |
| Yes | 50.5% |
| No | 49.5 |
| What kind of trouble? | |
| Electrical | 13.8% |
| Transmission | 12.3 |
| Oil leaks | 11.6 |

| | |
|-------------------------------------|-------|
| Speedometer cable | 9.4 |
| Fuel-injector leaks | 7.3 |
| Did you repair it yourself? | |
| No | 92.0% |
| Yes | 8.0 |
| Dealer repairs satisfactory? | |
| Yes | 68.9% |
| No | 31.1 |
| Is the Saab your only car? | |
| No | 55.3% |
| Yes | 44.7 |
| Other cars owned: | |
| Volkswagen | 15.9% |
| Another Saab | 14.6 |
| Ford | 12.6 |
| Chevrolet | 8.6 |
| Volvo | 8.0 |
| Pontiac | 6.6 |
| Age distribution of owners: | |
| 15-29 years | 28.2% |
| 30-49 years | 37.9 |
| 50-plus | 33.9 |
| Would you buy another Saab? | |
| Yes | 95.0% |
| No | 5.0 |

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

NEWS BRIEFS



Think chess is difficult? Try it on a sphere!

"Global Chess" (left), a sphere fitted with 64 magnets to hold pieces in place, is the most perfect form of 3-D chess, according to inventor Peter Yaspan. At right, he demon-

strates another 3-D form, Spherical Chess. In the foreground is his rounded chess board. All three new forms, he says, increase the number of strategies, tactics and moves.

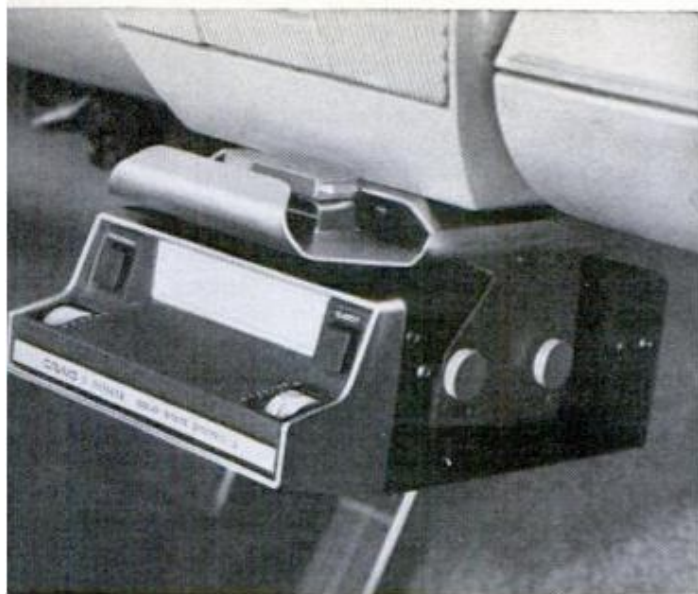


First European airbus nears completion

Scheduled for first flight tests this year, the A.300B European airbus is shown during con-

struction at Toulouse, France. It'll be powered by General Electric engines.

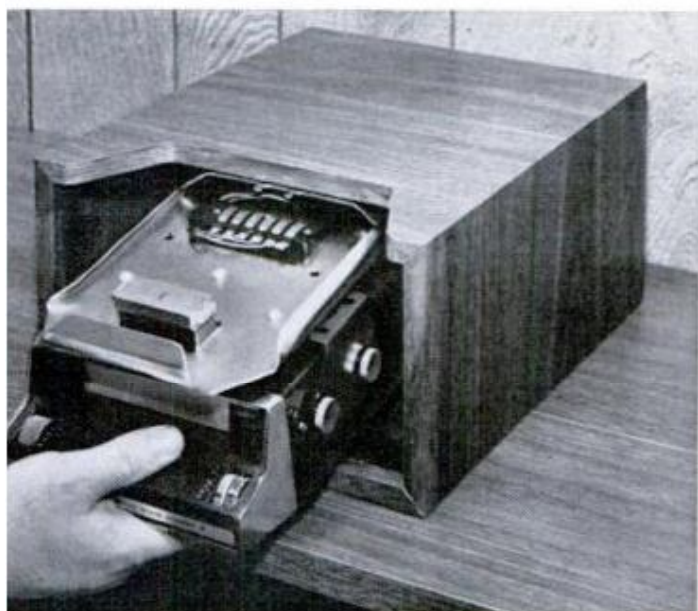
Slip it in— slide it out



SLID INTO UNDER-DASH MOUNT, tape deck automatically connects to car's wiring, ready to play



TO PLAY TAPES AT HOME, slip deck out of car (above) and into a matching mount in house (below)



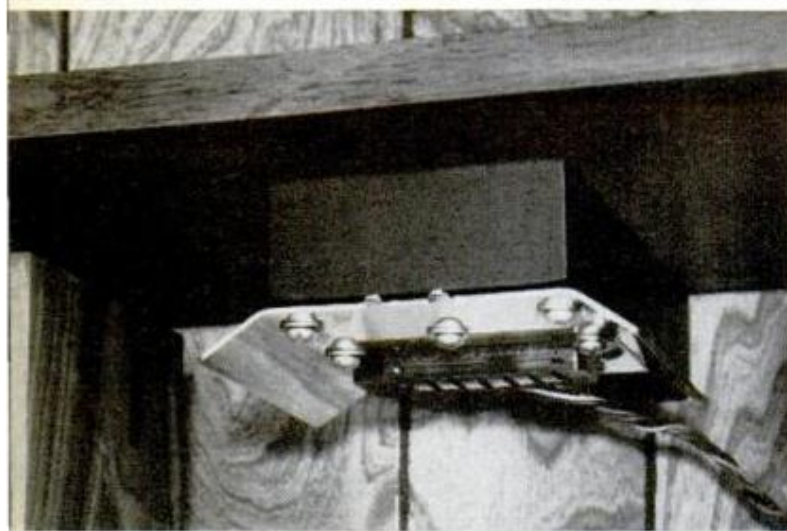
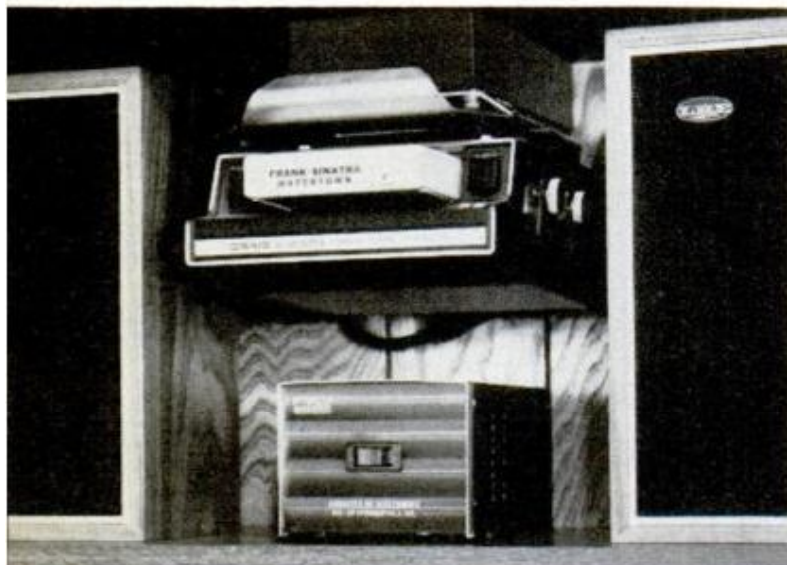
Handy slide mounts with pre-wired contacts make it easy to enjoy your tape deck or radio in your car, boat and at home—and keep it from being stolen in the bargain

By **SHELDON M. GALLAGER**

Photos by Robert D. Borst

THAT SHINY STEREO tape player hanging smartly below your car's dashboard is an eye-catching accessory—so eye-catching, in fact, that it's been catching the eyes of thieves all over the country. So many tape decks are stolen from cars every day that insurance companies no longer cover their loss. Nor will they cover the damage done to your car in breaking in to get at the deck, such as smashed windows and pried-open doors. As a result, a stolen tape deck not only means the loss of valuable equipment, but it can run up a steep repair bill as well.

The answer is a nifty little device called a quick-disconnect slide mount. With this clever piece of hardware, you can have your cake and eat it, too. You can enjoy stereo tapes while traveling, yet be reasonably safe from theft at the same time. The mount consists of two mating pieces—a metal track that installs permanently in your car and a matching



THREE SETUPS for playing car tapes at home are shown at left. Top photo shows ready-made enclosure by Kustom Kreations. Attractive walnut-finished cabinet contains a slide mount and 12-volt power supply for operating car-type tape decks on house current. Price, without speakers, is about \$35. Similar unit with built-in speakers is about \$50. Two center photos show simple homemade arrangement in which tape deck is suspended below bookshelf. It's necessary to mount slide plate on spacer block—a short length of two-by-six—to provide sufficient clearance for tape deck to slip in and out. Separate 12-volt power supply is also needed, here an Audiotex model priced at about \$26. Bottom photo shows still another possibility. It's a 12-volt power supply fitted with a slide bracket that mates with mounting plate on the tape deck. You just slide power supply onto deck, hook up two speakers and you're in business. About \$20 from Kustom Kreations

flanged slide that attaches to your tape player. The slide slips onto the track to hold the tape deck in place while you're on the road. When you leave your car, you just slide the deck out and take it in the house or lock it in your trunk. The absence of that tempting sight dangling beneath your dashboard deters thieves from attempting to break in.

What makes the slide mount so ingenious is that there are no wires to connect or disconnect every time you slide the tape deck in or out. Each half of the mount contains identical wiper-type, spring-metal contact strips. As the two parts come together, the contact strips engage each other, automatically connecting your tape player to your car. Contacts on the dash-mounted track plate are wired to the car's 12-volt electrical supply and speaker connections. Contacts on the tape deck are similarly wired to matching connections on the player. When you remove the deck from the car, the connections are neatly broken without any wires to undo.

There are advantages to the system beyond preventing theft, too. By installing duplicate mounting plates in a second car, boat, camper, motor home or other vehicle, you can quickly switch your tape player from one to the other as needed, making a single unit serve a variety of uses. You can even play your stereo tapes at home by connecting the deck to a 12-volt converter that will enable it to operate on house current. Home conversion units are available ready-made for this purpose, including a built-in 12-volt power supply and some with built-in stereo speakers as well. Or you can rig up your own home mount

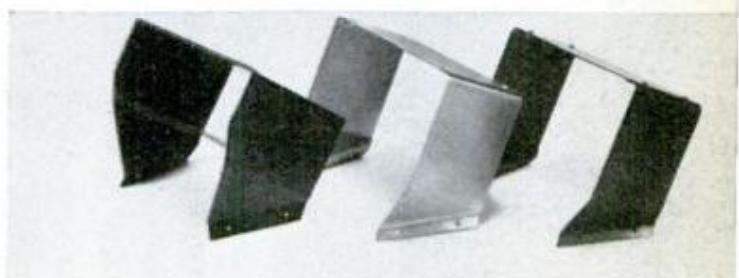
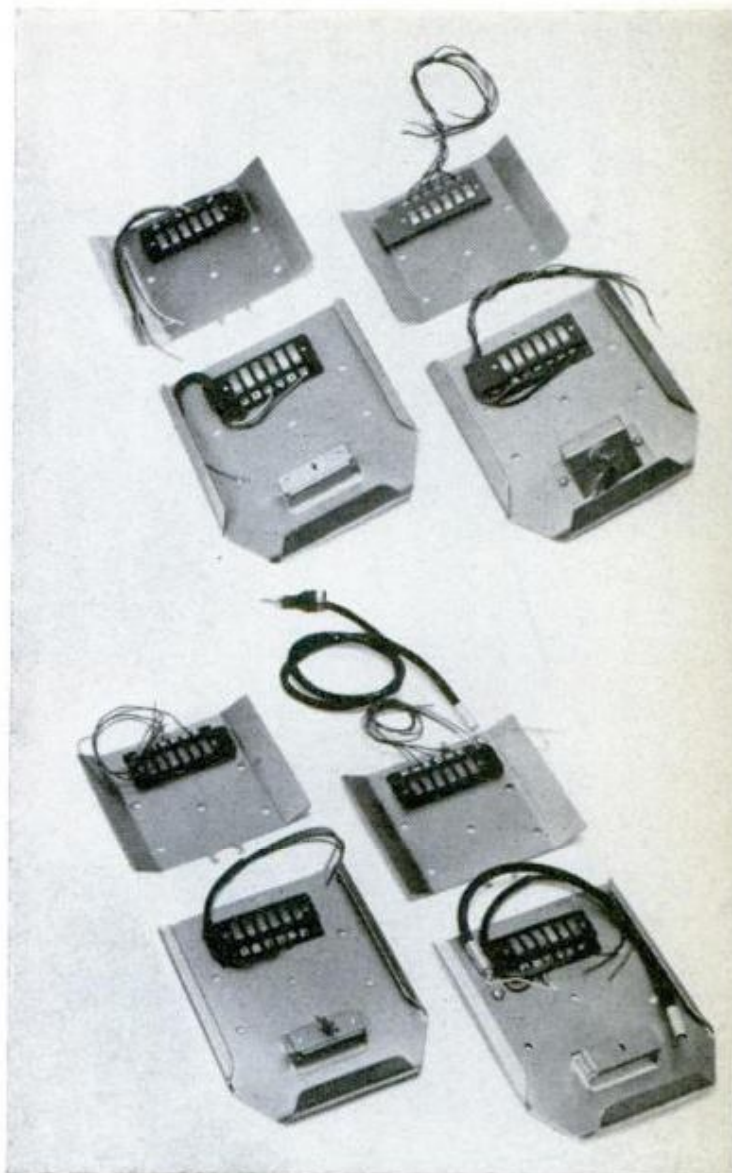
BASICALLY SIMILAR, slide-mount sets are made by a variety of manufacturers, as shown in photo at upper right. Each set consists of two parts—a base plate that mounts permanently in car or home and a flanged piece that attaches to tape deck and slides onto the base plate. As the two parts come together, spring-metal contact strips engage each other, making electrical connections automatically. Special set at lower right, made by Kustom Kreations, is designed for use with a radio and has extra shielded cable to permit mount to be connected to car's antenna. Two bottom photos show several types of floor mounts that straddle the car's transmission hump—useful where under-dash space is limited. In this case, slide bracket is bolted to underside of hump mount and tape deck hangs in U-shaped opening above car's floor. Mounts come in black or chrome, range in price from about \$9 to \$12. They're sold by Kustom Kreations, Audiotex and Myler Enterprises

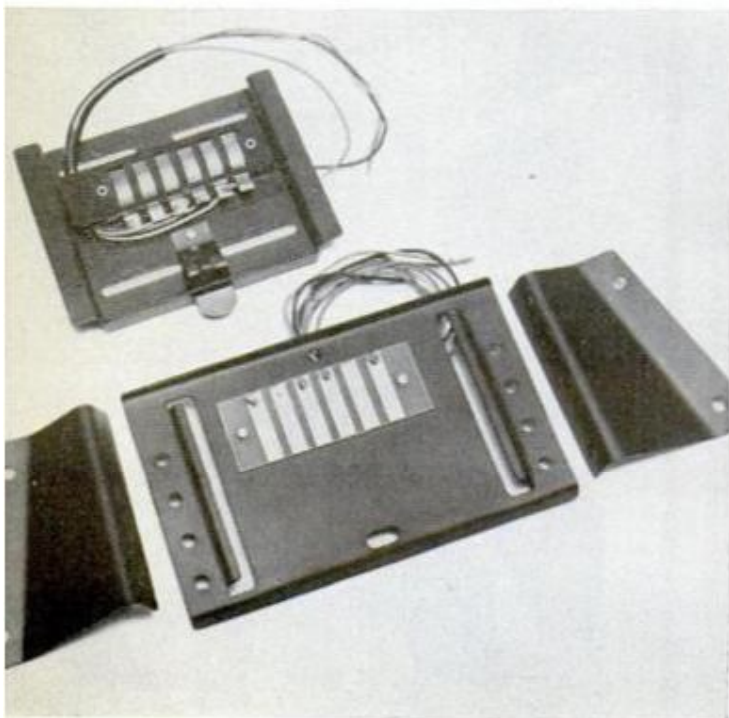
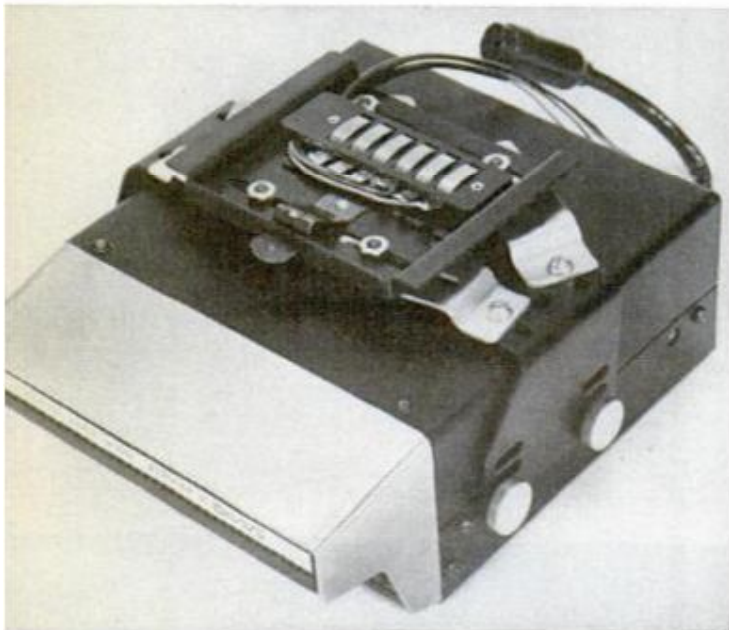
by attaching a bracket to a shelf, bookcase or other enclosure, as shown in the accompanying photos.

The interchangeable slides can also be used for quickly removable mounting of other electronic equipment, such as an FM radio, CB transceiver or shortwave set. All of these require basically the same electrical connections as a tape player—a source of 12-volt power and hookup to speakers. For radios, special brackets are available that include, in addition to the standard contacts, an extra shielded cable that permits the mount to be wired to a car or boat antenna. Dual connectors on these cables make it possible to tap the antenna line without affecting reception on an existing radio.

Though basically similar in function, slide mounts come in a variety of styles and are readily available at hardware stores, auto-supply dealers, discount centers and electronics mail-order houses such as Lafayette Radio. Among the major makers are Kustom Kreations, Inc., 19316 Londelius St., Northridge, Calif. 91324; Myler Enterprises, Box 2911, Van Nuys, Calif. 91404; Boman Astrosonix, 225 West Commercial Ave., Moonachie, N. J. 07074; and Audiotex, a division of GC Electronics, 400 South Wyman St., Rockford, Ill. 61101. If you should have difficulty locating a particular mount, write the manufacturers listed above for further information.

The mounts are generally sold in packaged sets—track plate and matching slide—and run around \$7 to \$10 per pair. Those with FM antenna leads for radio use cost a bit more—about \$13 per set. Extra track plates are also available separately so you can use one slide mount





MINI-MOUNTS work in same way as regular slide mounts, but are smaller—ideal for use in sports cars and subcompacts where there is often little under-dash space. They can be used either as hump mount (top photo at left), or side flanges can be removed, as shown in bottom photo, and the slide fastened underneath dash in conventional manner. For hump mounting, hanger bracket on tape player is turned upside down and slide is bolted to bottom of the player (center photo). To fit slide to hanger, it's usually necessary to use four small offset bracket arms, as shown. Photos show an 8-track Craig deck on mini-mount made by Kustom Kreations

in several locations. The track plates mount under the dashboard in the same way as the hanger bracket on the tape deck itself—usually with sheet-metal screws up into the lip on the underside of the instrument panel. The slide part of the mount is then attached to the deck's hanger bracket with machine screws.

For cars with limited under-dash space, or where you can't easily find a surface to attach to, there are floor-mount adapters that eliminate the need for dashboard mounting. These are U-shaped metal housings that fit over the car's transmission hump and support the tape deck or radio a few inches off the floor. Such hump mounts are handy and sporty-looking, their only limitation being that they can't be used in many cars with floor-mounted stick shifts. A smaller version of the standard slide mount is a "mini-mount" made by Kustom Kreations. This, too, is available in both under-dash and floor-mount styles and is helpful in making installations in some sports cars and subcompacts where under-dash space is tight.

One nice thing about slide mounts is that they provide six electrical contact strips—an ample number for virtually any electronic equipment you may want to install. Generally, only four are used—one for the hot power lead, one for a ground connection and one each for the two stereo speakers. This leaves two spare contacts that may come in handy for future use. One of the two, for instance, can provide an antenna connection if you decide to switch from tape to radio or if your tape player already incorporates a radio, as many more recent models do. The extra contacts can also be used to feed two additional speakers if you go in for one of the newer four-channel, quadraphonic-type tape players.

The contacts come prewired with color-coded leads that follow the color coding

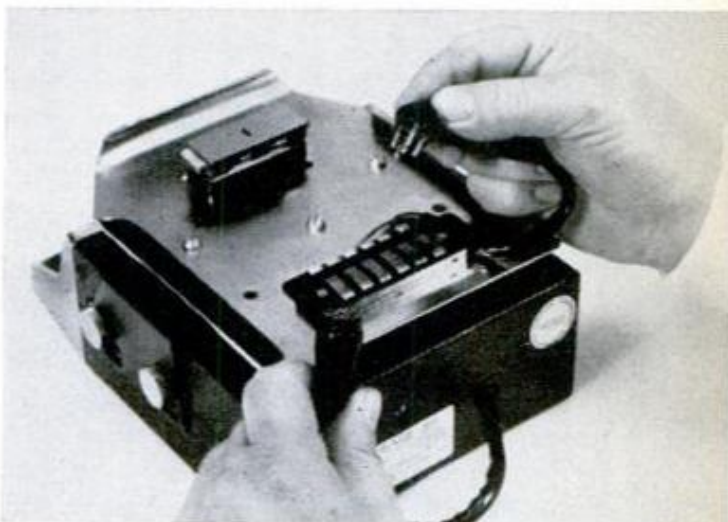
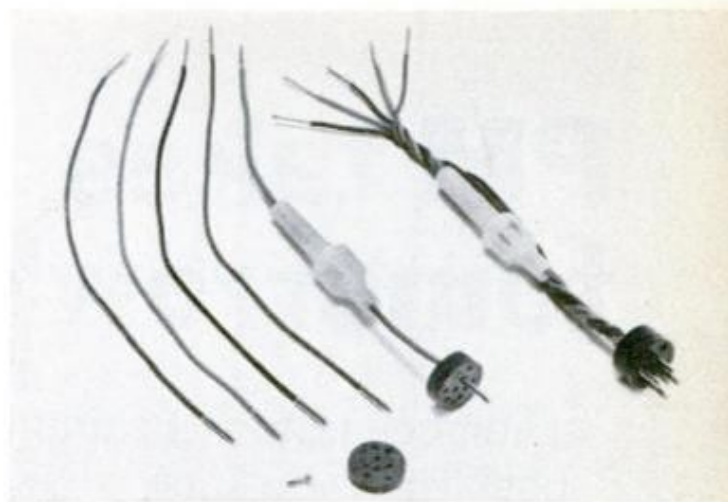
TYPICAL WIRING SEQUENCE is shown at right, using universal connector that comes as a kit. Kit (top photo) has interchangeable pins that can be arranged to form plug that will fit just about any stereo tape player on the market. Wires are color-coded and include a fuse holder in hot power lead. After plug is assembled, connector's leads are soldered to those coming from slide mount (second photo from top). Soldered joints are then taped, slide mount is bolted to player, and connector is plugged into player's cable. Photo at bottom shows how slide mount can be used to hold a radio as well as tape deck—in this case, a Heathkit CB transceiver

used by most tape-deck manufacturers to make hookup easy. The leads coming from the dash-mounted track plate are wired permanently into the car's electrical system. If you have a tape deck already installed, use the existing wiring to save making new connections. Simply cut the cable a few inches from the tape deck and splice the wire ends to the matching-color leads from the bracket on the dash. If you should find five wires coming from the mount instead of four, the fifth wire is for grounding your speakers separately from the power ground. However, most mounts use only four wires, combining speaker ground and power ground in one lead.

Most car stereos have a plug and jack connector in the wiring harness. When you cut the cable, save the plug with a few inches of wire left attached to it. The short wires from the plug are spliced to the leads coming from the slide mount attached to the tape deck, using the same color-matching procedure as for the dash mount. The plug can then be inserted in the jack on the tape deck to complete the hookup without disturbing the original quick-release connector. This makes it easy to disconnect the tape deck from the slide mount if you should decide to remove it later—you just unplug it.

If, for any reason, you should lose or don't have a plug to fit your tape deck, universal adapter plugs can be purchased in kit form from the same dealers that stock slide mounts. Pins on these can be arranged to match the pin patterns used by all major tape-deck manufacturers. You simply make up the appropriate pin arrangement, wire the plug to the slide mount, and you're ready to play stereo tapes anywhere. For home use, 12-volt converters are available from Kustom Kreations, Boman Astrosonix, Audiotex and most local radio-parts stores. ★★★

AUGUST 1972



PM takes a ride in tomorrow's bus today!

Ever been stuck behind a bus? Then you know what a smelly, unhealthy experience it is. Not so behind Lear's

By JOHN ETHRIDGE

A STEAM-DRIVEN TURBINE is the powerplant of the future, the way Bill Lear sees it. His steam-powered bus uses the same basic system intended for the firm's passenger-car project, a Monte Carlo sedan (see *A Look Under the Hoods of Tomorrow's Cars*, page 98, June '71 PM). The single-stage turbine powerplant is designed to put out 220 hp and propel the 17-ton (fully loaded) GMC coach to a top speed of 55 mph and negotiate a 19 percent grade at 5 mph, performance comparable to diesel-powered versions.

Preliminary to the first demonstration of the bus at Lear's plant near Reno, it was announced that the working fluid in the system was now "Learium III," which Bill Lear went on to say "... mixes well with scotch." The earlier fluorinated hydrocarbon "Leariums" were discovered to be not nearly so inert as hoped and changed into honey-like substances that clogged up the condenser. Consequently, for the time being at least, they switched back to the old standby, water! Other than an electric tach for the turbine redlined at 60,000 rpm, driver instruments and controls appear about the same as on an ordinary bus.

Start-up was accompanied by a whirl of the centrifugal fan that supplies combustion air to the vapor generator (boiler) and various noises of pumps and other auxiliary equipment. In approximately a minute from the time the starter button was actuated, the bus was under way.



READY TO ROLL in its first demonstration is Bill Lear's

Each time the bus started from rest there was a jerk followed by slow acceleration about like you'd expect if you popped the clutch on a conventional vehicle with the transmission in one of the higher gears. This, it was explained, was due to the automatic transmission not matching the turbine characteristics, which is quite plausible and should be easily cured by raising the stall speed of the torque converter.

Once under way, the power transmission is smooth and the noise from the engine compartment is such that no one would suspect anything unusual. No gear whine is distinguishable above that of the fans, pumps and the like.

Specifications for the vapor generator were given as 2400 pounds of steam per hour at 900 p.s.i. (absolute) at 950° F. No flat-out runs were demonstrated. The maximum observed speed was approximately 32 mph, at which the turbine inlet pressure and temperature were 650 p.s.i. and 600° F. approximately. The bus continued to trundle guest riders back and forth for over two hours without a hitch or in-



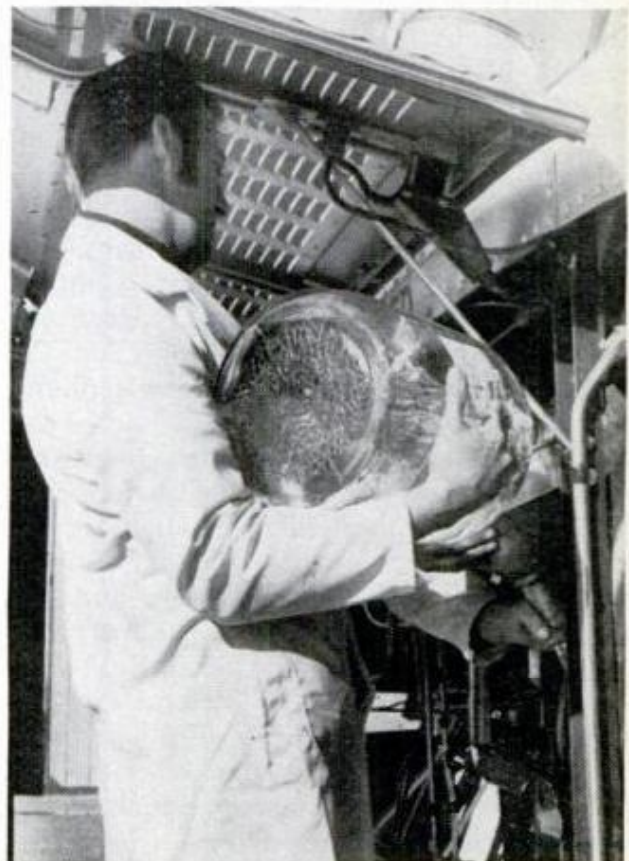
steam bus. It's being tested and evaluated by the State of California for future commercial service

interruption, an altogether satisfactory demonstration.

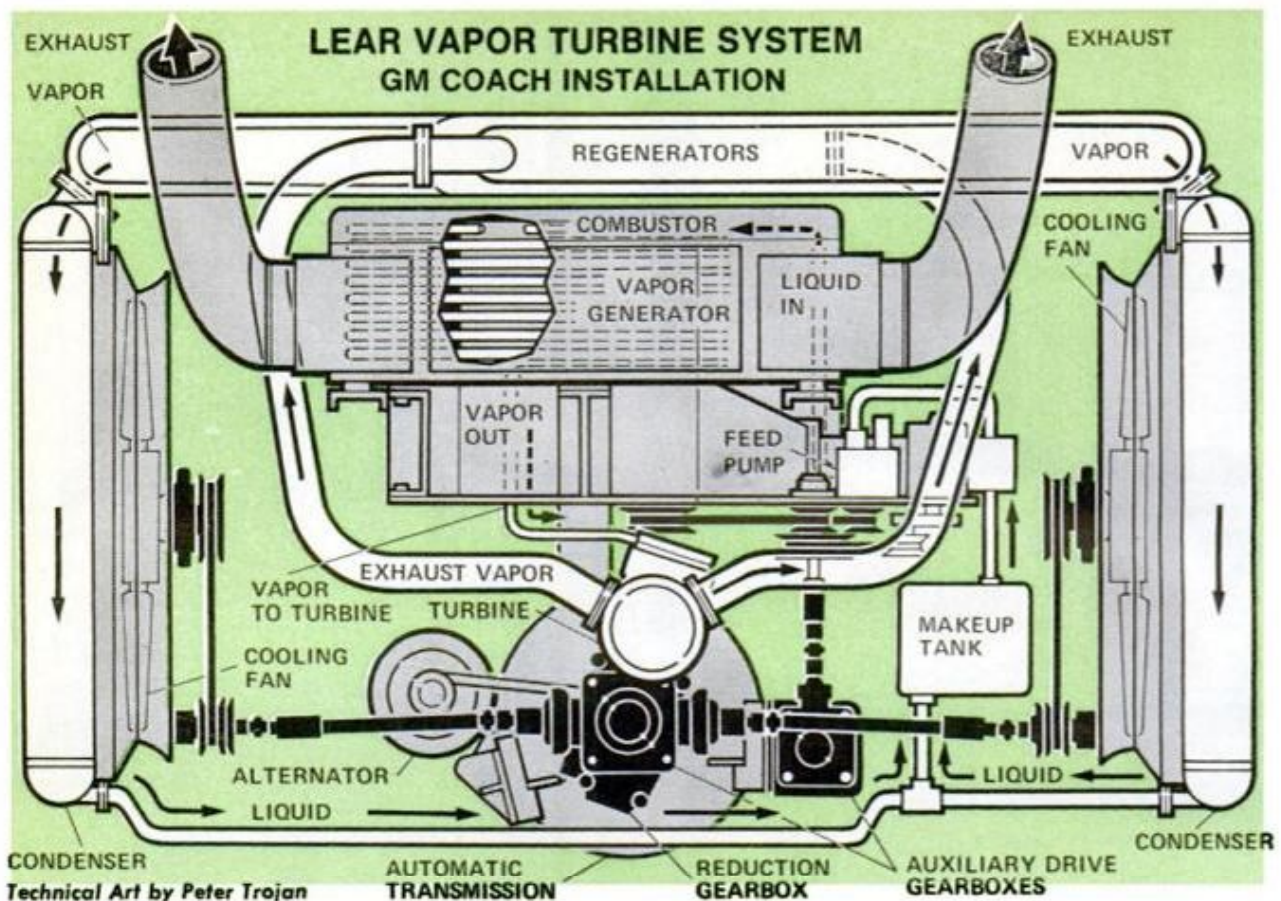
The Lear bus, one of three steam buses the state of California is having built under a federally funded demonstration project, will undergo a 60-day stint in passenger service in San Francisco after final testing by Lear.

Lear's avowed objective is to come up with a vapor turbine prime mover that meets or beats the conventional automotive engine in the areas of cost of manufacture, weight, size, durability, fuel economy and emissions. In most of these he still has a way to go, but the emissions picture is a rosy one indeed. If field tests by others confirm Lear's own lab results, the kerosene-burning vapor generator already exceeds by a comfortable margin the most stringent proposed federal or California emissions standards. This, of course, is a battle that must be won, or else victories in the other areas would be meaningless.

The combustion section and the turbine itself have been comparatively easy to develop and are farther advanced than some other system components. Ungla-



JUST ADD WATER to the regenerative system. The search goes on, however, for a better fluid to use



VAPOR-TURBINE SYSTEM shown as it appears in rear engine compartment of GMC coach used by Lear

morous parts such as variable displacement pumps, fans, blowers and controls have taken an unanticipated toll of money, manpower and time because nearly all of these had to be developed from scratch when suitable off-the-shelf components could not be found.

A major remaining task is paring off weight and reducing the size of the system so that it will fit under the hood of a passenger car. Lear engineers think they may be able to come up with a more compact vapor generator, and by rearranging other components, make room for the large condenser required. There's plenty of room in the engine compartment of the bus for the system as it is now, but space under the hood of the Monte Carlo is at a premium with practically the whole frontal area of the car below the windshield being occupied by a huge condenser and fan shroud.

And the search for a working fluid with better characteristics than water will doubtless continue. First of all, a fluid with heavier molecules than water would permit lower turbine speeds which would reduce stresses on the turbine wheel. This would, in turn, allow higher working temperatures which give greater efficiency

(less fuel consumption for a given power output).

Another limitation of water is that not much heat energy can be added to the vapor above about 700° F. without also going to extremely high pressures. For maximum efficiency, heat should be added at the highest possible temperature. The highest possible temperature is determined by the strength of materials used which, in the case of the nonexotic Lear turbine, is between 1100° and 1200° F. Thus with water as a working fluid, taking full advantage of the metallurgical limit cannot be done because high pressures and high temperatures cannot be tolerated simultaneously. (Some modern stationary turbines operate in the so-called *super-critical* region of 1000° F. and 3800 p.s.i., but it is doubtful if the design can be adapted economically to automotive application.)

Steam engineers have long understood the above problem and have been wishing for a Learium for three-quarters of a century. They've even gone so far as to plot the characteristics of ideal Rankine (steam cycle) working substances in textbooks. One calls for a fluid that requires

(Please turn to page 176)

Don't let those brownouts become burnouts

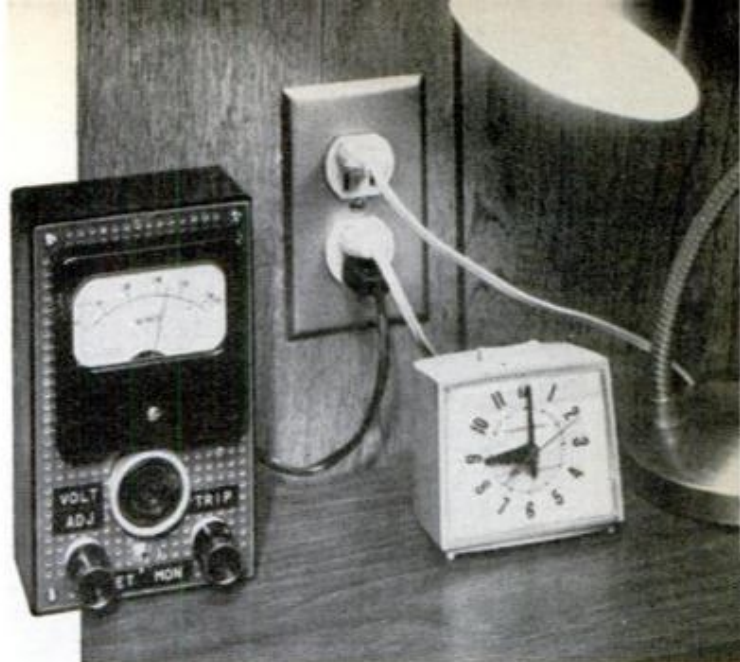
This easily built current checker lets out a loud warning squawk if your line voltage falls below a safe limit for motor-driven home appliances

By RUDOLF F. GRAF and
GEORGE J. WHALEN

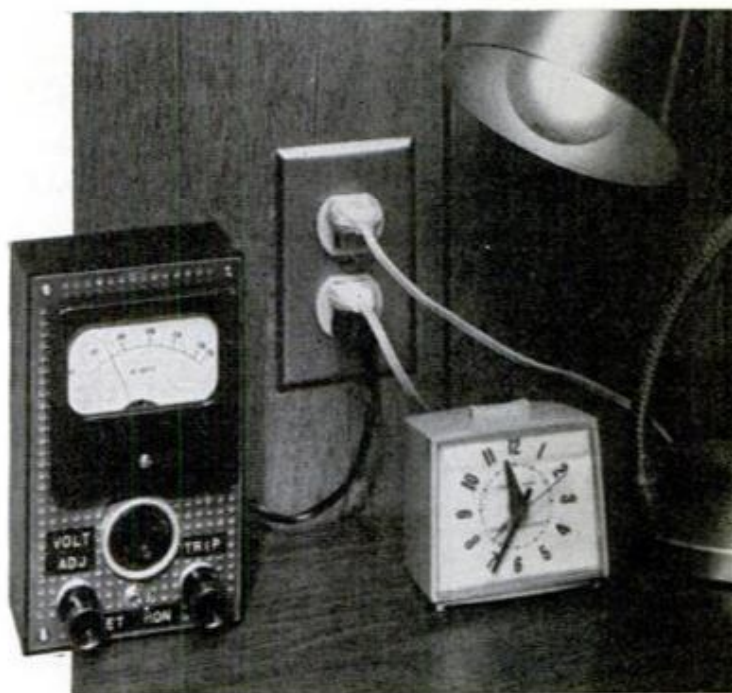
Photos by Robert D. Borst

WHEN A BROWNOUT OCCURS, your lights go dim, the picture on your television screen shrinks, and your electric coffee percolator takes a little longer than usual to perk. You tend to shrug—just the power company cutting back the voltage a bit to conserve juice on a hot day. No harm done. Other things are happening, however, that *can* cause harm.

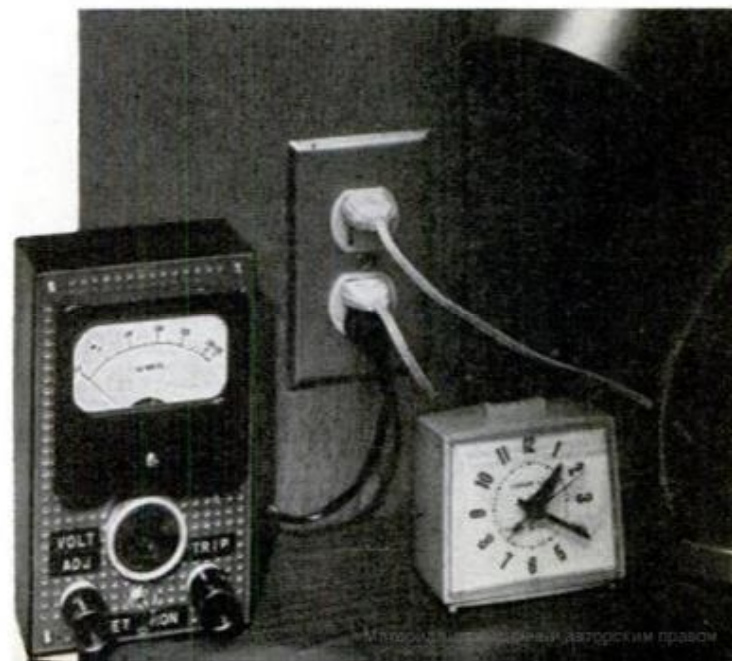
Induction motors must operate at or near their rated voltage or they're in for trouble. A drop of only 10 percent in line voltage can cause running torque to decrease 19 percent, slip to increase 23 percent, current draw to jump 11 percent and temperature to rise 12° to 15° F. Maximum overload capacity decreases 19 percent. What happens is that the motor, struggling to operate on the reduced voltage, draws excessive current in an attempt to compensate for the loss of power. If the voltage drops too low, intense heat builds up and the motor can

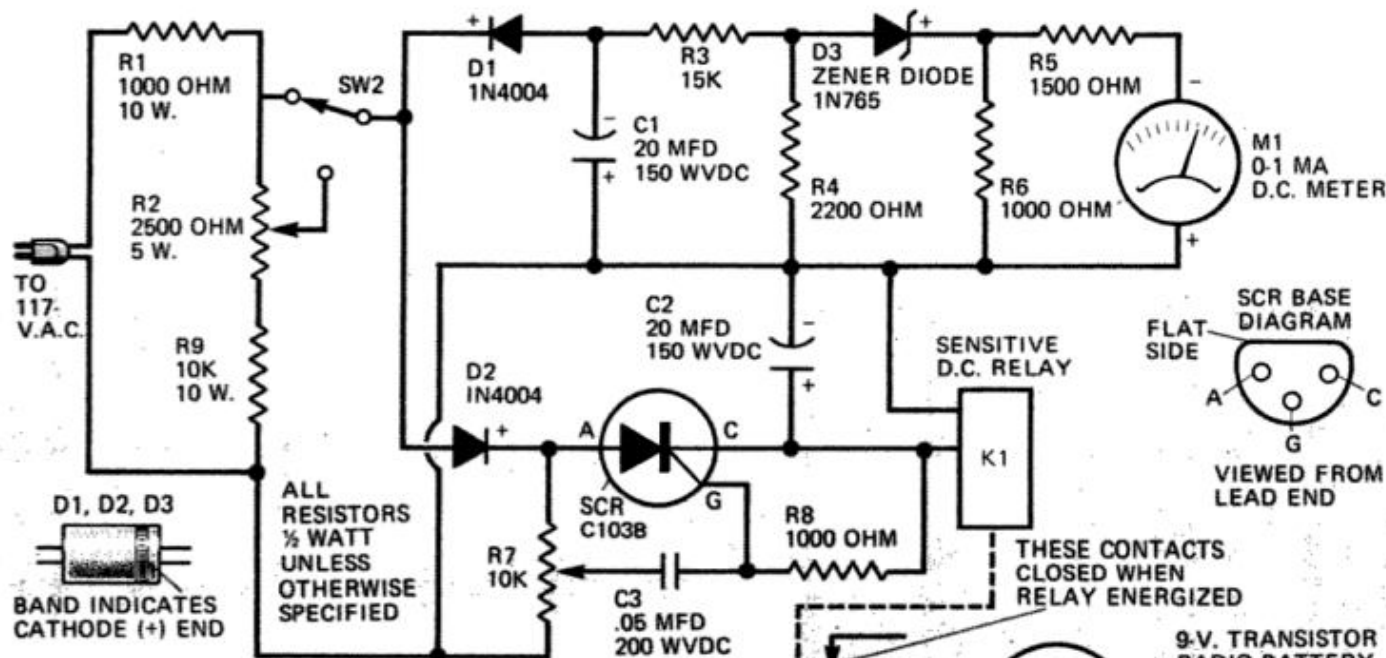


ALL'S WELL—meter reads normal line voltage



WHOOPS! LIGHTS DIM, meter needle falls and warning beep sounds to indicate drop in voltage (above). Blackout (below) also trips alarm





PARTS LIST

- D1, D2—General-purpose silicon rectifier diode, 400 PRV, 1-amp. rating, (type 1N4004 or HEP 157)
 D3—Silicon zener regulator diode, 0.25-w., 10-v. (type 1N765 or HEP Z101)
 SCR—Silicon-controlled rectifier, 200-v., 0.8-amp. rating (General Electric C103B)
 C1, C2—20-mfd., 150 WVDC miniature electrolytic capacitor
 C3—.05-mfd., 200-v. mylar capacitor
 R1—1000-ohm, 10-w. wirewound resistor (Lafayette Radio 33R46301)
 R2—2500-ohm, 5-w. wirewound potentiometer (Lafayette Radio 33R13525)
 R3—15K, 1/2-w. composition resistor $\pm 5\%$ (Lafayette Radio 52R8101)
 R4—2200-ohm, 1/2-w. composition resistor $\pm 5\%$ (Lafayette Radio 52R8081)
 R5—1500-ohm, 1/2-w. composition resistor $\pm 5\%$ (Lafayette Radio 52R8077)
 R6—1000-ohm, 1/2-w. composition resistor $\pm 5\%$ (Lafayette Radio 52R8073)
 R7—10K, 1/2-w. linear taper potentiometer (Lafayette Radio 33R11255)
 R8—1000-ohm, 1/2-w. composition resistor $\pm 5\%$ (Lafayette Radio 52R8073)
 R9—10K, 10-w. wirewound resistor (Lafayette Radio 33R46525)
 M1—0-1 d.c. milliammeter (Lafayette 99R50403)
 SW1—S.p.s.t. switch attached to R7 (Lafayette Radio 33R11891)
 SW2—D.p.d.t. miniature toggle switch (use as single-pole switch; Lafayette Radio 99R61624)
 K1—Remote-control relay, 5K coil, s.p.d.t. contacts, 1.4-ma. pull-in, 1.2-ma drop-out (Lafayette Radio 99R60915)
 Sonalert—P. R. Mallory Co. type SC-628 Sonalert electronic sounder (Lafayette Radio 12R74018)
 Case—6 1/4 x 3 3/4 x 2" plastic box with perfboard front panel (Allied Radio Shack 270-097)
 Misc.—9-v. transistor-radio battery, battery clips, perfboard, line cord, hookup wire, solder

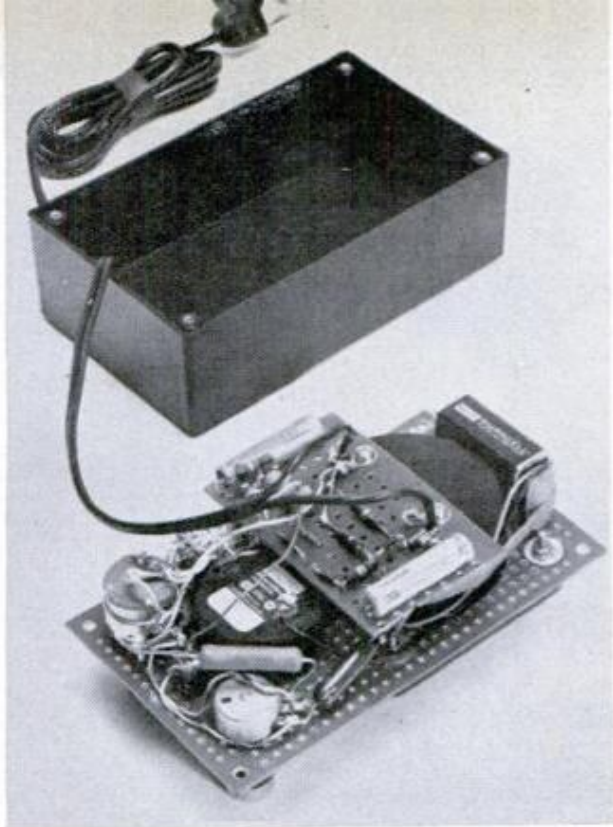
burn out. This is an especially serious problem with high-drain appliances like airconditioners, but it can also affect power tools and other motor-driven home equipment. Some motors have built-in overload protection, but many do not and their loss can mean a costly repair and replacement job.

While power companies don't intentionally allow line voltages to fall below the safe limit, accidental brownouts can

occur. The simple little current checker shown here keeps an eye on your line voltage and automatically beeps a loud warning if it falls below a preset level. It also sounds an alarm if the current goes off altogether, as in a power failure. While a blackout is obvious if it occurs at night when you're awake, it may not be if you're asleep or if it happens during the day when lights are normally off. The checker alerts you that there's been a power failure and keeps you from being fooled by clocks that don't tell the right time and morning alarms that don't go off when they should.

The voltage minder is built around a standard 0-1 milliammeter that measures current, a Mallory Sonalert that sounds a high-pitched beep when energized, and a sensing circuit that monitors line voltage and triggers the alarm at a preset point. The parts fit neatly into a 6 1/4 x 3 3/4 x 2-inch black Bakelite case. While any suitable box will do, this type was selected because it has a removable perfboard front panel that's easily cut and drilled for installing the meter and Sonalert. The VOLT ADJUST potentiometer (R2), the TRIP potentiometer (R7) and the SET/MONITOR switch (SW2) also mount in this panel.

The small parts—SCR, three diodes, two capacitors and five resistors—mount on a small separate piece of perfboard 2 7/8 x 2 1/8



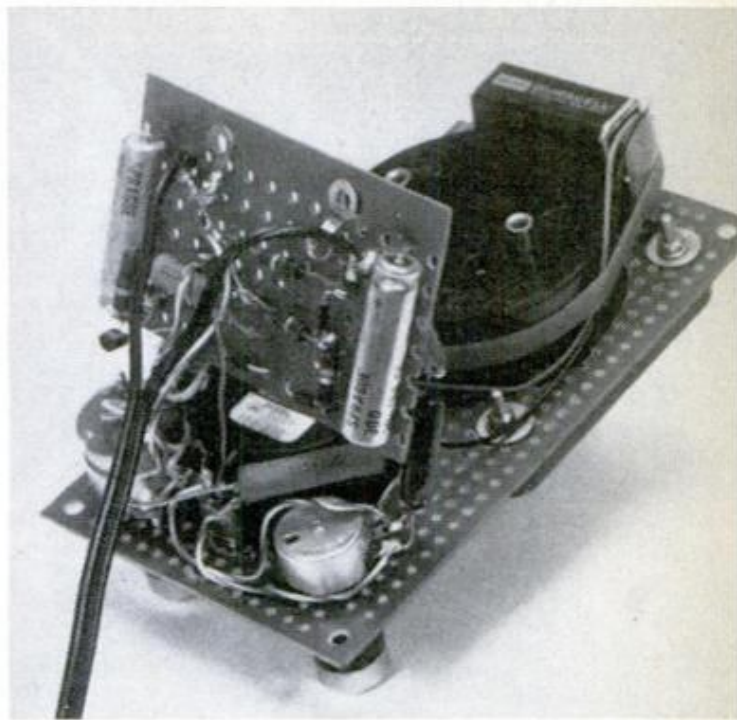
PARTS ARE MOUNTED in small black plastic case. While other enclosures can be used, this type is handy because it has removable front panel of perf-board that can easily be cut and drilled for in-

ches. This is held in place by the two terminal screws on the back of the meter. A conversion scale is needed for the meter so it reads in volts instead of milliamperes. The one shown here is designed to fit standard $3\frac{1}{8}$ -inch-square panel meters of the type sold by Lafayette Radio. Cut it out and paste it over the existing meter scale, being very careful not to touch the delicate meter needle. Wire the unit as shown in the accompanying diagram. Power resistors (R1 and R9) should be mounted in free space as they get hot and need good ventilation.

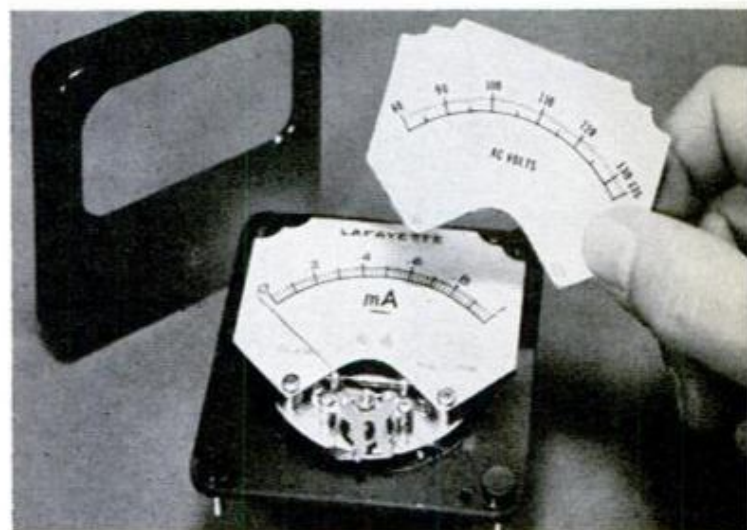
To use the checker, simply plug its line cord into any convenient wall outlet. With the SET/MONITOR switch in the MONITOR position (see diagram at SW2), the meter reads a.c. line voltage as it appears at the outlet. To set the checker to the desired trip point, flip the switch to the SET position. This cuts in the VOLT ADJUST potentiometer (R2). Adjust this control until the meter needle reads the voltage level at which you want the alarm to sound. Since 115 to 120 is normal in most areas, a setting of around 100 volts provides a safe trip point.

With the SET/MONITOR switch still at SET, adjust the TRIP potentiometer (R7) to the point where the Sonalert just goes on, then flip the switch back to MONITOR and

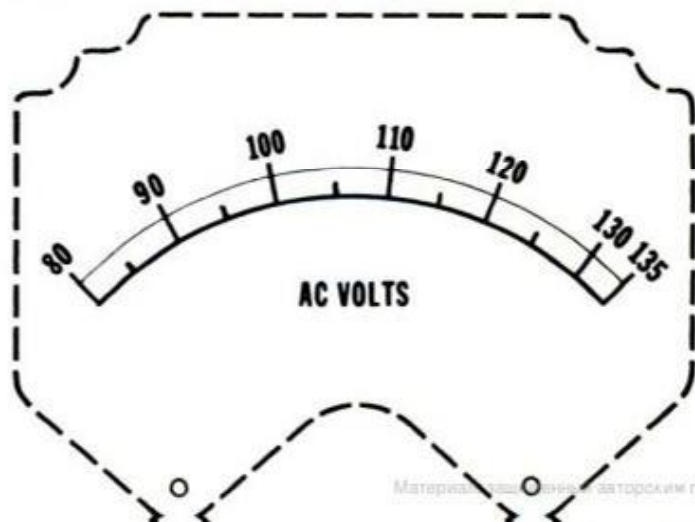
(Please turn to page 174)



stalling the meter, Sonalert and controls. Small components fit on separate scrap of perfboard held in place by two terminal screws on the meter. Board is shown tilted up at right before mounting on meter



CONVERSION SCALE must be added so meter reads in volts instead of milliamperes. One shown below, calibrated from 80 to 135 volts, is actual size and is designed to fit standard $3\frac{1}{8}$ -inch-square panel meters. Carefully cut it out along the dotted line and cement it over meter's existing milliampere scale



Sure way
to save:

Fix your own alternator

By MORT SCHULTZ



The first step is troubleshooting: It's as easy as using an ohmmeter to check your diodes

DON'T TEST YOUR ALTERNATOR until you've checked out your battery and regulator, and even then, always check the alternator drive belt first. If the belt is too loose, worn, or glazed and slipping, alternator output will be reduced.

A damaged belt should be replaced with a new one of proper size, and adjusted properly. In adjusting tension, a drive-belt tension gauge is much preferable to the "press-in-by-finger" method: You'll minimize the danger of overtightening the belt. A belt that is overtightened will put too much strain on the alternator's bearings, which can cause them to fail.

A new drive belt is set tighter than a used belt, but a new belt is considered "used" after it has been in use for 15 minutes. In most cars, the drive belt is tightened by bringing leverage against the center of the alternator housing, with a pry

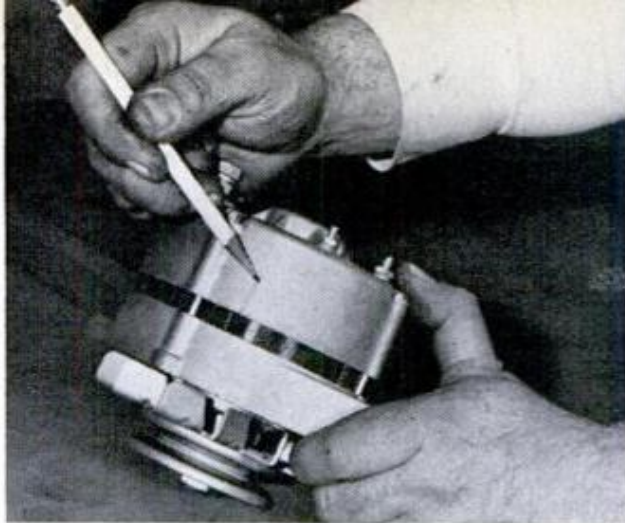
bar, running up the bracket nuts as you do.

All alternators consist essentially of two end-frame assemblies, a rotor and a stator. One of the end frames contains the diodes, which convert the alternating current generated by the stator and rotor to direct current.

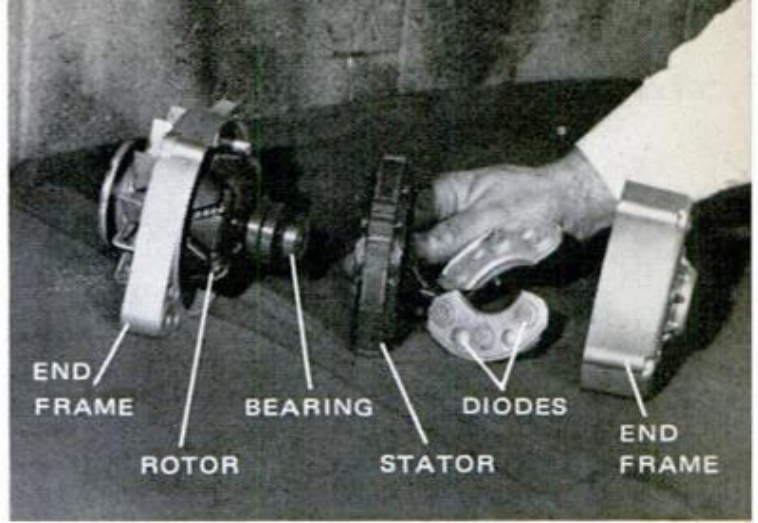
The rotor is basically a field coil wound onto an iron spool that is mounted between two iron poles. It revolves inside the stator, which is mounted between the end frames.

The stator is made up of loops of wire wound into slots of a laminated frame. There are two spring-loaded brushes on two slip rings on one end of the rotor shaft. The slip rings are attached to leads from the field coil, and the brushes are connected through a switch to the battery.

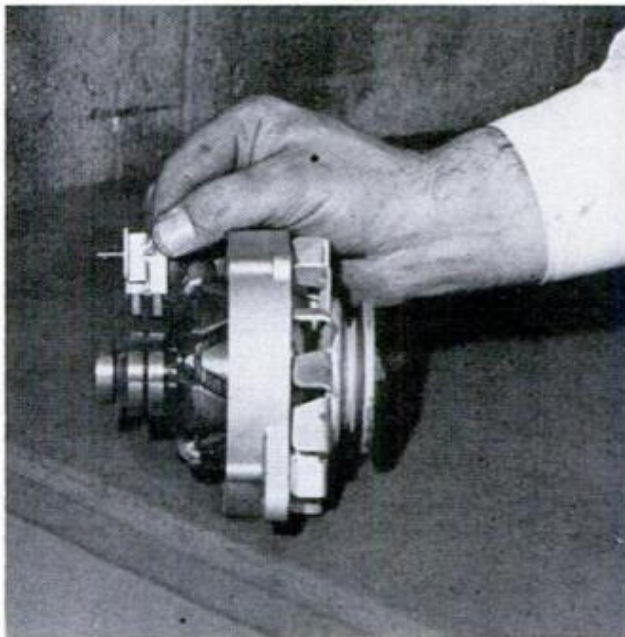
When the switch is closed, current



MARK ALTERNATOR before disassembling for bench testing to make it easier to reassemble properly



ALTERNATOR COMPONENTS can be checked out individually. Diodes are mounted on heat-sink assembly



CARBON BRUSHES ride on slip rings at one end of the rotor shaft. Periodically check them for wear



DISCONNECT DIODES before checking them and before bench-testing other components of the alternator

passes through one brush, through the slip ring on which the brush rides and then through the field coil. After leaving the field coil, the current continues through the other slip ring and brush—then returns to the battery through the ground path.

As the rotor revolves within the stator, the moving magnetic field that's created cuts across the stator windings, inducing an alternating current which is converted to direct current by the diodes. The diodes are electronic check valves: They permit current to flow in one direction only—to the battery.

Alternators normally have six diodes—three negative and three positive. With some alternators, the diodes are contained in a heat sink. To replace a bad diode, you have to replace the whole heat sink and all the other diodes it contains. With other

alternators, diodes are individually pressed into the end frame.

By knowing exactly what component(s) you need—rotor, stator or diodes—you can save money. For example, in the New York City area a new alternator costs about \$65—a rebuilt unit, about \$35. A new rotor costs \$25, a new stator costs \$15 and new diodes (press-in types) cost \$2 each.

To test an alternator and regulator, you need a service manual for the car or service instructions for the alternator and regulator. There are six makes of alternators in Detroit cars: Motorcraft (Autolite), Chrysler, Delco, Leece-Neville, Motorola and Prestolite. Each is somewhat different from the others and connections for tests vary.

For example, earlier Delco and Autolite units employed electro-mechanical volt-

age regulators to limit output voltage. Later models have solid-state (transistorized) regulators.

Service instructions may be obtained by writing the technical publications department of the company that makes your alternator and regulator. Be sure to supply the model and serial numbers of the unit, which are normally embossed on a nomenclature plate attached to the alternator end frame: Ford Parts Div., Ford Motor Co., Livonia, Mich. 48150; Mopar Div., Chrysler Corp., 341 Massachusetts Ave., Detroit, Mich. 48231; Delco Products Div., General Motors, 2000 Forrer Blvd., Dayton, Ohio 45401; Leece-Neville Co., 1374 East 51st St., Cleveland, Ohio 44103; Motorola Automotive Products, Inc., 9401 West Grand Ave., Franklin Park, Ill. 60131; Prestolite Co., 511 Hamilton St., Toledo, Ohio 43602.

To test an alternator and regulator, you also need a voltmeter/ammeter with carbon-pile rheostat to control voltage, and

High resistance in circuits may block flow of current from alternator that's okay

a tachometer. If the alternator has to come off the car for bench testing, you will need an ohmmeter.

For the alternator output test, instruments are connected as described in the service instructions. The engine is started and allowed to run at a speed specified by the manufacturer—1250 rpm, for example.

The carbon-pile rheostat is adjusted so that the voltage specified by the manufacturer is obtained (15 volts, for instance). Now read the ammeter. Current output, which depends on the rated capacity of the alternator, should be to manufacturer's specifications.

Alternators generate from 30 to 60 amps. The size of the unit in your car depends on the car's electrical needs. Vehicles requiring more electricity because of more accessories, such as air conditioners, power windows and power seats, have alternators of greater capacity.

Keep in mind that during the alternator output test the regulator is out of the circuit. Complete the test as quickly as possible and do not exceed the engine rpm requirement of the manufacturer.

If the ammeter shows that the alternator is operating at its rated capacity, any problem in the charging system that may exist is *not* being caused by the alternator. It may be the fault of the regulator. However, if tests indicate that the alternator isn't putting out as it should, the trouble may lie with resistance in the circuits which is blocking the flow of current. In other words, the alternator may be okay—its product just isn't reaching the market.

So before you remove the alternator for testing on the bench, conduct resistance tests of the field and charging circuits. You may save yourself a lot of work. High resistance is usually caused by loose or corroded connections.

If the alternator has to come off the car for bench testing, the tests you have to make are as follows (before disassembling the unit, mark or scribe a line across the end frames to assure correct reassembly):

- *Diode test*—Diodes fail more often than the stator or rotor. An ohmmeter will tell you if a diode has shorted out or opened up.
- *Stator test*—Test the stator for grounds and continuity. Tests require that leads be unsoldered at the diodes.
- *Rotor test*—Test the rotor for opens and grounds.

Another alternator problem is noise. An alternator requires no lubrication, because bearings are permanently lubricated. If a unit appears to be making noise, be sure the noise is coming from the alternator. Water-pump noise in particular is often mistaken as noise from the alternator.

A squealing sound may just be a dry drive belt. Adjust the belt and apply belt dressing. If this doesn't eliminate or lessen the noise, then the problem may be a bad bearing inside the alternator.

Disassemble the unit and check the rotor shaft for scoring, wear and out-of-round. If the rotor looks bad, replace it. Bearings are usually located on the rotor shaft or end frames. They can frequently be pressed out and replaced.

Another cause of alternator noise is a diode which is going bad. This condition will create a whine.

Testing an electromechanical regulator is similar to checking alternator output. The only difference is that the regulator is allowed to remain in the circuit. If the test doesn't show that the regulator is

controlling alternator voltage at about 14 volts, the regulator may need an air-gap adjustment. This is usually done by means of an adjustment screw and/or bending one of the contacts.

Transistorized regulators are often inside the alternator, which means that the alternator must be disassembled to reach them if one has to be replaced. A voltage-range test informs you if this regulator is performing as it should. If testing reveals that the alternator is being controlled between 13.5 and 14.5 volts, you have no regulator problem.

For the most part, transistorized regulators cannot be adjusted or repaired but must be replaced as a unit.

There are several precautions to keep in mind when dealing with an alternator. They will prevent damage and protect you from injury.

- *Never hook up test meters without first disconnecting the battery ground cable. Make connections, double check to make sure polarity is correct, and then*

reconnect the ground cable. Remember—plus to plus, negative to negative. Incorrect polarity, even momentarily, will ruin diodes.

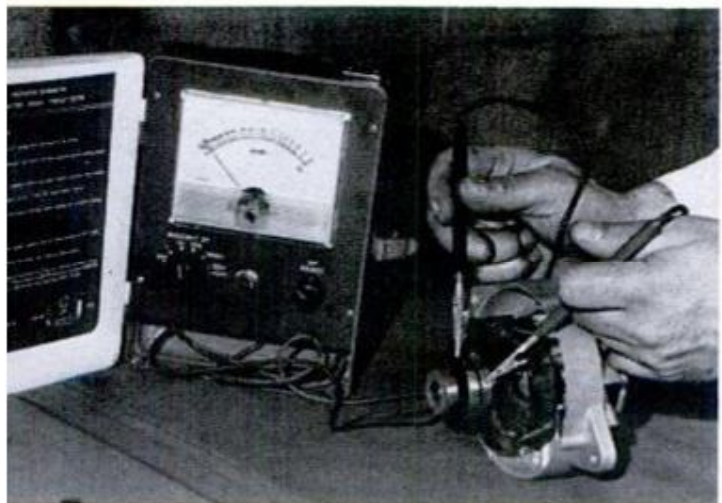
- *Never ground the field circuit between the alternator and regulator. This will damage the regulator and may burn out the field wiring. Only some alternators are fused.*

- *Watch out for the output terminal of the alternator. It is always "hot." If you accidentally ground or flash this terminal, you will cause a short.*

- *Make sure that the ignition is turned off, before you go near either the alternator or regulator.*

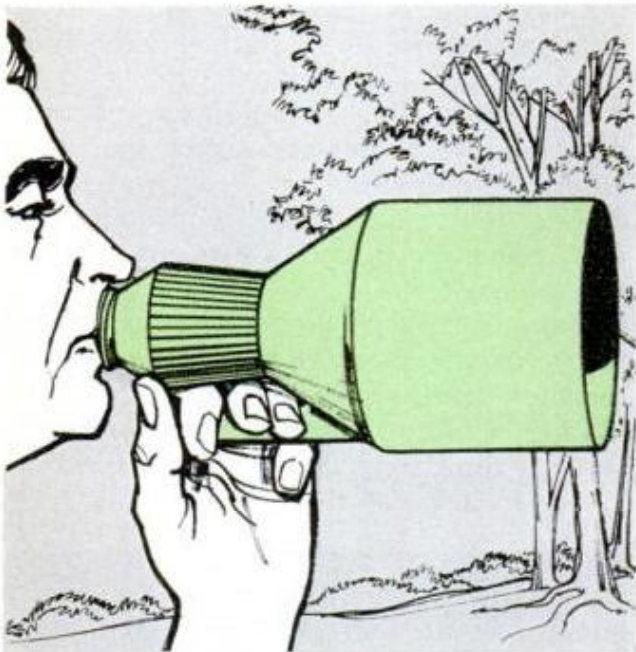
- *Use tools which are insulated with plastic sleeves or tape to prevent accidental shorts.*

- *Take care when you add oil or coolant to the engine. Keep it away from the alternator. If oil or coolant gets into the air intakes, slipping will occur between brushes and slip rings that will cause a decrease in alternator output.* ★ ★ ★



ALTERNATOR OUTPUT TEST (upper left) is performed using a volt/ammeter with carbon-pile rheostat. Disconnect battery ground, make connections, check polarity and reconnect. The rotor (left) is checked with an ohmmeter for grounds or an open circuit. The transistorized regulator (above) is encapsulated

BETTER WAYS TO DO IT!



LOW-COST "BULLHORN" can be made from a half-gallon bleach bottle. Wash bottle thoroughly, then cut out the bottom and you have a ready-to-use megaphone with handle.—E. V. Reyner, Salinas, Calif.

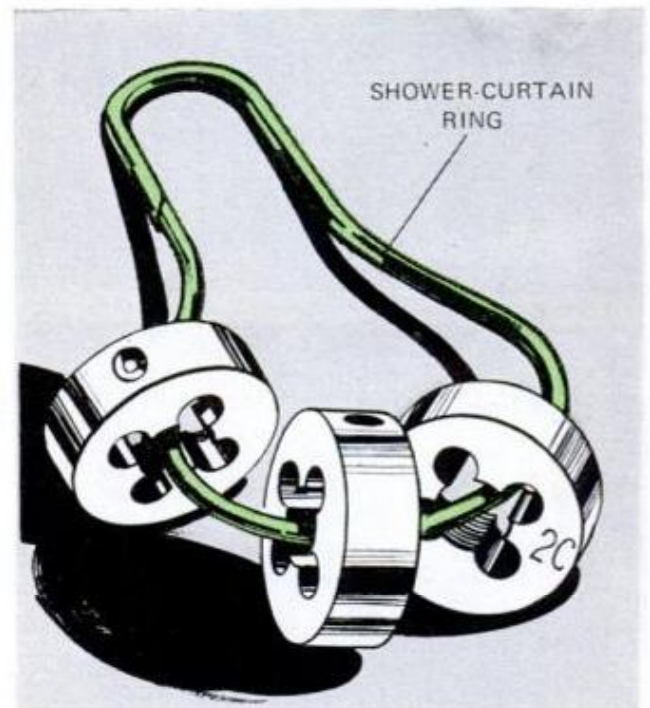


PAINT TOUCH-UP APPLICATOR is made from a $\frac{1}{2} \times 1 \times 1\frac{3}{4}$ -in. piece of foam rubber and two tongue depressors. Clamp half the rubber between tips and wrap ends with tape.—G. Bertrand, Le Saules, Que.

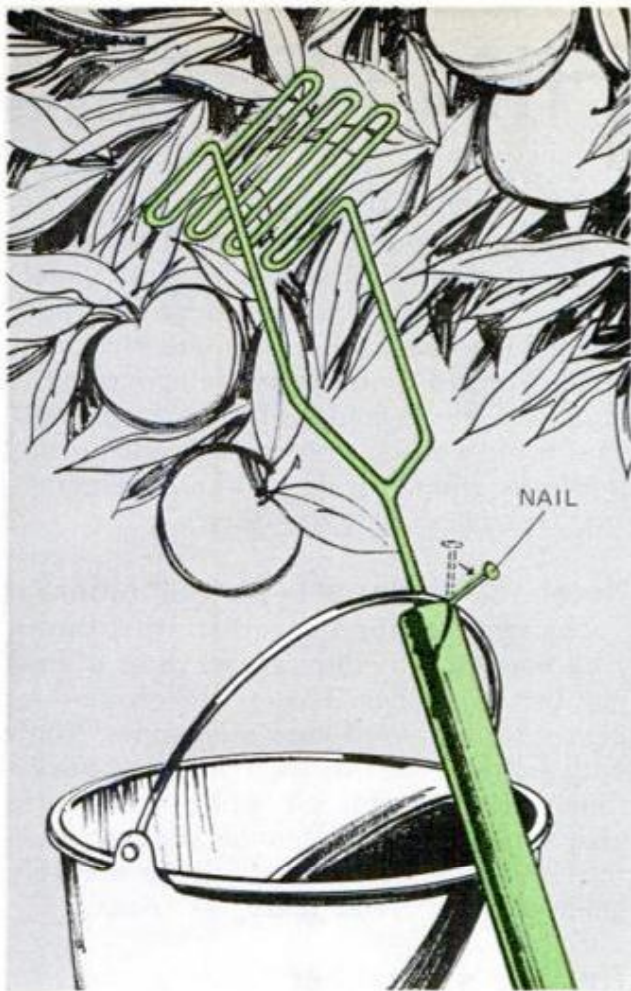
Illustrations by Adolph Brotman



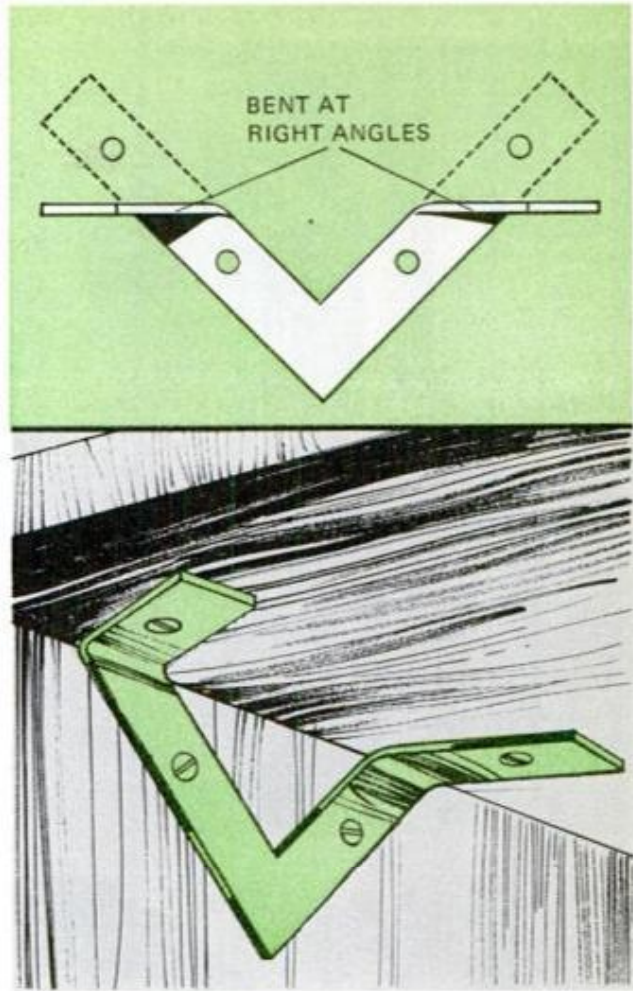
CELLOPHANE TAPE END will be easy to spot if you slip a penny in place before putting away the roll. This stunt saves annoyance of picking at the end with your fingernails or a knife.—Joe Braunstein, New York.



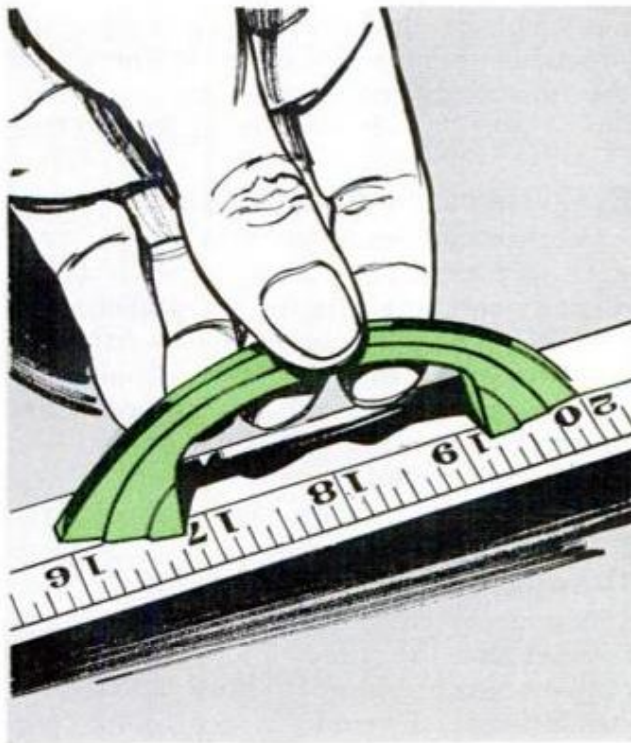
DIES ARE EASILY FOUND if kept on a shower-curtain ring as shown. Use separate ring for duplicate sizes, hang them from nails into studs or hooks on perforated hardboard.—W. H. McClay, Pasadena, Calif.



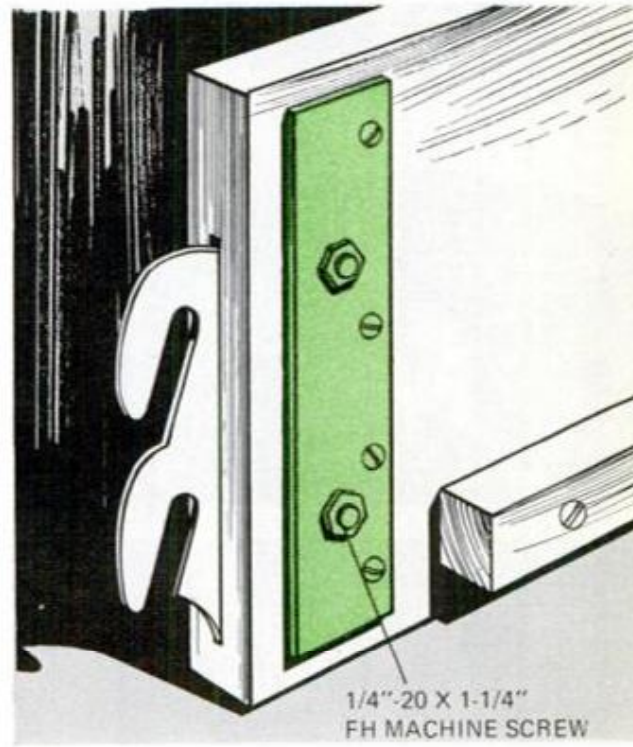
A FRUIT PICKER—for the high ones—can be made from an old potato masher attached to a long handle. Drive a 6d nail in the handle as shown to hold the pail securely in place.—*W. H. McClay, Pasadena, Calif.*



NEAT, STURDY SHELF BRACKETS can be made by bending metal corner braces at right angles as shown. Braces have predrilled, countersunk holes, so they can be used immediately.—*Ken Patterson, Regina, Sask.*

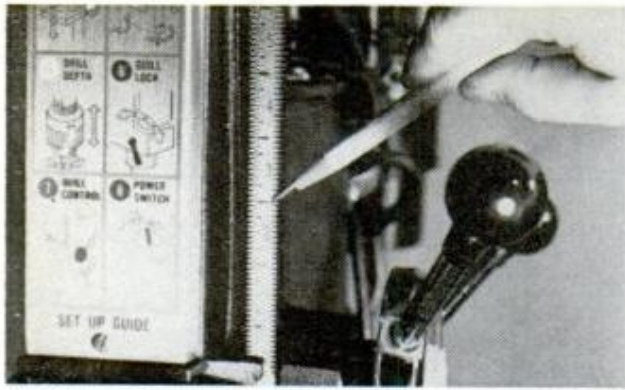


ATTACH A DRAWER PULL to the center of a yardstick and you will find this measuring tool will be easier to manipulate. Adding the handle provides good one-hand control.—*William Swallow, Brooklyn.*
AUGUST 1972



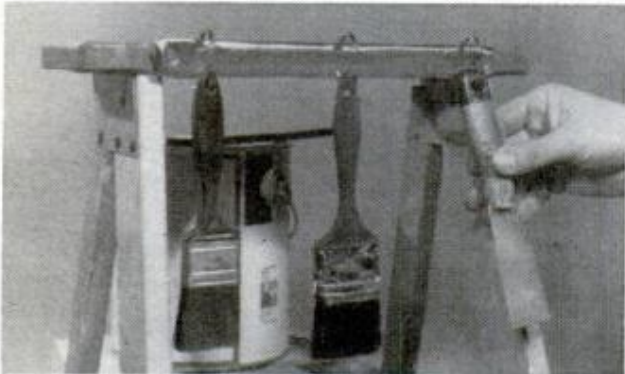
BED RAILS will stay put if you replace the original pins that hold the connecting hooks. Drill through, add the metal plate and use machine screws and nuts to hold it.—*James P. Marshall, Barrington, R.I.*

HINTS FROM READERS



Easier-to-read depth gauge

The depth gauge on my drill press had graduation lines all of equal length except at the 1-in. markings, which made it hard to read intermediate depths quickly. Using a fine-tipped permanent felt marker, I extended the $\frac{1}{4}$ and $\frac{1}{2}$ -in. marks as well. The trick worked and makes quick readings easy and accurate.—*John F. Pilznien-ski, Dearborn Heights, Mich.*



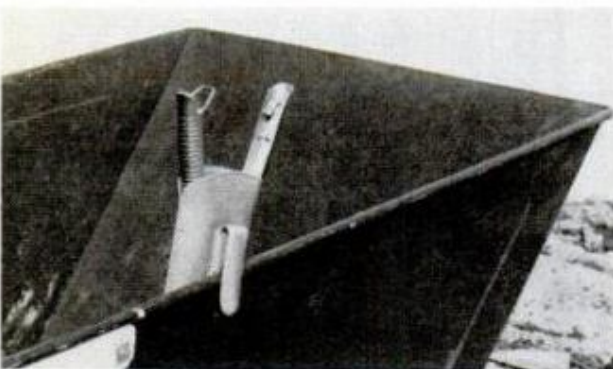
Notebook binder acts as toolholder

The metal portion of a discarded three-ring notebook binder can serve as a good paintbrush holder. Fasten the three-ring device to the top of your stepladder. Tools with holes drilled in their handles can be removed and replaced while you work, and, when ladder is to be moved, snap shut the rings and tools will be securely held.—*Ken Patterson, Regina, Sask.*



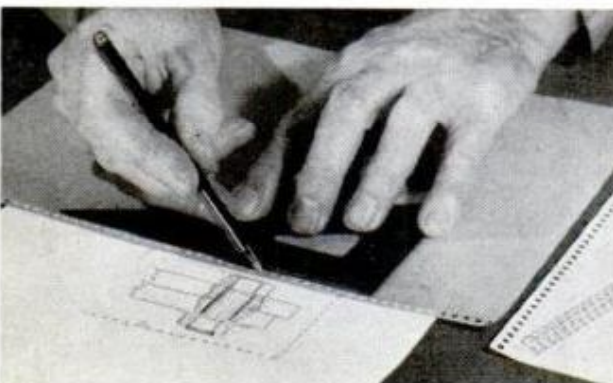
This grip's a grabber

Silicone compound spread on the palms of cloth workgloves, in a series of dots or beads, lessens the tendency of the gloves to slip when the wearer grasps tool handles and the like. The rubber-like coating need not be thick enough to cause appreciable increase in glove stiffness. Let the silicone dry before you use the gloves.—*B. W. Ervin, Kent, Ohio.*



Eyeglass case makes 'holster'

A discarded eyeglass case of the type with an attached pocket spring-clip makes a handy carrying case for pruning clippers or other small gardening tools. Attached to your garden cart as shown, clippers are always at the job and cutting edges are protected when the tool is not in use. And tools won't be left outside.—*Marshall Lincoln, Wickenburg, Ariz.*



Drawing dotted lines

A page or cover from a spirally bound booklet can be used for drawing neat dotted (or dashed) lines. Place a straightedge to guide a ball-point pen or pencil across centers of the series of holes through which the wire spiral had been inserted. To remove a spiral, clip one end and simply "unscrew" the coil.—*Walter E. Burton, Akron, Ohio*

At last—a new paint can



PRY-OUT TINT PLUG lets dealer add color, replace plug and machine-shake without removing cover. Hole admits portable-drill stirring rod for home mixing, keeps the paint from flying. Plug seals the hole tightly

EVER HAD PAINT SPATTER all over when you put the cover back on the can? Or had a devil of a time prying it open with a screwdriver? Or found the paint dried up when you were ready to use it again? If so, you'll be happy to know that house paint is beginning to be packaged in a container with a radically different cover that's designed to make painting less of a mess and chore.

In the first significant change in paint-can design in over 50 years, Continental Can Co. is producing a one-gallon container that opens like a can of peanuts—the complete top tears off by pulling a tab. Called Easy-O, it replaces the old-type *press-on* metal cover with a snug-fitting *press-over* cover of polyvinyl. With the rim of the can no longer a sealing factor, any paint that remains in the rim in no way interferes with the replacement or tight seal of the storage cover—the plastic pull-off cover fits *over* the can.

An additional novel feature of the can is a plastic pry-out tint plug that lets the paint dealer add tinting pigments, reseal and agitate the can by machine. The removable plug also lets the do-it-yourselfer stir the contents with an electric drill without having the paint fly all over. The new can is also a bit taller than the familiar gallon container to provide extra "headroom" for the paint and reduce the likelihood of spillage when stirring and pouring.

★★★

AUGUST 1972



FINGER RING on tear-off, throwaway cover makes it easy as pie to open can, eliminates prying off cover



PRESS-ON PLASTIC CAP comes with each can to seal it tightly after can's top is torn off and discarded

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Things to keep

Colonial weather station

This weather station not only makes an attractive wall decoration for den or family room; it keeps you posted on relative humidity, temperature and barometric pressure 24 hours a day. The eagle and instrument plaques are cut from knot-free (clear) white pine. To simplify cutting and working the small plaques, gang the three in a row and cut them apart after making the holes and boring the corners.

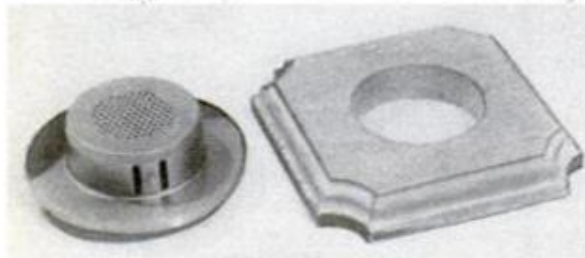
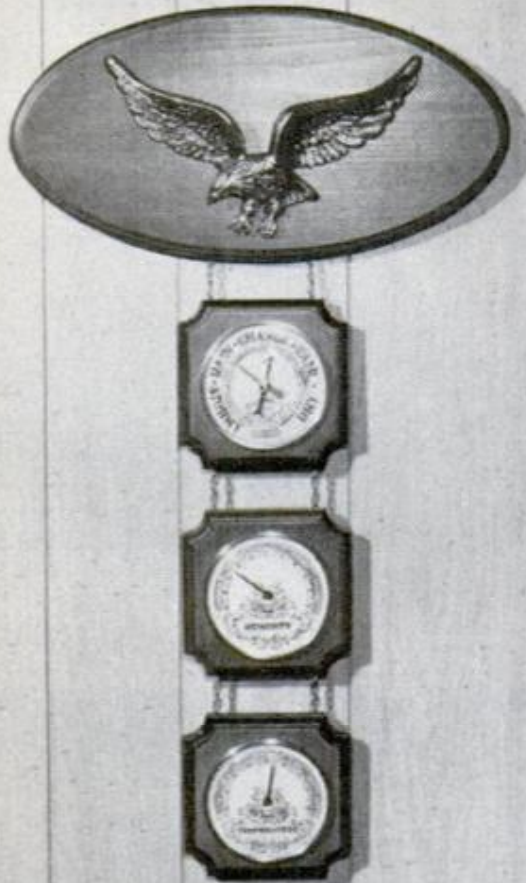
Holding small pieces for shaping is difficult, especially when the work is smaller than the router base. To do this simply and safely, make a workholder by driving a few brads up through the bottom of a piece of 1/4-in. plywood and clamp or nail this to the workbench. The work is simply pressed down on the protruding brads.

Humidity and temperature gauges are merely press-fitted into their holes. A separate flange is provided to hold the barometer bezel. This is pressed over the flange after it is screwed in place.

Since weather instruments must "breathe," wood spacers glued to the backs keep the wood plaques out from the wall. Tiny screweyes and brass chain link the plaques, the screweyes being opened to accept the chain and then pinched shut.

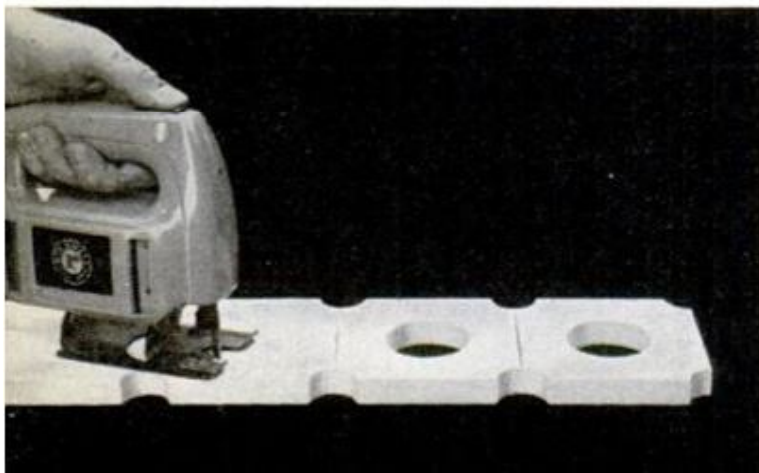
You can finish the wood parts as desired; the new antique colors are ideal for pine. The three weather units, plus the eagle, sell for \$21 postpaid from Armor Co., Box 290, Deer Park N.Y. 11729. New York residents add sales tax.

—John Capotosto, New York City

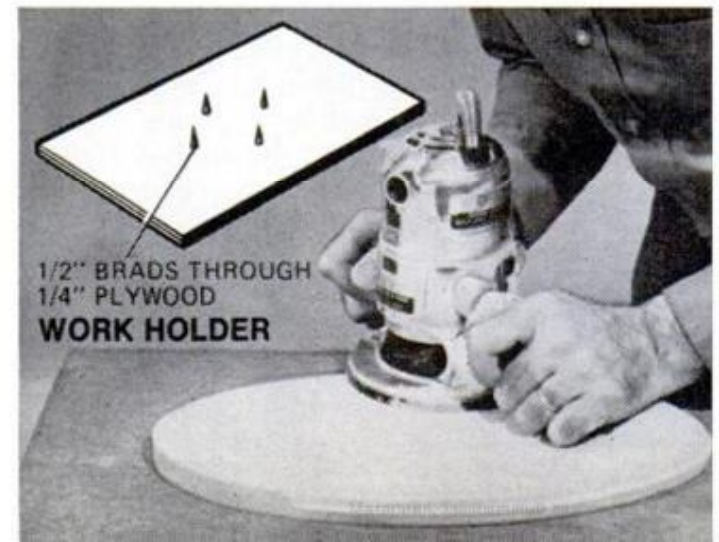


INSTRUMENTS ARE HELD in panels by a snug press-fit. The holes can be sawed, or bored on a drill press

SAWING HOLES for instruments is less of problem when three panels are sawed as one, then cut apart

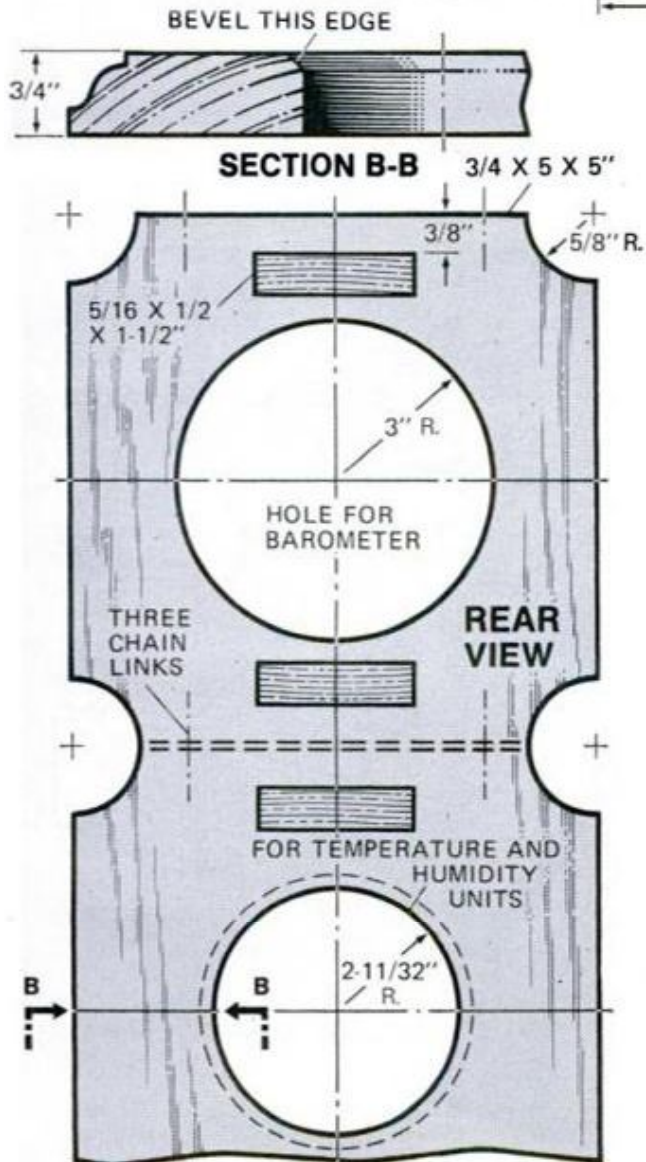
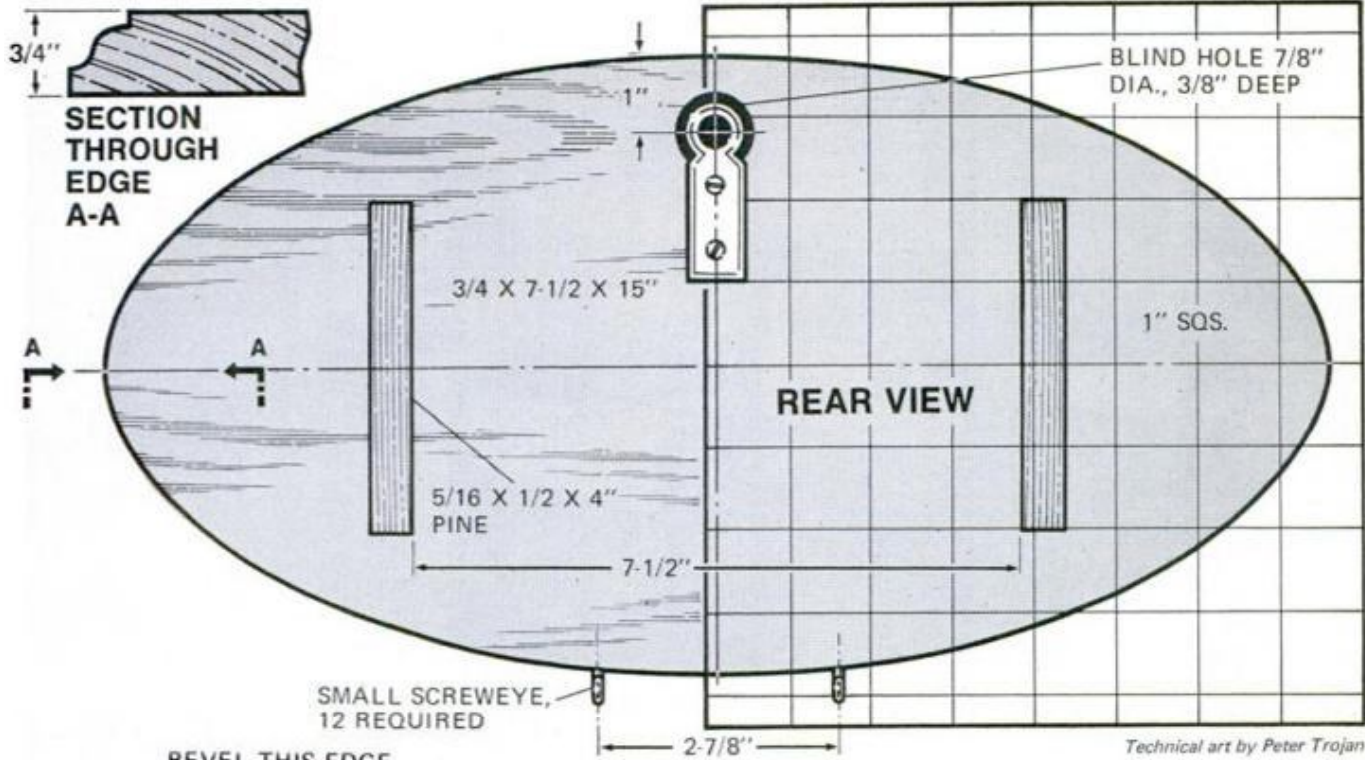


HOLDING WORK when shaping edge is made easy by resting it on brad points driven up through plywood

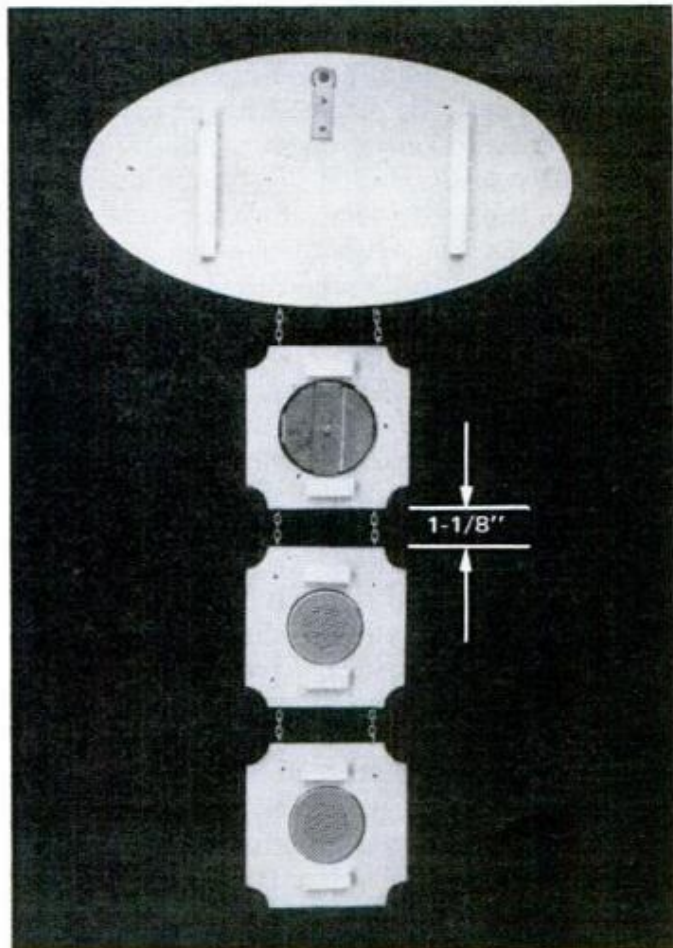


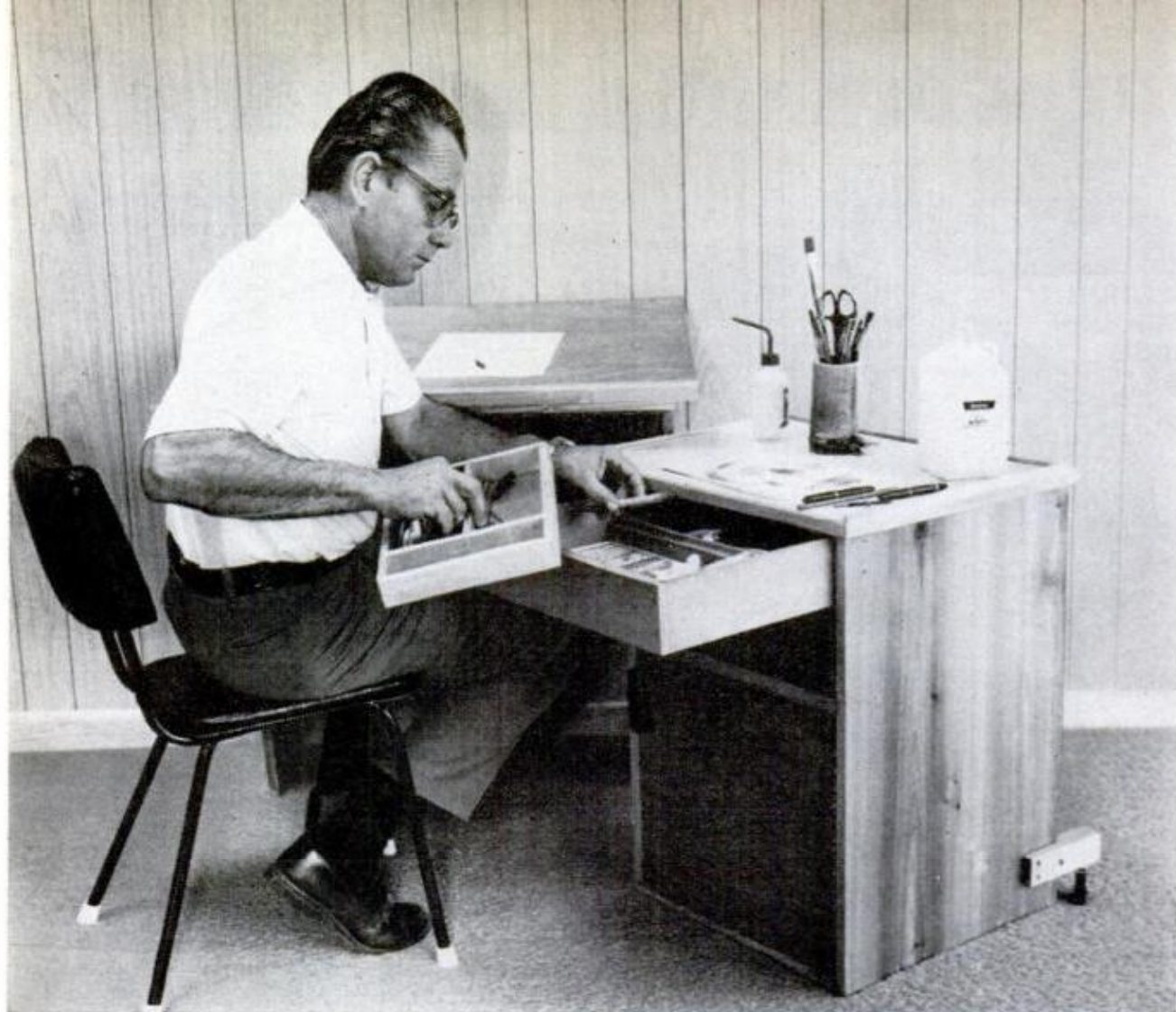
1/2" BRADS THROUGH
1/4" PLYWOOD
WORK HOLDER

Our workshop humming



SPACER BLOCKS ARE GLUED to back of panels to hold instruments out from wall so they can "breathe"



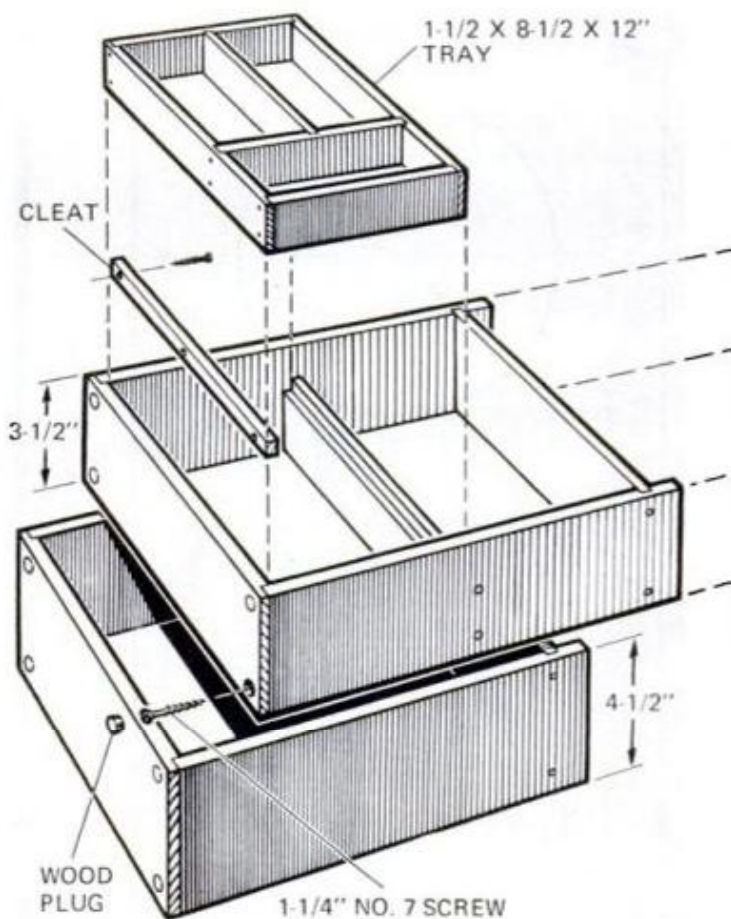


Hobby worktable

Here's the handiest worktable the hobbyist, would-be artist or finger painter could ask for. Consisting of a rolling taboret which parks under a slant-top drawing table, the two-piece affair provides a safe storage compartment (under a lift-off top) for wet, unfinished paintings, and storage galore for all kinds of artist supplies in two roomy drawers and a hinged-door compartment. The drawing table remains affixed to the wall by four angle brackets, while two caster-fitted blocks attached to the taboret let you wheel it in and out, yet it stays put when in use.

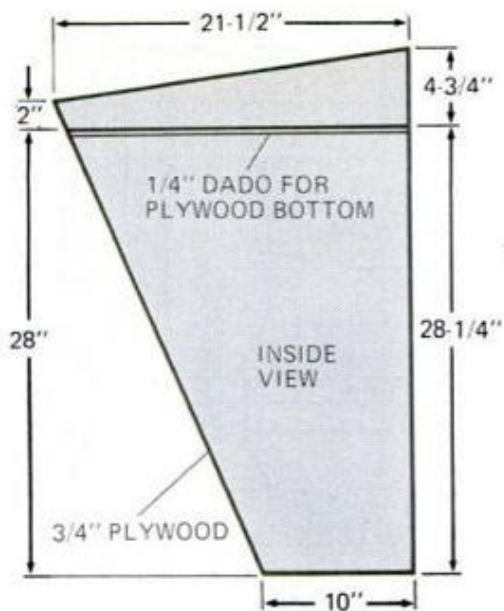
Both sections are made nearly all of plywood. The bottom of the traylike compartment of the drawing table is $\frac{1}{4}$ -in. plywood set in $\frac{1}{4}$ -in.-deep grooves cut in facing surfaces of the slanting legs.

The top of the taboret was cut from a Formica-covered countertop cutout. It's dadoed on the underside to fit over the back and side panels. Side panels are rabbeted along the bottom to house the bottom panel; along rear edges to house the back.—Hal Kelly, Fort Pierce, Fla.



Technical art by Peter Trojan

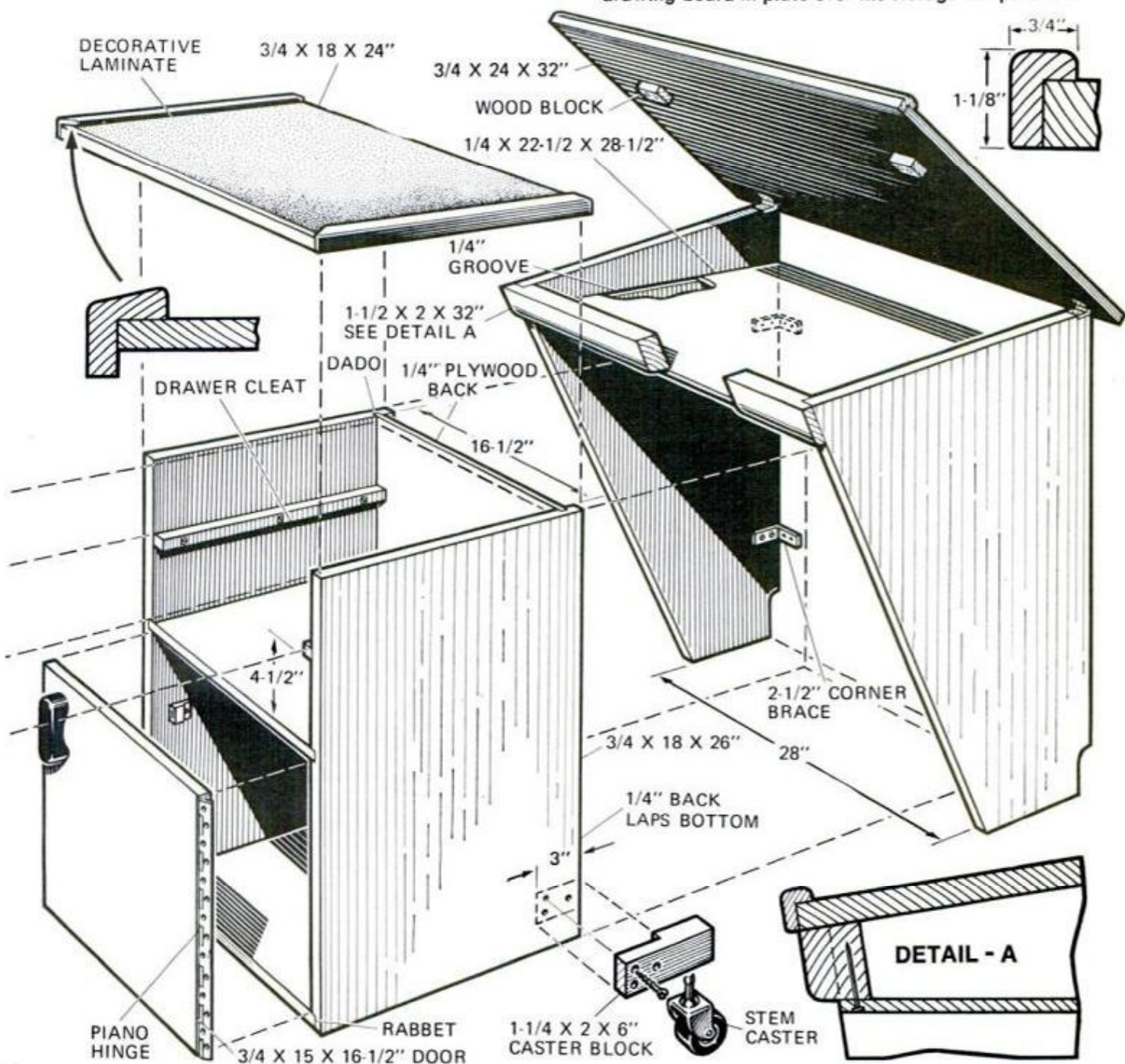
POPULAR MECHANICS

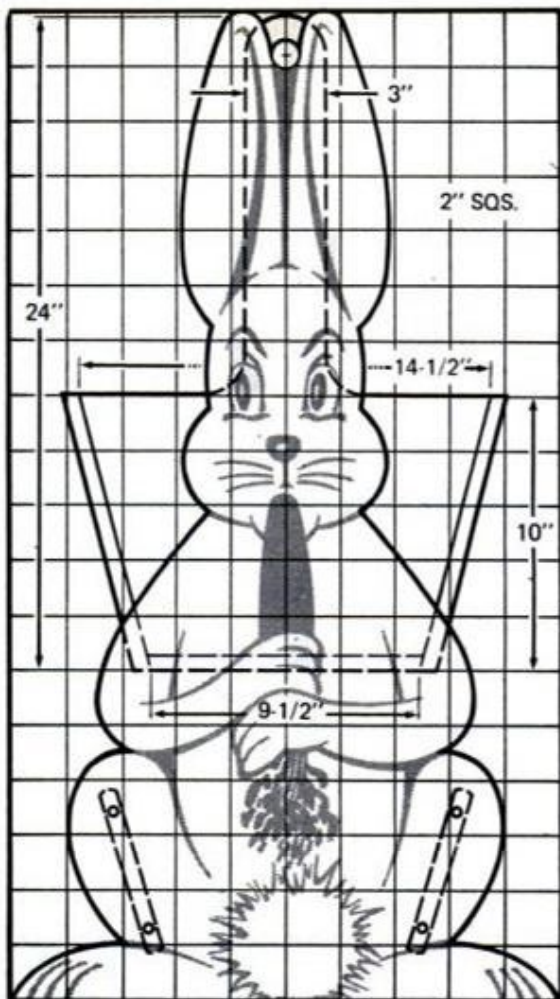
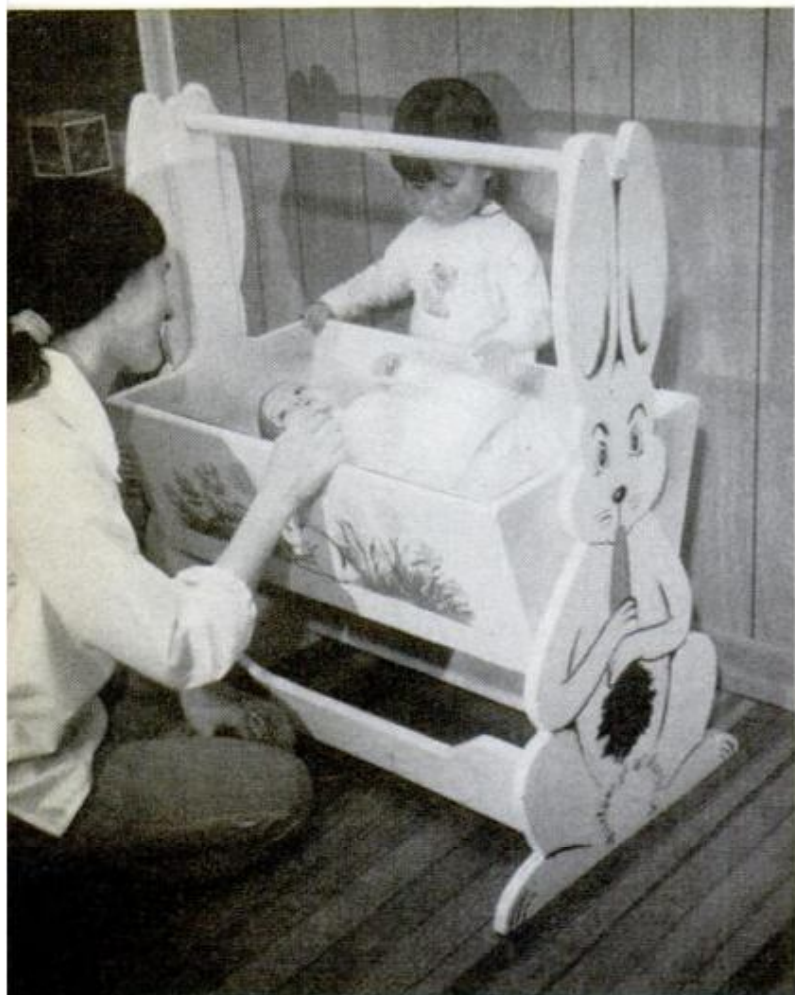


END PATTERN



WOOD BLOCKS glued to the underside keep lift-off drawing board in place over the storage compartment



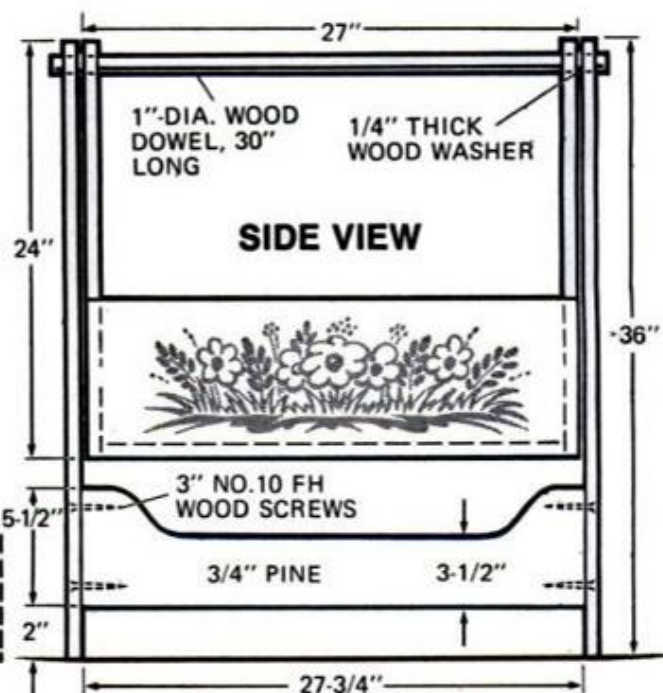
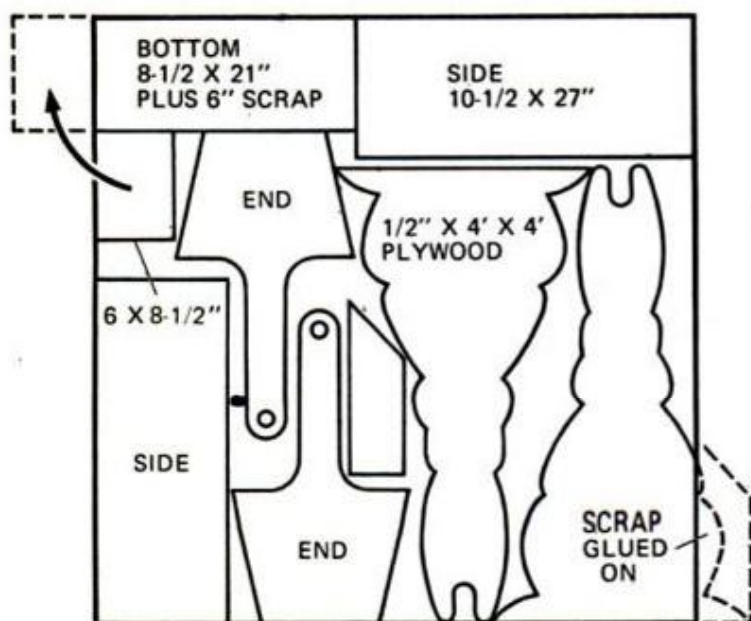


Bunny cradle

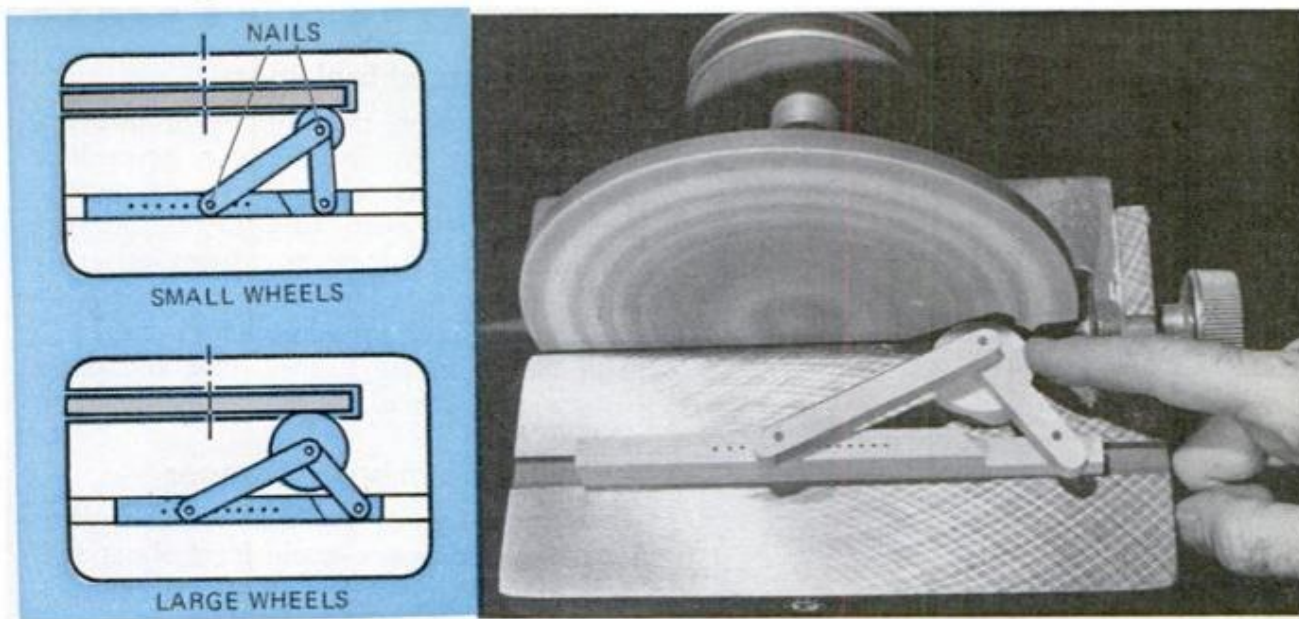
This novel cradle swings instead of rocks, and you can lift it out of its rabbit stand and carry it like a bassinet. Most of the parts are cut from $\frac{1}{2}$ -in. plywood, and the diagram below shows how you can lay them out on a 4x4-ft. panel with a minimum of waste. The two rabbit cutouts

are joined together at the bottom with a pair of $\frac{3}{4}$ -in. pine stretchers cut from a 1x6 board. Notches in the rabbit's ears hold the projecting ends of the 1-in. dowel handle which passes through the upper ends of the cradle.

—Hank Clark, Dumont, N.J.



Sanding jig turns out perfect wooden wheels



Not wanting to buy any parts when I was making some wooden cars and trucks for my kids, I dreamed up this adjustable sanding jig which enabled me to "turn" perfectly round wheels on my disc sander every time.

Here's how it works: First, I adjust the jig for the size wheel I want. Then, starting with a square wood blank, I make a hole in the center for the nail pivot. Now

with the sander running I place the jig in the table groove, and with one hand holding the jig and the other the blank, I slowly move the jig forward to meet the disc as I turn the blank with my fingers. One time around and I have a perfect wheel. Downward direction of rotation of your sanding disc determines which end of the table to use.

—Paul D. Fiebich, Utica, Mich.

Silicone sealant pads clamp jaws

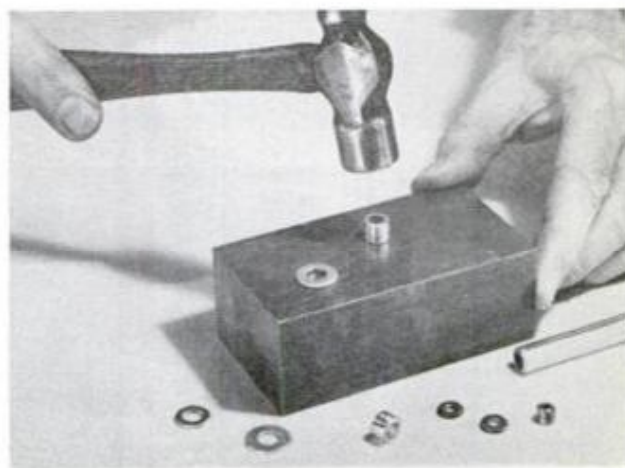
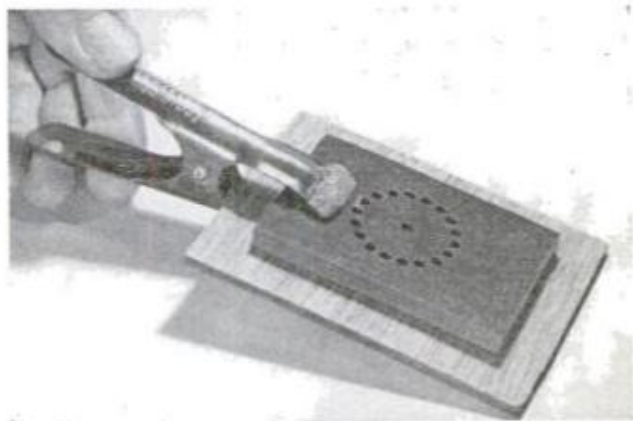
A simple way to pad or cushion the bare jaws of a steel spring-clamp of the type shown is to coat the ends with silicone sealing compound. To do it, prop the jaws open with a wood block and spread the compound over the tips to a thickness of about $\frac{1}{8}$ in. and let it "harden" for 24 hours.

This eliminates the need to protect finished wood surfaces from marring by the jaws.—Hugh Midity, Anchorage, Alaska

Quick washers from tubing

Emergency washers can be made by cutting soft steel, copper or aluminum tubing into short lengths, $\frac{1}{4}$ in. or more depending on diameter, and compressing the rings endwise in a vise or by hammering. Since the amount of compression affects thickness and diameter of the washer the best length and degree of compression for a particular job are found by trial or experience.

—Walter E. Burton, Akron, Ohio.

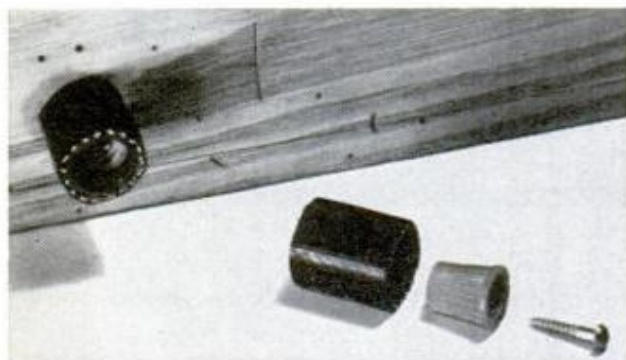




Hints from

Prevent clogged fuel lines

You can lessen the chance of mower-engine failure by following a procedure used by cautious pilots and experienced mechanics. To keep tiny flecks of rust and other bits of matter from entering small passages in the carburetor, strain gasoline through a piece of chamois. A small patch in the funnel does the trick.
—Marshall Lincoln, Wickenburg, Ariz.



Toothpaste cap holds bumper

Bumpers for doors and other moving items sometimes are made from short sections of rubber garden hose, but mounting them can be a problem. One solution is to use a plastic toothpaste-tube cap that fits tightly inside the hose. The cap is drilled in the center for a mounting screw and forced into the hose section.

—Walter E. Burton, Akron, Ohio.



Styrofoam gluing jig

A block of rigid plastic foam will prevent ball-shaped objects from rolling about while being glued together in series or patterns. To glue the marbles shown, a guideline was drawn on the foam surface, and then, after epoxy glue was added to each marble, it was pressed into the foam and glued to the preceding marble.

—Burt Webb, Skokie, Ill.



Sanding stunt to save corners

When using a fast-cutting power sander to smooth a small, flat surface such as the lid of a trinket box, you can avoid accidental overcutting at the edges by surrounding the work with wood. The protective wood border can be made by clamping strips flush with the top surface. If necessary, lower strips for finish sanding.

—B. W. Ervin, Kent, Ohio.



Chain can be used as drawer pull

A short piece of chain secured at the ends by bolts or Pop Rivets makes a novel drawer pull. By placing spacers under it, the taut chain can be positioned for easy finger gripping. "Drawer" shown has chain riveted to end of a solvent can whose side has been removed to convert it into a small-parts drawer for the workshop.

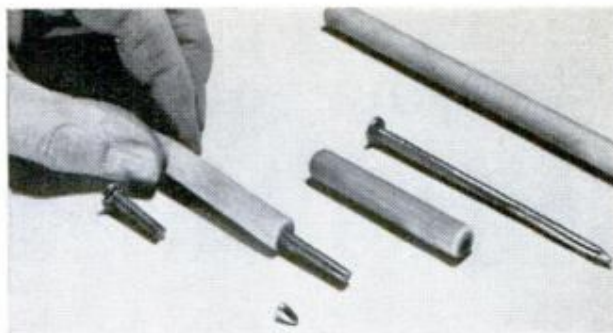
—Walter E. Burton, Akron, Ohio.

readers

When you need a stronger dowel

A good way to beef up shear strength of a wooden dowel is to bore it lengthwise to receive—in a snug fit—a metal core made from a large nail or hardened steel rod. Normally, the rod is flush with the dowel ends; in the photo it was pushed part way out to be seen.

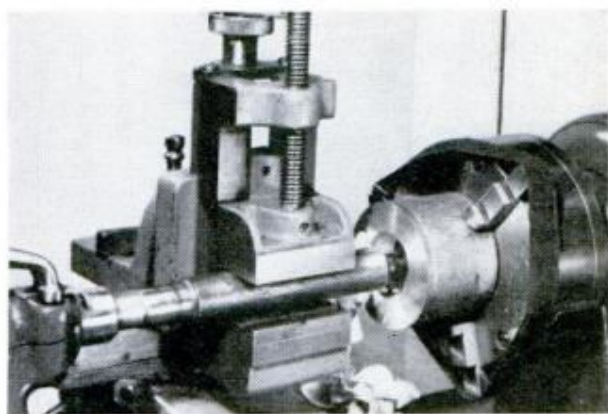
—W. B. May, Oak Park, Ill.



Attachment holds big boring bar

A boring bar designed for a 14-in. lathe turret can be used on a 9-in. bench lathe by clamping it in a carriage-mounted milling attachment. To ease the stress on the attachment, and to prevent the possibility of its shifting under pressure, apply boring force to the end of the bar by feeding the tailstock spindle against it.

—Walter E. Burton, Akron, Ohio.



Tape reduces a chuck hazard

If a workpiece cannot be clamped in your lathe chuck without having the jaw ends projecting beyond the chuck body, the projections could be considered a hazard. One way to treat such a chuck is to wrap two layers of smooth masking tape around the chuck body and over the angular jaw ends.

—E. B. Walters, Chicago.



NEXT MONTH IN SHOP AND CRAFTS

25 PAGES OF GOOD IDEAS FOR BETTER HOME ENTERTAINING. Now that fall is just around the corner, it's time to start thinking about what you can do to improve the at-home entertaining scene. PM's round-up of ideas—from a piano bar to clever "cover-up" suggestions that let you convert an unfinished basement to a party room shortly before the party—show what you can do to make your home the "life of the party." Included are hi-fi cabinets, an out-of-sight home movie screen and the latest products for the good life at home.

ALL-TIME GREAT NO. 6: A WORKBENCH SETUP FIT FOR A PRO. Just about all homeowners, do-it-yourselfers and tradesmen have one common need: A good, sturdy workbench with a wall cabinet for tools. We first published this deluxe bench in 1951 and since updated it by adding plastic laminates, perforated board and a shop-built light fixture. Plans are included to let you duplicate the setup.

SHORT COURSE IN POWER TOOLS; BENCH-SAW KNOW-HOW, PART 3. Parts 1 and 2 covered jigs, accessories, work habits and dado sawing. In part 3, you'll learn how you can add the professional touch to all your projects by using a molding head.

Build this cabinet for your router and you'll have an Instant 'shaper' for your shop



By WALTER E. BURTON
Photos by the author

THIS PORTABLE ROUTER was converted into a shaper by inverting it in plywood cabinet

IF YOU TURN a portable router upside down, you have, essentially, a wood-working shaper. To do it, the inverted router must be supported in such a way that it can function as a shaper with work guides, guards and the like. This shop-built version was designed to accommodate a Millers Falls MF router, Model A, catalog No. 7200. But, where necessary, dimensions can be altered for your own router.

The router hangs suspended from the underside of the cabinet top so that it can be removed for conventional routing operations by unscrewing four nuts. The hinged top tilts upward for convenience in changing cutters and making adjustments—although you can make cutter-height settings by reaching into the cabinet.

The cabinet top is hinged to the rear panel. Centered on the top is a $\frac{1}{8}$ x 8 x 8-in. aluminum plate that rests in a recess

so plate surface and adjacent wood are in the same plane. The hole at plate center is approximately $1\frac{1}{8}$ in. in diameter. In the wood top, concentric with this hole, is a 6-in.-dia. opening for the router base. Check your router's shoe diameter before cutting this circle.

You can form the $\frac{1}{16}$ -in.-deep recess by routing out most of the area with a straight bit. Leave an "island" in the center until last so the router shoe is supported. Then, remove the island with a router bit in a drill press. Next, jigsaw the 6-in. opening. Fasten the plate in its recess with two countersunk wood screws near opposite corners.

To determine the center of the $1\frac{1}{8}$ -in. hole, insert a pointed cutter in the router and place the router base into its opening. The point where the bit touches the metal plate is the center for the hole. Use two 2-in. butt hinges to join top to back panel.

Although the router's weight will hold the top down, rigidity is increased by installing a simple wooden latch at the corner near the front panel hinge.

The router-mounting arrangement is dictated by router-base construction. For the tool shown, two $\frac{1}{8} \times \frac{3}{4} \times 7$ -in. aluminum strips, with $\frac{1}{16} \times \frac{3}{4} \times 4\frac{5}{8}$ -in. pads (to compensate for difference in router base and wood thickness) riveted to them, worked fine. Four 10-24 bolts extend through these strips, through countersunk holes in the metal top insert and plywood and are secured to the cabinet top with nuts and washers.

The cabinet and cabinet-top sizes are not critical. The dimensions given provide adequate space, although the power cord must be curved sideways in order to clear the bottom at the usual cutter depth settings.

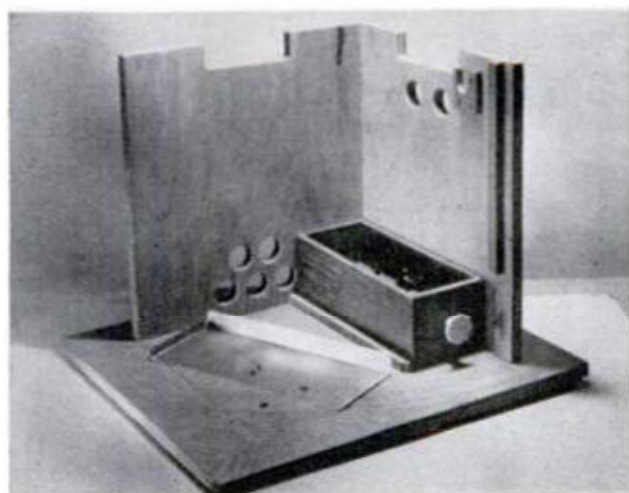
Since a router motor "breathes" by



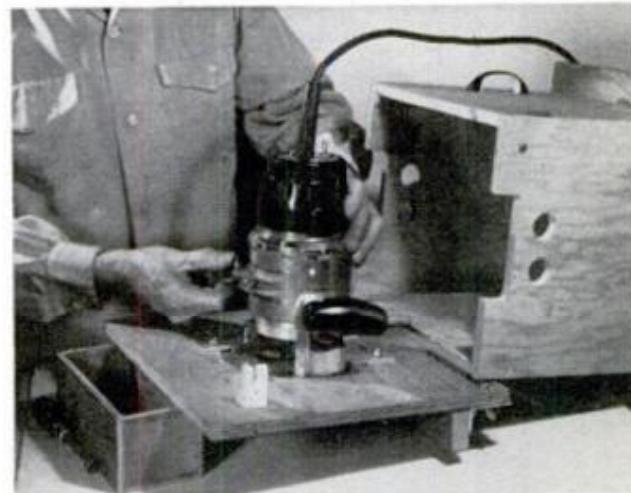
ROUTER CUTS RECESS in cabinet top to hold metal plate against which the router base will be clamped



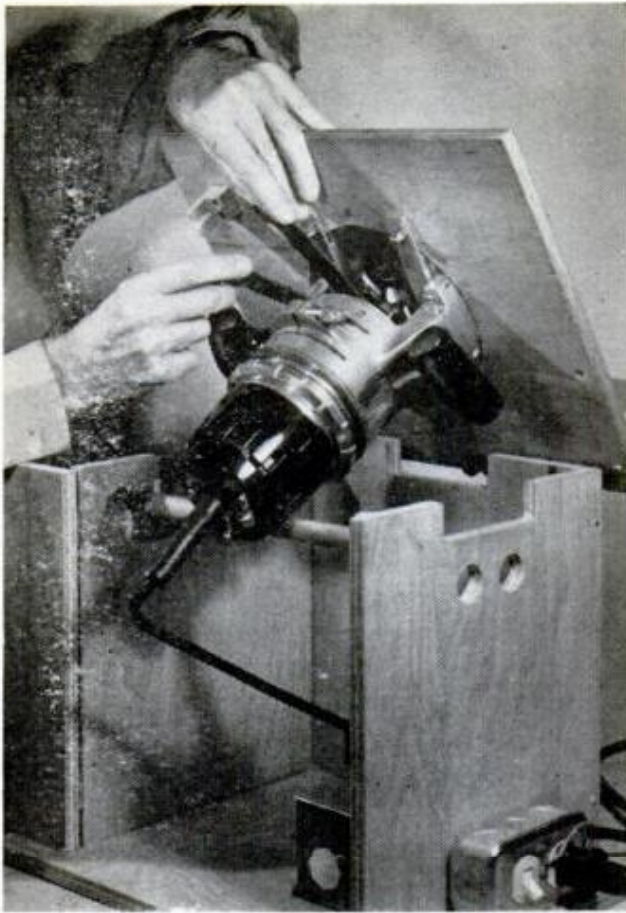
BOTTOM OF TOP PANEL: Router is clamped against metal plate. Two strips make up thickness difference



IN PARTIALLY ASSEMBLED CABINET, the accessory drawer and some vent openings for airflow are seen
AUGUST 1972



FOR INSTALLING or removing router, the cabinet is flipped on its back and the top panel is swung open

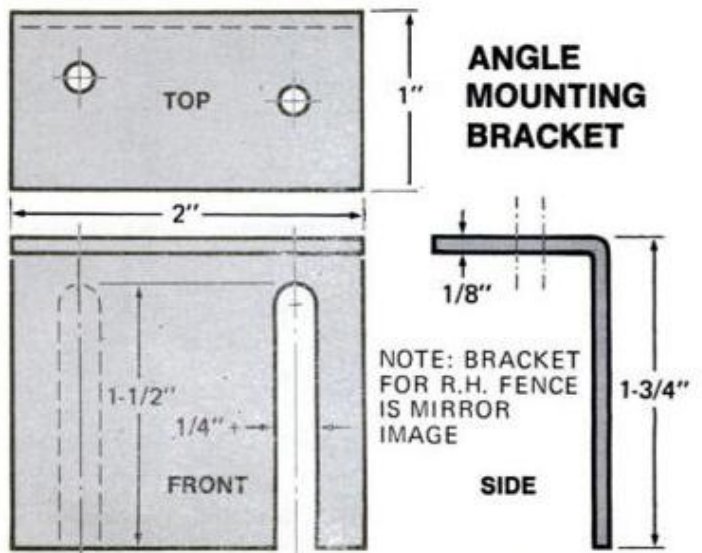
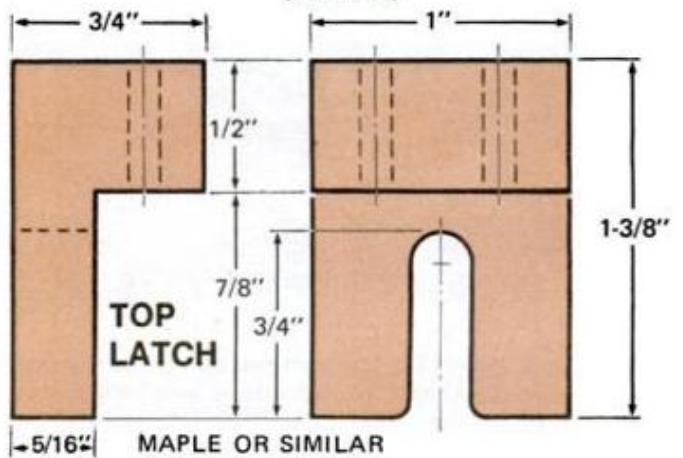
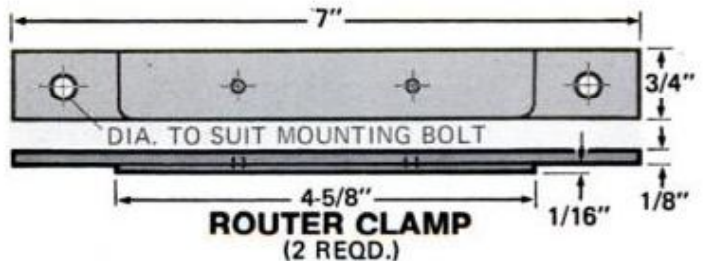
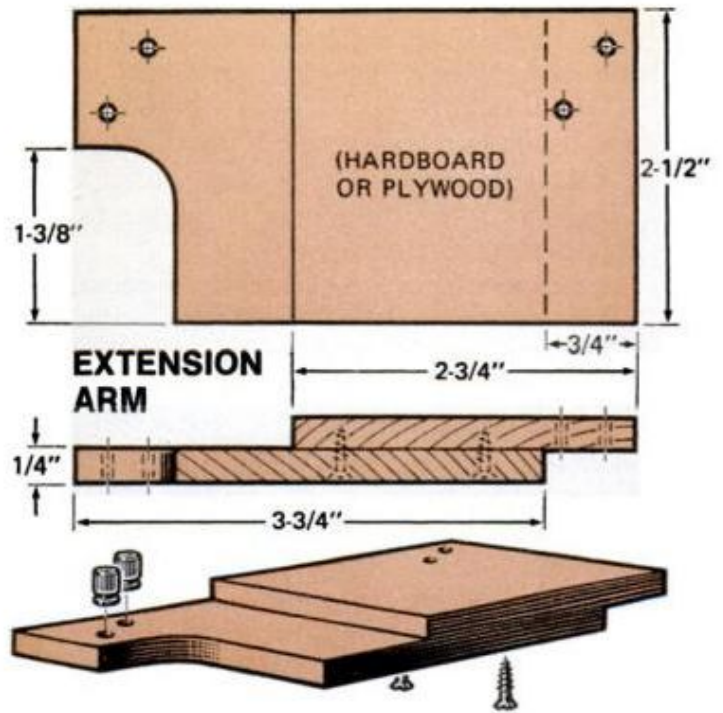


TO CHANGE CUTTERS, router is swung up and supported by dowel engaging sockets on the side panels

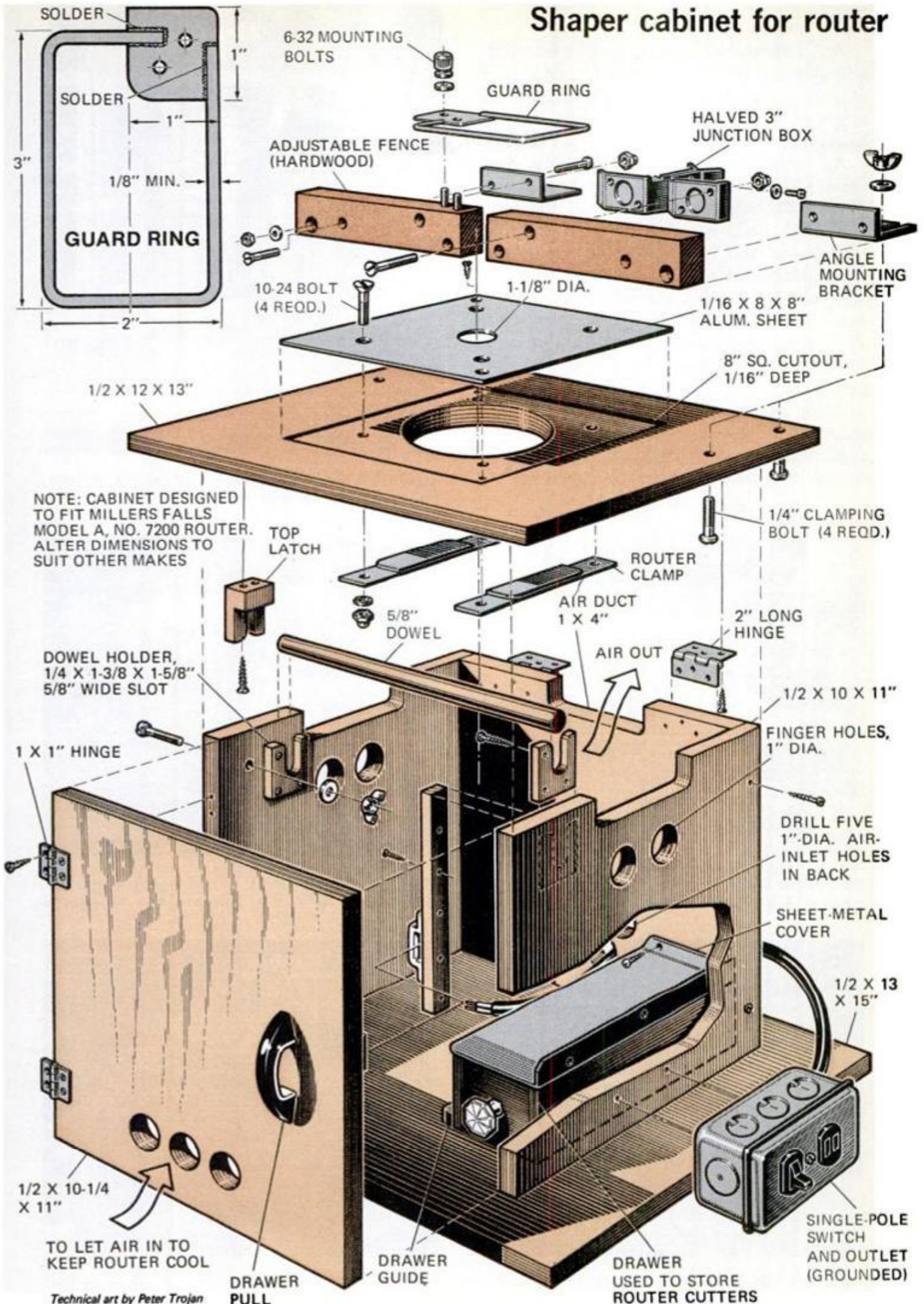
drawing air in at cord-end and discharging it around cutter, it's a must to provide airflow holes in the box. These consist of 1x4-in. notches at top edges of sidepieces and back panel and multiple 1-in. holes in back and front panels. (The two 1-in. holes at the top of each side are primarily finger holes for carrying.) If the intake air seems to carry excessive dust and chips, it's a good idea to install some fine-mesh screen over the inlets. Chips should not be permitted to build up in the box; if the router is to be used for long periods, periodically check the motor to avoid overheating. If necessary, leave the door open.

The hinged top can be raised to give better access to the router when you change cutters. The router is held in the tilted position by resting it on a piece of $\frac{5}{8}$ -in. dowel whose ends engage notched plywood pieces screwed to the inside surfaces of sidepieces.

The storage drawer is made of $\frac{1}{4}$ -in. plywood and is located in one corner of the cabinet. To keep it in position, glue a guide strip along the bottom. A sheet-aluminum cover helps keep dirt out and the drawer in place. Inside, a wooden



Shaper cabinet for router



Technical art by Peter Trojan

AUGUST 1972

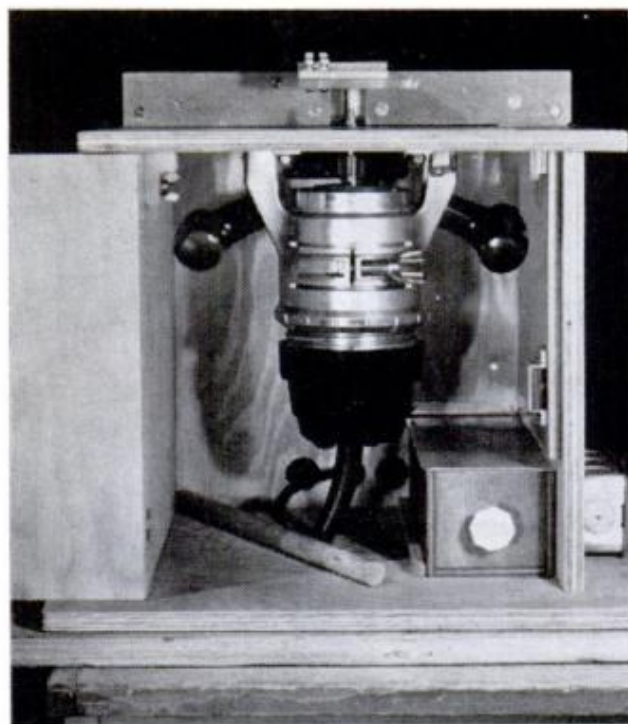
block drilled to receive cutter shanks holds stored cutters.

An adjustable fence guides straight-edged work past the cutter. I used a piece of maple cut to dimensions indicated. An angle mounting bracket was then fastened to each end with bolts.

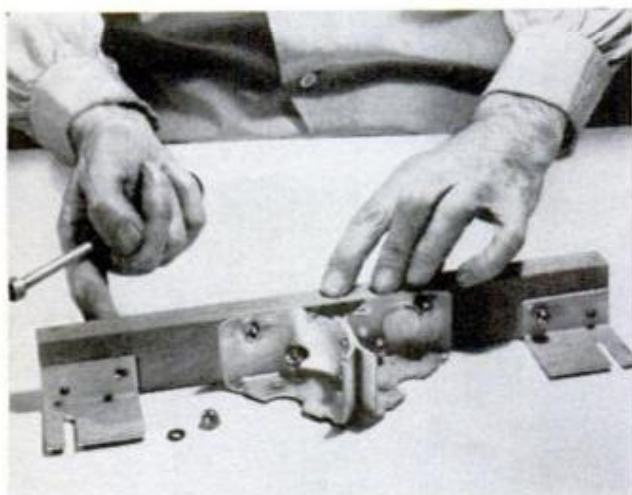
An adjustable bracket assembly made from a 3-in. electrical junction box (sawed diagonally in two) is bolted to the fence center. A little hammering and filing will let you fit the box halves squarely with the surfaces at a right angle and parallel where they contact the wood. Three 8-32 bolts hold the two halves together: holes in one of them are slotted so the guide fence can be adjusted for cut depth when jointing.

After bolting the junction-box bracket assembly to the wooden strip, saw a section slightly over 1 in. wide from the center of the strip to provide space for the

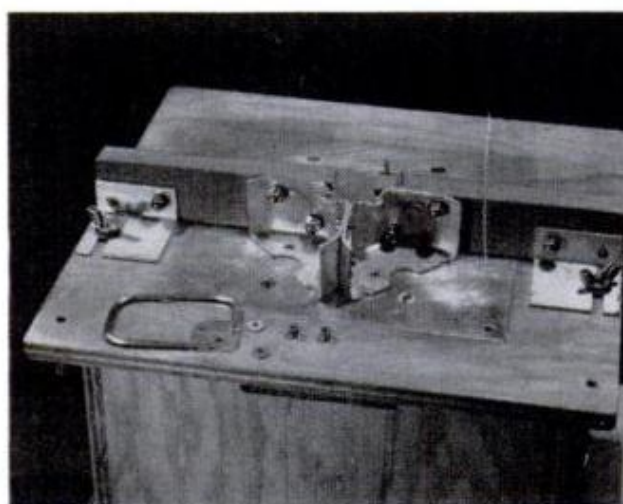
(Please turn to page 115)



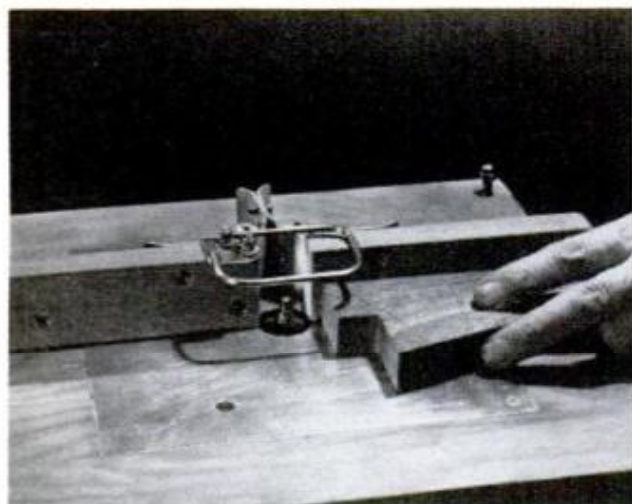
INTERIOR VIEW shows router in operating position. Plastic shield here was replaced by the ring type



MOUNTING CLAMPS and center coupling, made from a halved 3-in. junction box, are attached to the fence

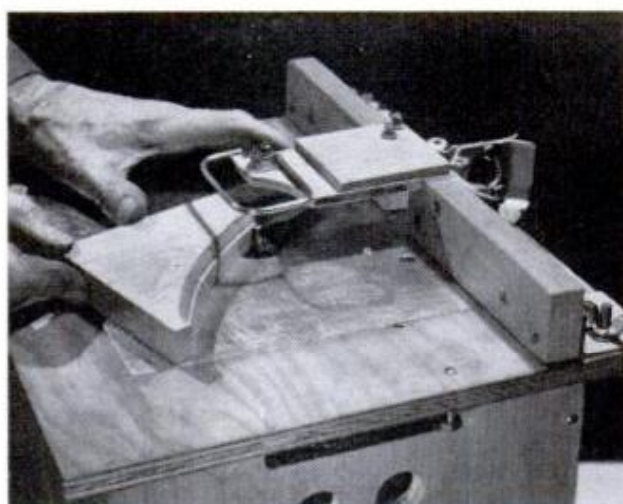


REAR OF GUIDE FENCE in position for straight-edged work. Notice ring-type shield in foreground



TO SHAPE EDGES on straight work, ring-type shield is mounted on the rear fence, protects fingers

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FOR CURVED WORK, guide fence is moved to back position, ring guard is mounted on extension arm

POPULAR MECHANICS

WITH THE PRICE of just about everything going up these days, my curiosity was aroused several months ago when a \$30 circular saw was introduced by Wen Products, Inc. Since the new saw had more horses and a larger blade, weighed a couple of pounds less and was priced about \$6 lower than a circular saw that I bought over 20 years ago, I wondered just how well the tool would perform.

To test the saw, I kept it on my workbench a couple of months and used it on those jobs a homeowner most frequently tackles: crosscutting and ripping two-by-stock, freehand cuts on plywood (inset photo at right below) and for conventional cutting of 3/4-in. stock, including long rip cuts with the rip fence.

I found that the saw is well balanced, easy to handle, and doesn't have to be pampered (held back) when cutting heavy stock. Though some might consider it nit-picking because of the low price, I think it is a mistake that blade-changing wrenches do not come with the tool. I



A lightweight saw with a heavyweight punch

By HARRY WICKS, Workshop Editor

Photos by Robert D. Borst

prefer to keep related accessories with portable tools to save trips back to the shop.

To change the blade, two wrenches are recommended; a one-incher for the flange and a 1/4-in. wrench for the center bolt (arbor). The bolt, however, can be loosened using just the smaller wrench by giving it a sharp rap on its end. High-impact, shockproof Cyclocac housing and convenient location of the saw's key elements (photo, right) are other features that make this saw a good buy. ★★★

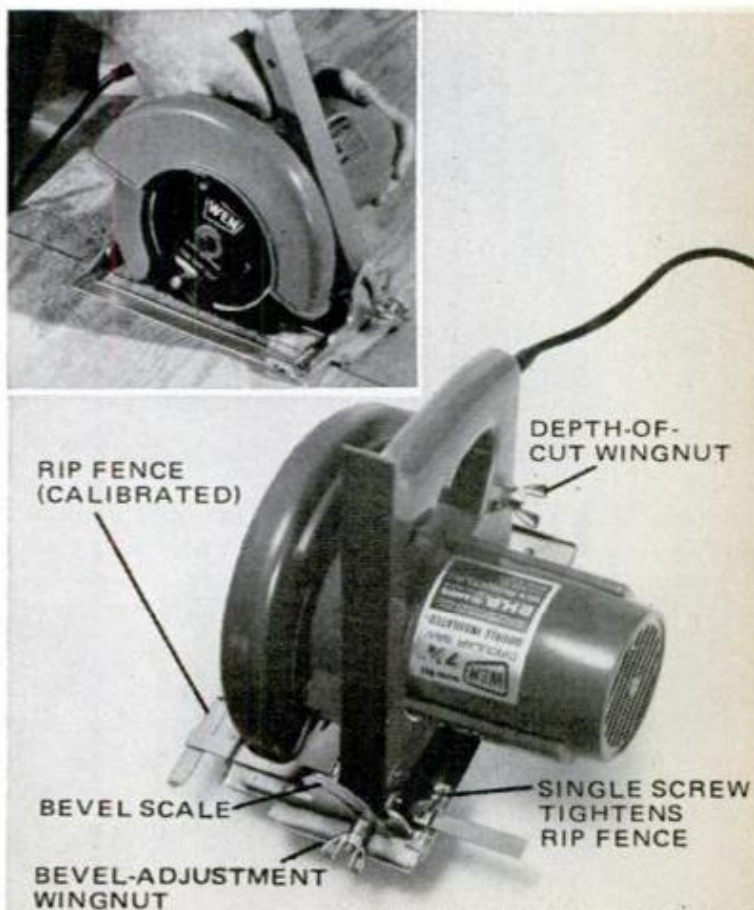
MANUFACTURER'S SPECIFICATIONS

(Model 961 Circular Saw)

| | |
|--------------|---|
| Motor | 11-amp., 120-v., 2-hp, 5100 rpm |
| Blade | 7 1/4-in. dia., 5/8-in. round arbor |
| Depth of cut | 2 3/8 in. at 90° 1 7/8 in. at 45° |
| Weight | 8 lbs. |
| Price | \$29.95 (including a calibrated rip fence) |
| Manufacturer | Wen Products, Inc., 5810 Northwest Highway, Chicago, Ill. 60631 |

AUGUST 1972

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Bench-saw know-how

**A work-support stand you can build
 . . . Good saw stunts . . . Dado sawing
 . . . Two simple 'projects' that will
 mystify nonwoodworkers**

PART 2

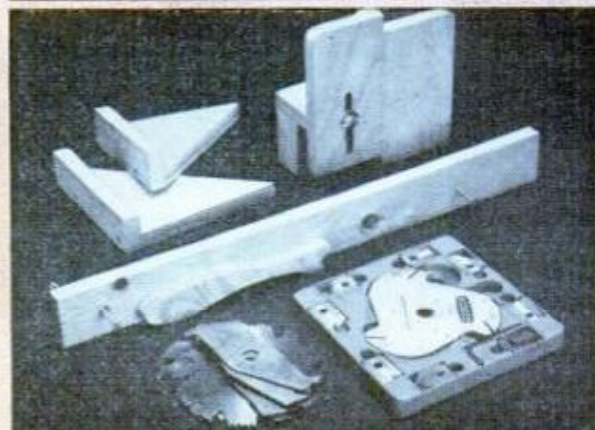
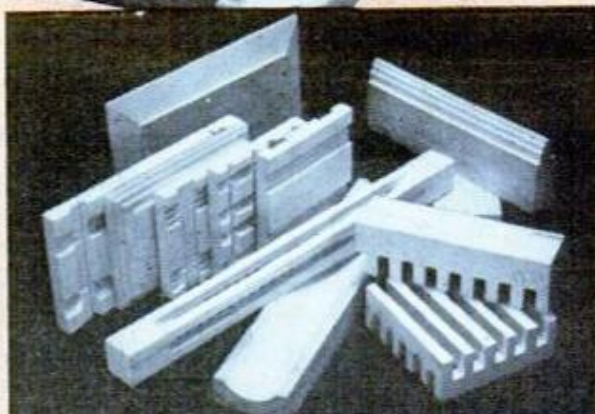


Photos by Robert D. Borst

By **HARRY WICKS**, Workshop Editor

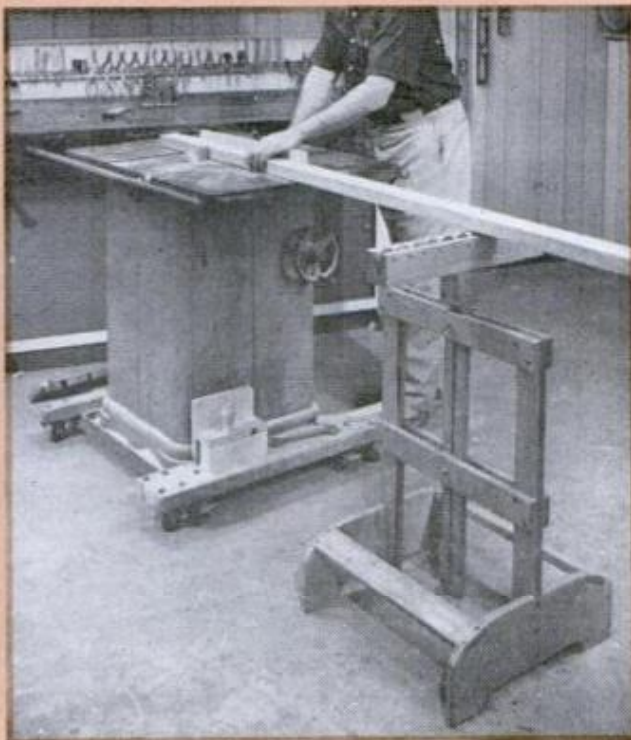
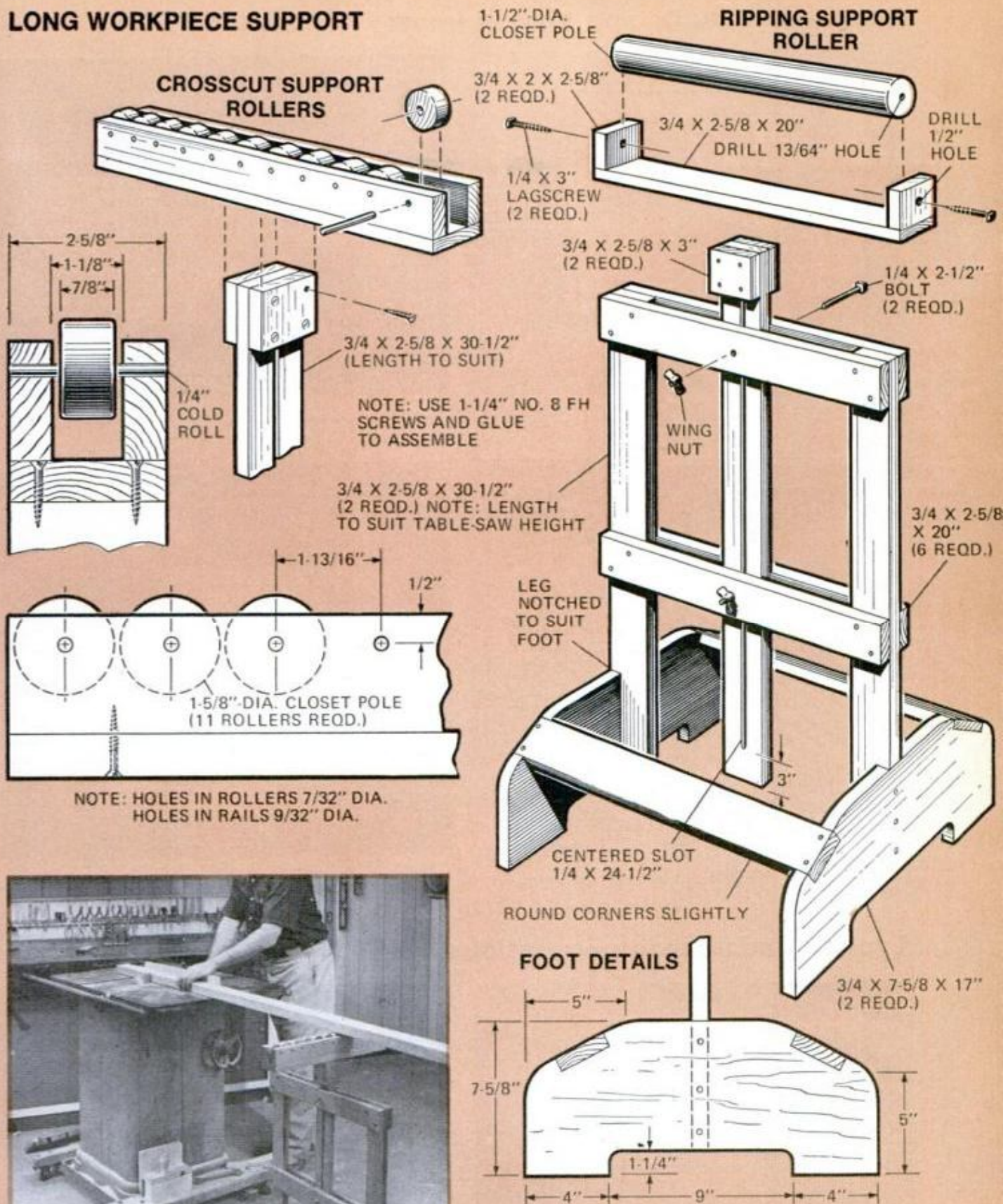
ONCE YOU KNOW the basics—and the safety rules—of the bench saw (see [Part 1, page 152, July PM](#)), you're ready for the more sophisticated sawing techniques and accessories of Parts 2, 3 and 4 in this and the next two issues. You'll learn to make such cuts and work aids as those shown in the photos at right.

A basic rule in all power-tool wood-



WORK SUPPORT (lead photo) and special cuts (top) were made with tools and shop-built jigs (above). How to make them begins with Part 2

LONG WORKPIECE SUPPORT



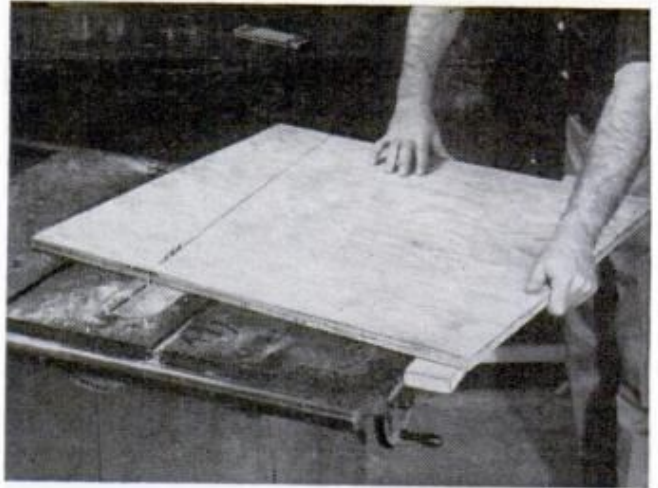
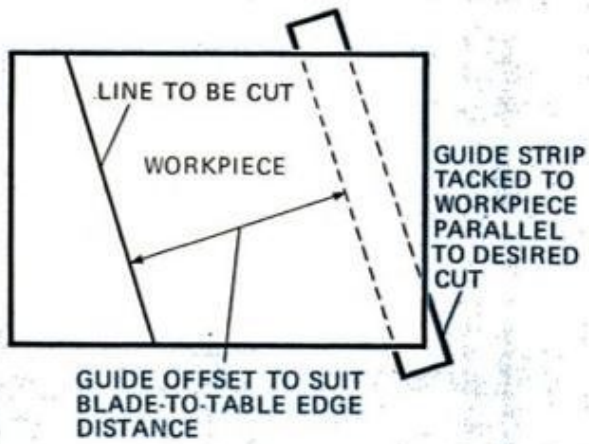
CROSSCUTTING long pieces is simplified because support has a roller-head for this saw operation
AUGUST 1972

for the workpiece. A stand for supporting long, overhanging pieces should be one of the first things you build.

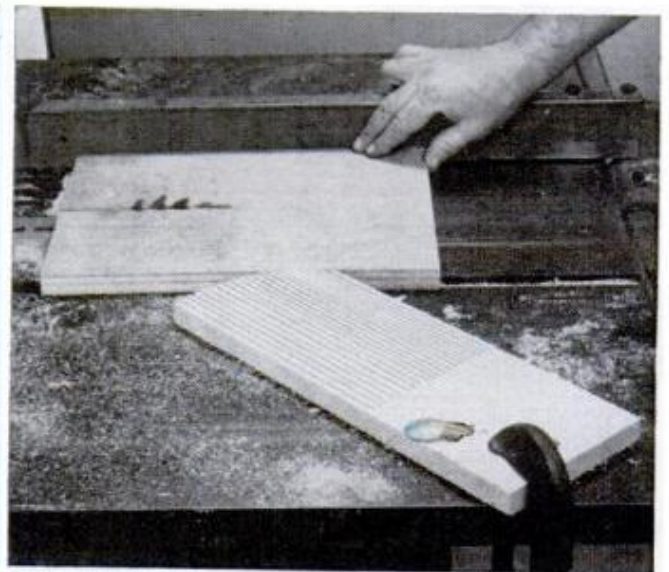
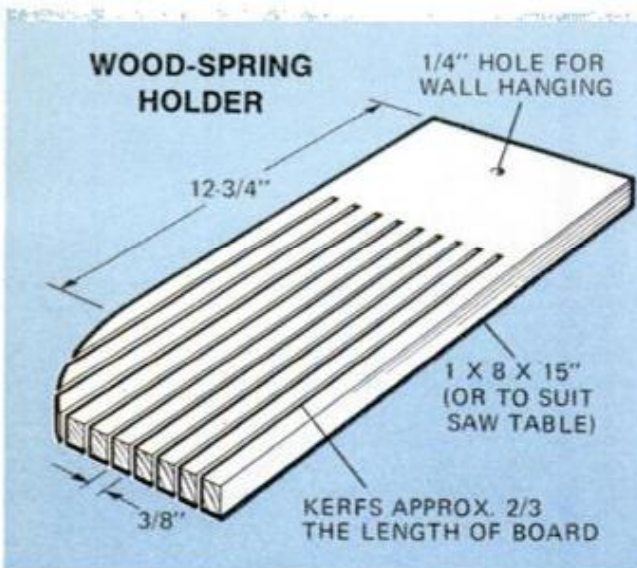
Ripping, crosscutting long pieces

Because the stand shown here is of standard, dimensioned pine, it's an inexpensive project. The support has a single-roller head for holding long boards for

Bench-saw stunts you should know

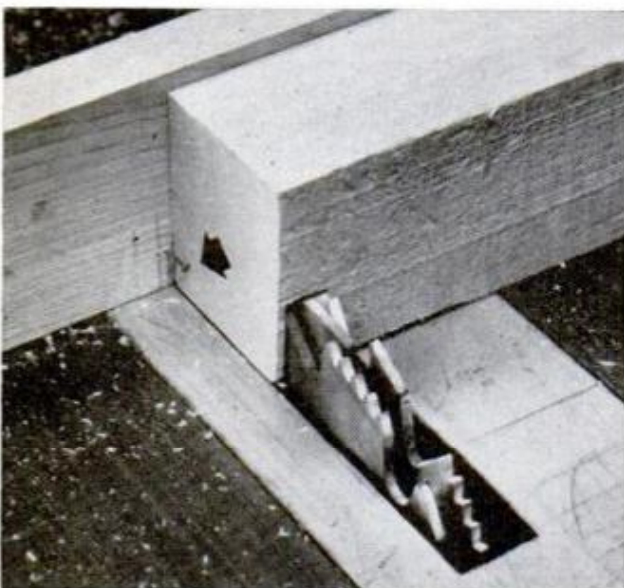


DIAGONALS can be cut on large pieces of plywood by tacking a straightedge to ride along the table edge

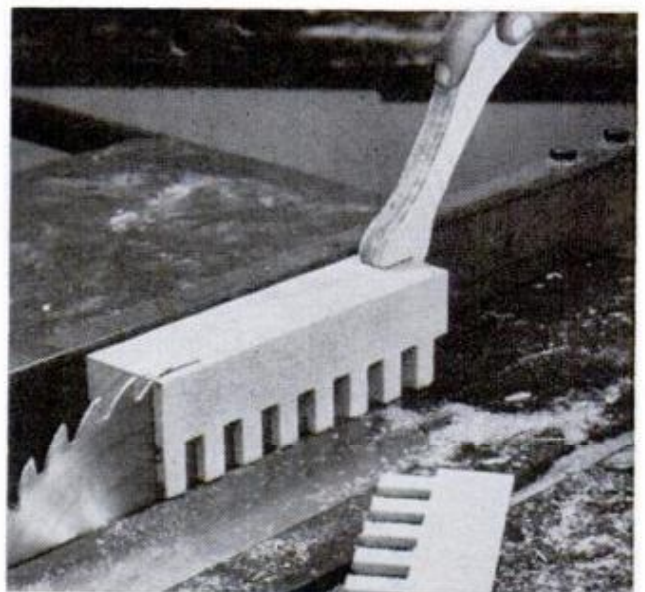


WOOD SPRING HOLDER can be made of scrap. It's always used as a work hold-in when accuracy is required

Typical dado-sawing operations

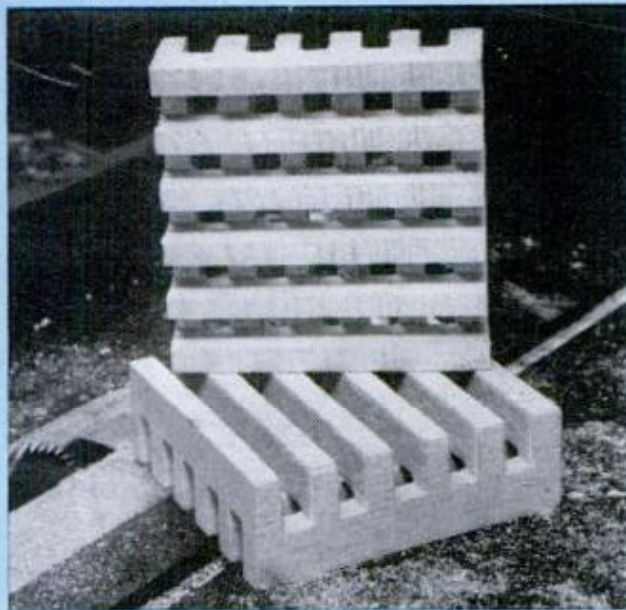
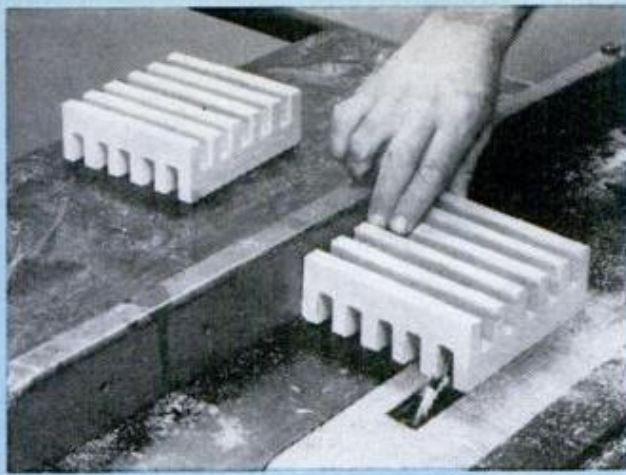


DENTIL is simply evenly spaced dados. Make first cut with end against pin; loop over pin for second



DADOED PIECE is sliced to the desired thickness—usually 1/4 to 3/8 in.—for use in trim-molding work

POPULAR MECHANICS

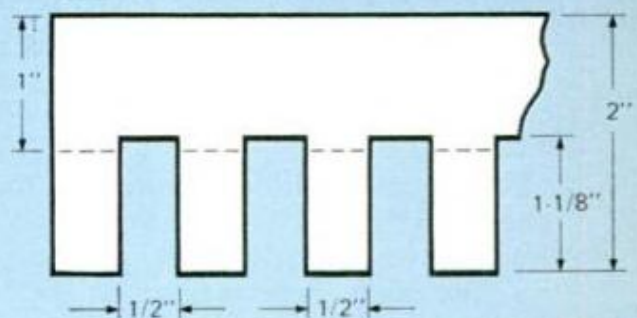


MAKING A TRIVET is good exercise in pierce-cutting and dadoing. You can practice both techniques at the same time—and wind up with a useful item

Trivet from a solid block

Here's a project that's fun to tackle once you have become familiar with your dado-head set. Making the trivet is a fine exercise in dado cutting, and your skill in cutting it—as with the "carved" tower—is sure to astound your nonwoodworking friends. Select wood that is knot-free; if you have some hardwood lying about the shop, so much the better. Pine was used for the trivet at left, and it worked well. To make it, the author used the fence and, when work was within 3 in. of blades, a pusher stick. Make the dados (across the grain) first, then flop and rotate the workpiece 90° and cut the grooves. For safety, achieve desired depth using multiple passes. To finish the piece, sand thoroughly; sanding is a must—particularly where blades exit the work. Stain the piece and use a tough finish that will withstand heat.

USE 2 X 5 1/2 X 5 1/2" STOCK (ACTUAL)



DADO ACROSS GRAIN FIRST, FLOP BLOCK AND USE SAME DIMENSIONS FOR GROOVING WITH GRAIN

ripping; a second head has multiple rollers for crosscut sawing.

Dimensions are standard except for overall height, which is determined by the floor-to-tabletop distance of your saw. (My saw is mounted on a 2x6 frame fitted with casters. Thus, floor-to-tabletop distance is above average.) Build the stand so that when the head is at its lowest position, it is lower than saw-table height. By making the stand's height adjustable, you will be able to use it when working with other tools (jointer, jigsaw or drill press). When laying out parts for cutting, check out the stationary tools you own and try to arrive at a height-variable that gives you maximum use from the stand. If necessary, shorten the four vertical legs of the stand as well as the single vertical on each head.

Rollers must rotate freely. To assure this, drill undersize pilot holes in the

closet pole and oversize, loose-fitting holes in the rails. An occasional brushing-off and a blast of silicone spray on the cold-roll and lagscrew "axles" is the only maintenance needed.

To use the stand, set the roller top surface to match the saw-table height and lock the head by tightening the two wing-nuts. As the workpiece leaves the table it is supported by the rollers and is easier—and safer—to handle.

Tongue-and-groove cutting

While a conventional rip or combination blade can make tongue-and-groove cuts, the job is best done with a dado head because it does a neater job faster. Four passes are required to cut a tongue with a conventional blade, two each for the cheeks and shoulders. The cheek cuts are made first, then the blade is lowered and waste removed by making the shoulder

cuts. To make a groove with a conventional blade requires repeat passes until the desired width is attained.

Using a dado head, the groove can be cut in a single pass and the tongue made in two. If you are gluing up narrow stock to make a wide board, do as the pros do and make the tongue slightly less than the groove depth; this trick leaves room for any excess glue to escape to.

The dado head

In wood joinery it is often necessary to cut grooves wider than the typical saw kerf. For this job a serious woodworker owns a dado head. Stated simply, a dado is a U-shaped groove. It is common practice to call this shape a dado when it's across the grain and a groove when it runs with the grain. For a deep dado or groove, it is best to achieve depth by making repeat passes, raising the cutting tool slightly and moving the fence for each pass.

Blade projection is always less than the thickness of the stock being cut. A dado (or molding head) table insert with a larger slot must be used, and work is always fed slowly.

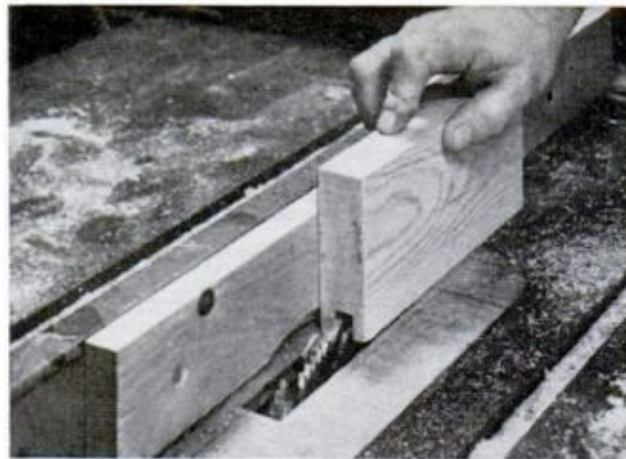
The typical dado head comes with two blades (each with a $\frac{1}{8}$ -in. kerf) and four chippers (three $\frac{1}{8}$ -inchers and one $\frac{1}{16}$ -in.). By using these in various combinations, you can obtain 11 different groove widths. Adding paper shims between cutters increases the number of grooves you can cut even more. The blades, mounted outside the chippers, determine the groove width. The chippers clean out the stock between the kerfs.

The latest type of dado head is a one-piece unit that produces varying groove widths (which are dialed and locked-in) by wobbling as it spins. These dadoes will be discussed in a later installment.

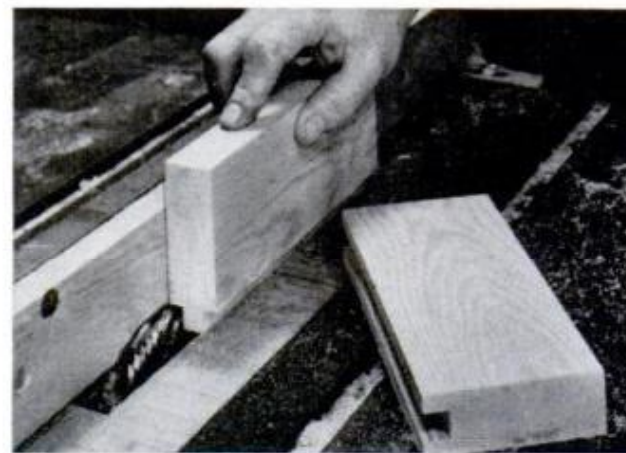
Almost any cut that can be made with a conventional blade can be made with a dado. You can cut coves faster, for example, but the cut will not be as smooth as the surface of a cove made with a combination blade. And a cove cut with a dado will also be slightly flat at center. As mentioned above, it makes tongue and grooving operations quicker. The same is true of other cutting such as edge-rabbeting, tenoning, saucering, piercing, maximum kerfing and hollowing.

Hollowing, as in fashioning a scoop or trough, is done by making a series of

Tongue-and-groove cutting



DADO HEAD makes fast work of cutting tongues and grooves. For perfect alignment, test on scrap first



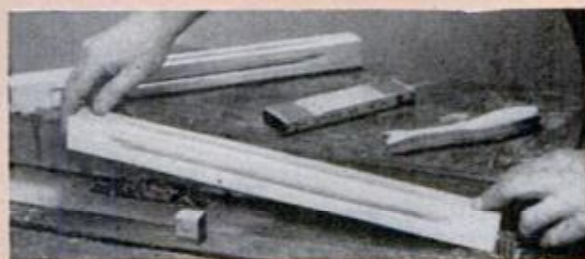
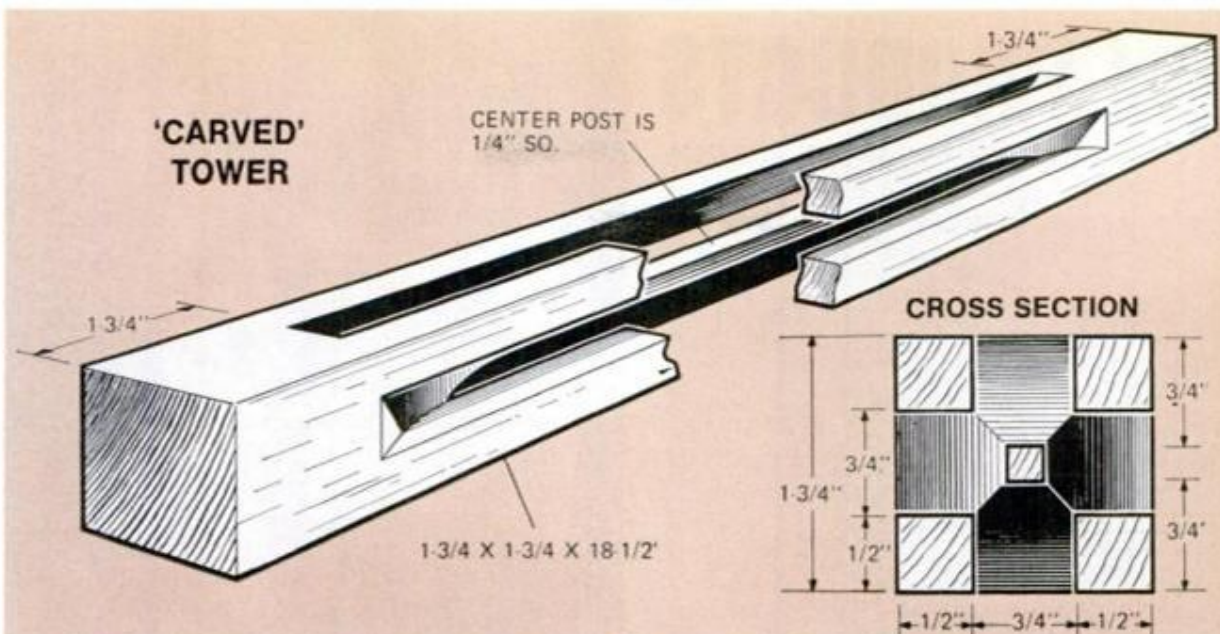
TO CUT TONGUE, fence is moved and locked. This small amount of stock can be removed in one pass

passes. After each pass, the fence is adjusted so that the cutters will overlap the last cut and the work is pushed through. Here, start and stop blocks (as in the Carved Tower, page 149), determine the length of the dado or groove.

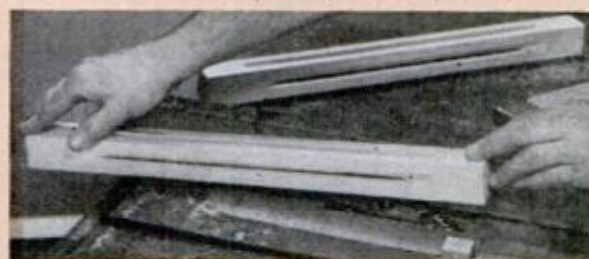
Start and stop blocks can be clamped to the rip fence or, simply, magnetic blocks positioned on the saw table. (I prefer the latter method in most instances because it eliminates the need for a fence extension when dadoing long pieces.) Block placement is determined mathematically by raising the blade to ultimate (final) projection and putting pencil marks on the table where the cutting tool will start and stop cutting the workpiece. Blocks are then positioned relative to these marks.

Dado safety rules:

- *Never* use the chippers—or a single chipper—without the mating blades.
- Because dadoing is on the underside it is, in effect, “blind” cutting. *Never* attempt to dado freehand; always use a guide, either a fence or miter gauge.



BOARD is held against the starter block and fence, then lowered slowly onto spinning cutting tool



WHEN END OF WORK aligns with finish block, back slightly, depress leading edge to lift off

● *Never* use a dado to cut *through* a workpiece.

● As a rule of thumb, the wider the kerf being cut with a dado, the more passes—raising the cutting tool for each successive pass—you should make. Keep in mind that a considerable amount of material is being removed from the stock; a too-large bite will place an undue strain on the motor and the cutting tool. And, you. Dadoing hardwood requires even more passes than a softwood such as pine does.

● Because of that large bite, chances of kickback with a dado are much greater than with a conventional saw blade. Generally, it's best to use a work hold-down or hold-in. In many cases, both.

● To insure easy and clean cutting, keep blades and chippers sharp and, periodically, lubricate with a silicone spray during extended cutting operations.

Two exercises with your dado head

The "tower" and trivet shown on these pages are good practice projects to familiarize yourself with your dado head. Grooves for both should be made in multiple passes. To cut the tower, for example, raise the cutting tool so that it projects about

1/4 in. and cut all four sides; then raise the blade 1/4 in. each for the second and third passes. The "stop" for starting must be solid enough to press the workpiece against as you lower it. Magnetic types shown are by General Hardware Mfg. Co., 80 White St., New York, N.Y. 10013.

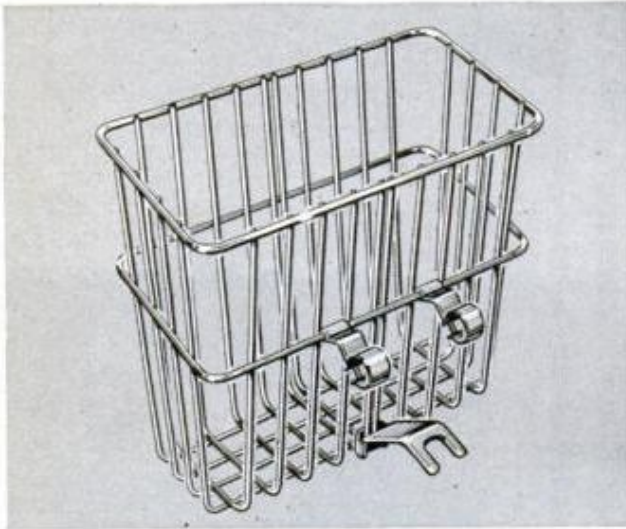
Lower the piece onto the spinning cutters. Push it slowly through until the trailing edge reaches the stop gauge or mark. Back up the piece slightly, put pressure on the leading edge and lift off the piece. Repeat procedure for the remaining three sides. Make the trivet with at least three passes. Cut the dados first, then the grooves. Both pieces are examples of pierce-cutting as well as dadoing; that is, cuts from opposite sides intersect, without going through the workpiece, to produce a see-through effect. Both also prove why it is a must to keep dado-cutting tools razor sharp. Dull ones make the job difficult and unsafe.

The tower could be used as an integral part of a leg, or, sprayed with Da-Glo paint, as "pop art." The trivet makes a handsome protective base for hot pots.

Next month: Use of the molding head and some of the available cutters. ★★★

EXCITING NEW PRODUCTS

BY CATHERINE BILSKI



THINGS WON'T BOUNCE OUT when carried in the 12-in.-deep bike basket shown above. Support and spring clamps are designed to fit all shapes of handlebars. The basket mounts easily on all bicycles—lightweights, middle-weights and sports models, 20, 24, 26 and 27 in. Capacity is 840 cu. in. Model No. 183 (shown) sells for \$2.98 by Androck Co., Div. of Roblin Hope's Industries, Inc., 28 Union St., Worcester, Mass. 01608.

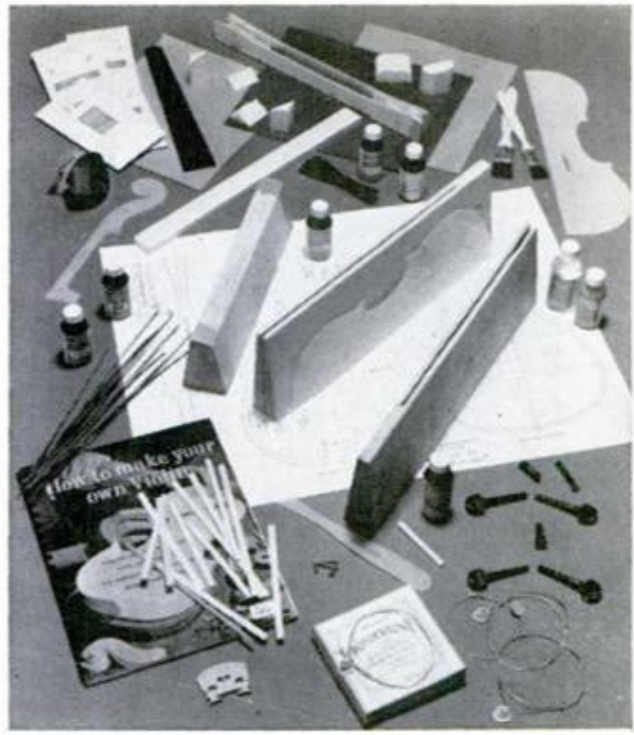


A PRACTICAL take-along concept in writing desks, Tote Desk (below) is ideal for the businessman who travels. It's also handy for bed patients. Molded of polypropylene plastic with a convenient built-in handle, it can be used as a suitcase, toolbox, briefcase or book carrier. A transparent flat top serves equally well as a lap writing desk, hobby tray or game table. Retail for \$5.95, made by Peabody/Mutschler, North Manchester, Ind. 46962.





A COUNTERTOP APPLIANCE providing cooking convenience and flexibility is the Savory Centre Drop-In Combination (Model 2855). It combines an electric range and continuously cleaning oven with built-in grill. Smoke and odors from all three are vented outdoors. Optional accessories convert grill to rotisserie, shish kebab, deep-fat fryer or nonstick griddle. \$249 from Jenn-Air Corp., 3035 Shadeland, Indianapolis, Ind. 46226.



VIOLINMAKING is a fascinating and rewarding hobby, and now you can make one from a kit. Three different kits (A, B or C) come unassembled but complete with everything you'll need from seasoned, tone-wood tops and backs down to superb oil-varnish and fine polished strings. Graded according to quality of wood, prices range from \$90 to \$129. Made by Scherl & Roth, Inc., 1729 Superior Ave., Cleveland, Ohio 44114.



CREATE OLD PUB ATMOSPHERE in a family room or den with these oak miniature "whiskey" barrels. Barrel Bank, at left, is 6 in. high and 4 in. wide, has four brass hoops and key, holds up to \$200 in coins. The usable 1-gal. Bar Keg, at right, has four chrome hoops and comes with plug, spigot and stand. They sell for \$7.50 and \$8.50, respectively; are made by Sweeney Cooperage Ltd., 1341 North Northlake Way, Seattle, Wash. 98103.

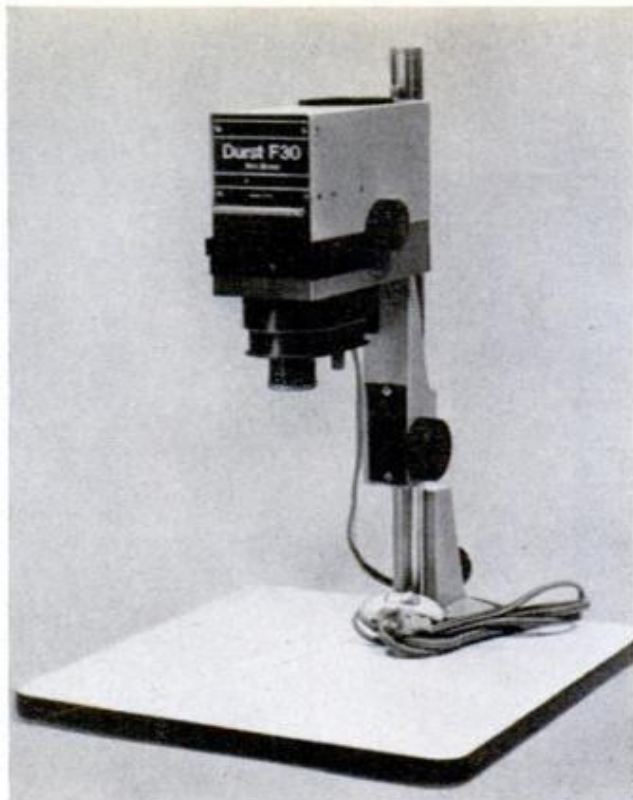
AUGUST 1972



YOU CAN DO SOMETHING about air pollution—at least in your home. The Air Care Cleaner developed by the West Bend Co., West Bend, Wis. 53095, effectively removes up to 99 percent of all pollen and up to 90 percent of all airborne dust, smog, smoke and odors from the air that passes through it. The unit is designed to look like a piece of furniture to complement any decor. It retails for less than \$200 ready to plug in.

151

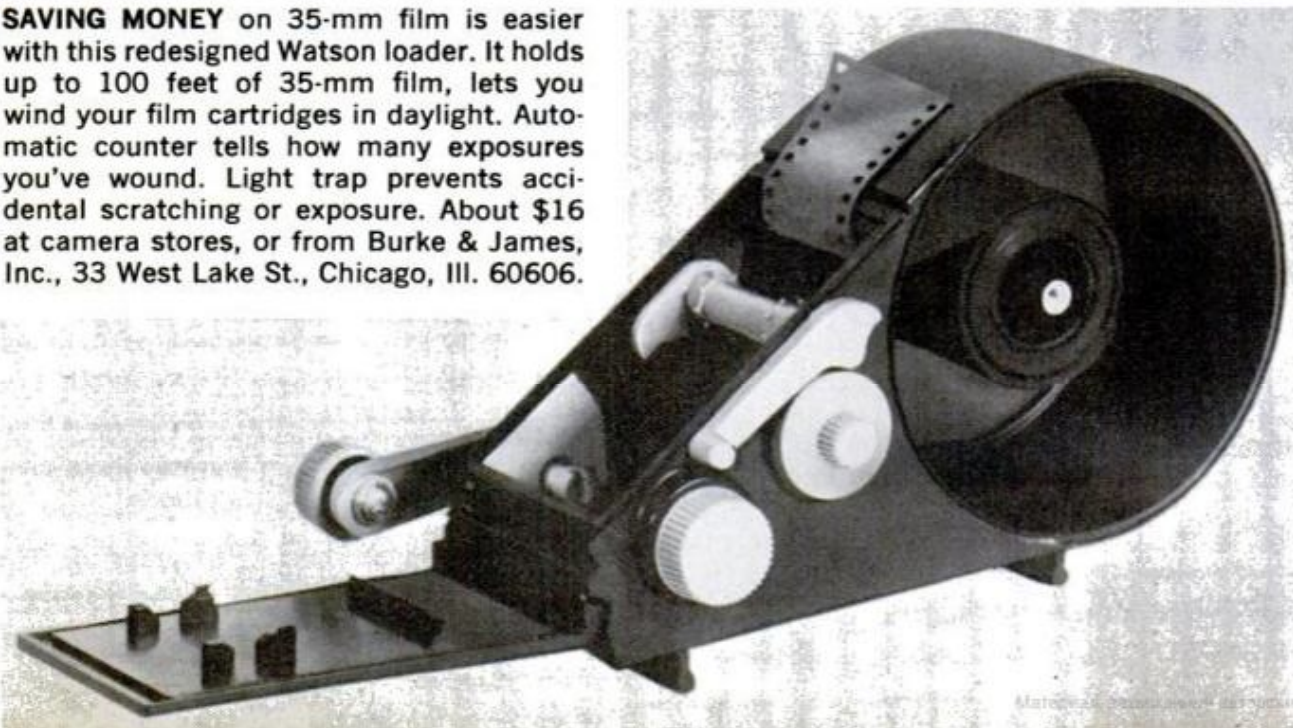
NEW IN PHOTOGRAPHY



COMPACT, ECONOMICAL new Durst 35-mm enlarger makes 11x14-inch enlargements on its baseboard, can be turned to make even bigger blowups on your floor or wall. Color or variable-contrast filters fit a built-in drawer. Enlarger can be taken down in minutes for storage in a drawer or elsewhere. Model F30, \$49.50 less lens. Durst Div., Ehrenreich, 633 Stewart Ave., Garden City, N.Y. 11530.

NEW LINE of five compact electronic flash units from Keystone runs from under-\$20 model shown to a quick-charging, computer-automatic flash just under \$70. All models feature color-corrected tubes, hidden sync cords, rear-mounted controls, three-position mounting shoes, and two-year guarantee. Keystone, Keystone Pl., Paramus, N.J. 07652.

SAVING MONEY on 35-mm film is easier with this redesigned Watson loader. It holds up to 100 feet of 35-mm film, lets you wind your film cartridges in daylight. Automatic counter tells how many exposures you've wound. Light trap prevents accidental scratching or exposure. About \$16 at camera stores, or from Burke & James, Inc., 33 West Lake St., Chicago, Ill. 60606.





Today, a man needs a good reason to walk a mile.

Start walking.



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

25 mg. "tar," 1.5 mg. nicotine av. per cigarette, FTC Report APR. '72.

A beauty—and so simple to make

Inexpensive 'hand-carved' panels
glued to sides give this octagon
lamp table a handsome \$100 look

By WAYNE C. LECKEY, Home and Shop Editor

Photos by Robert D. Borst



NOTHING GIVES home-built furniture the look of elegance more quickly than molded reproductions of hand-carved panels. A good example is this handsome lamp table. Team up the panels with decorative laminate and a portable router, and your workshop project will stack up with the best in any furniture store.

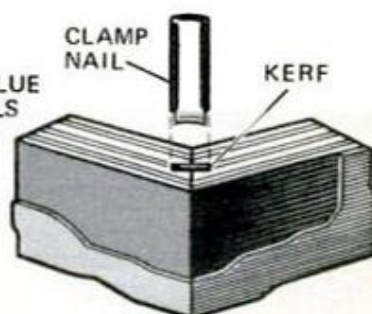
Prefinished molded reproductions used in this table are like those that added a rich hand-carved look to the roll-out buffet bar (*A handsome buffet that leads a double life*, page 140, Dec. '71 PM). As in that case, the table begins as a plain plywood shell. But when exposed plywood surfaces are covered with wood-grain decorative laminate and molded panels are added to all eight sides, your piece will look anything but homemade.

To start the octagon base, cut eight 10x20¼-in. panels from ¾-in. fir plywood, but don't bevel the edges. Next cut and cement pieces of decorative wood-grain laminate to the panels—top, bottom and center—as indicated below. The center piece can be scrap. Use contact cement to stick the laminate flush with the edges and run the grain crosswise. When applying the cement, be

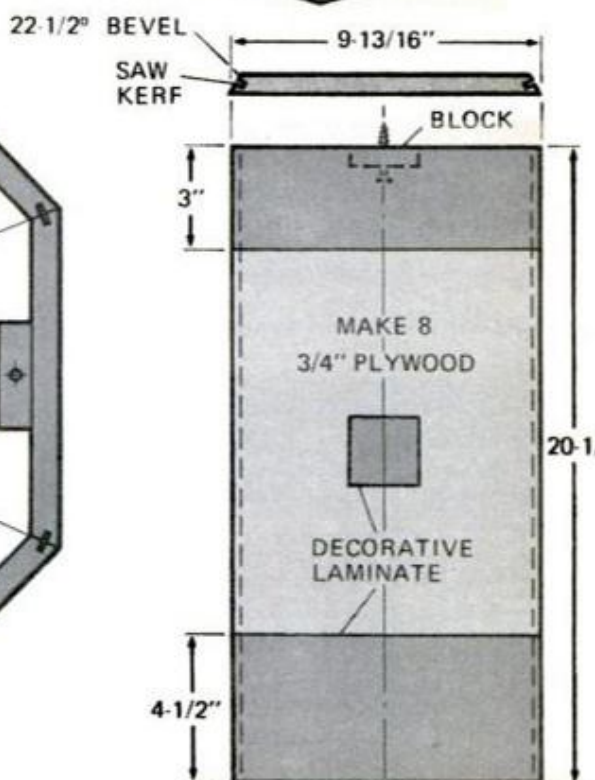
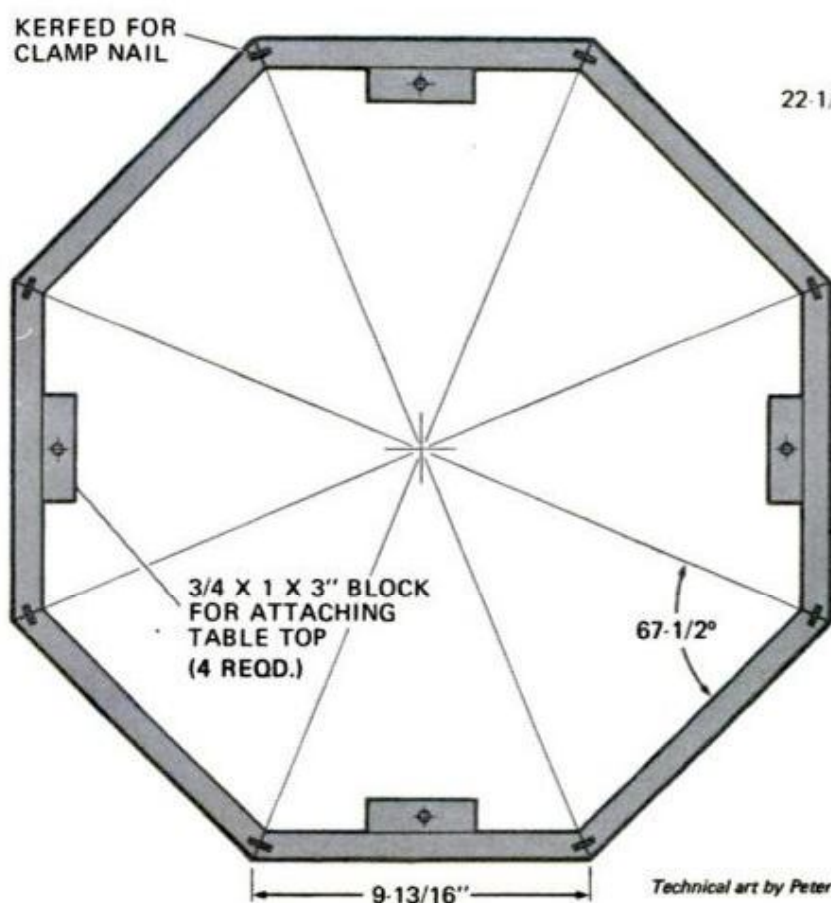


BOX NAILS ARE USED in addition to clamp nails when you assemble the shell; drive nails at an angle

PANELS ARE JOINED USING GLUE AND CLAMP NAILS



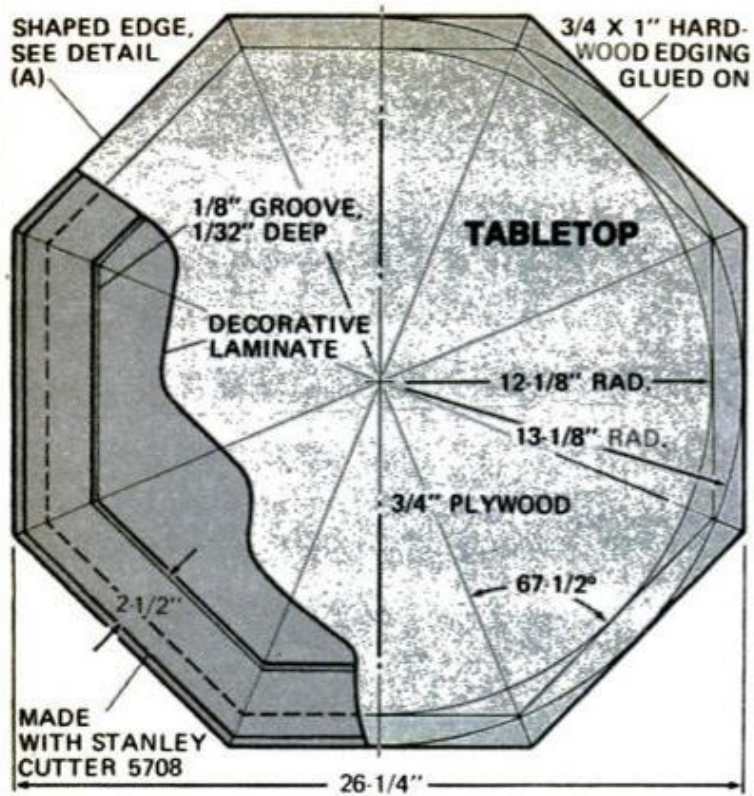
TOP VIEW OF BASE



TYPICAL SIDE PANEL (8 REQD.)

Technical art by Peter Trojan

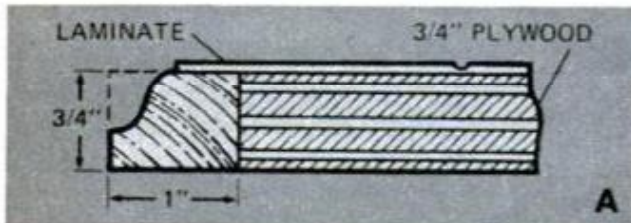
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BAND OF CONTACT CEMENT is applied to laminate along edge of masking tape with a small paintbrush

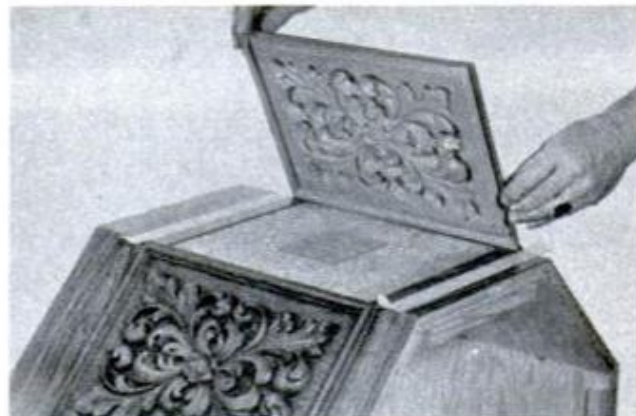


CONTACT CEMENT IS APPLIED also to back of carved panels at the center and along top and bottom edges



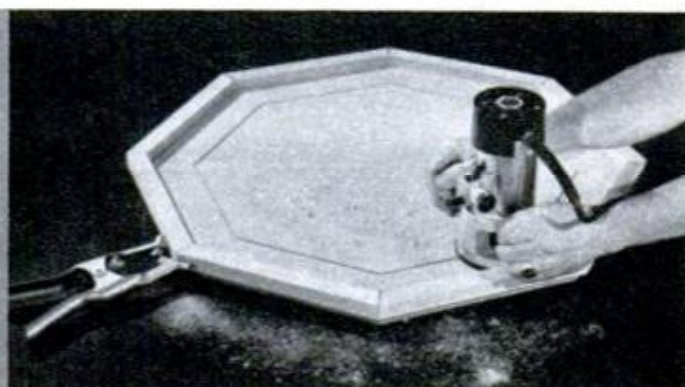
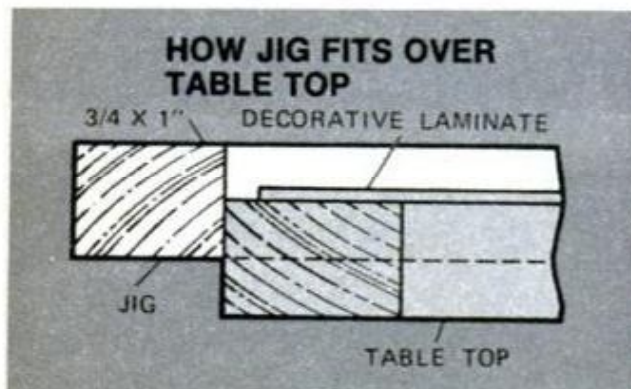
sure to follow the directions on the can. Tilt your table saw to cut a $22\frac{1}{2}^\circ$ (or $67\frac{1}{2}^\circ$) angle and slowly bevel the two side edges on each panel. Use a carbide-tip blade so you won't chip the laminate. Finished width of each panel should be $9\frac{3}{16}$ in.—actual width of molded panel.

Special clamp nails, hammered into saw kerfs, are used to assemble the eight into an octagon shell. To cut kerfs in the beveled edges, return the blade to 90° , set it for a $\frac{1}{4}$ -in.-deep cut and run a kerf ($\frac{1}{8}$ in. wide) full length down the center of the bevel. Hold the plywood with the [\(Please turn to page 174\)](#)



WHEN CEMENT IS DRY to the touch (about 20 minutes), carved panel is positioned, lowered into place

WOOD RING clamped to perimeter of top provides fence for router for making $\frac{1}{8}$ -in. groove in laminate



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SAILING FASTER than the wind seems impossible—like getting something for nothing.

Yet thousands of boats can do this, though most skippers do not fully understand why or how. Iceboats can sail about four times the speed of the wind that drives them. Racing catamarans can do about 1.2 times the speed of the wind and future multihull designs may get up to twice the speed of the wind. Some planing monohulls can go faster than the wind, too.

But keel boats, no matter how slick or how expensive, can never equal the speed of the wind, let alone go faster.

Why is this?

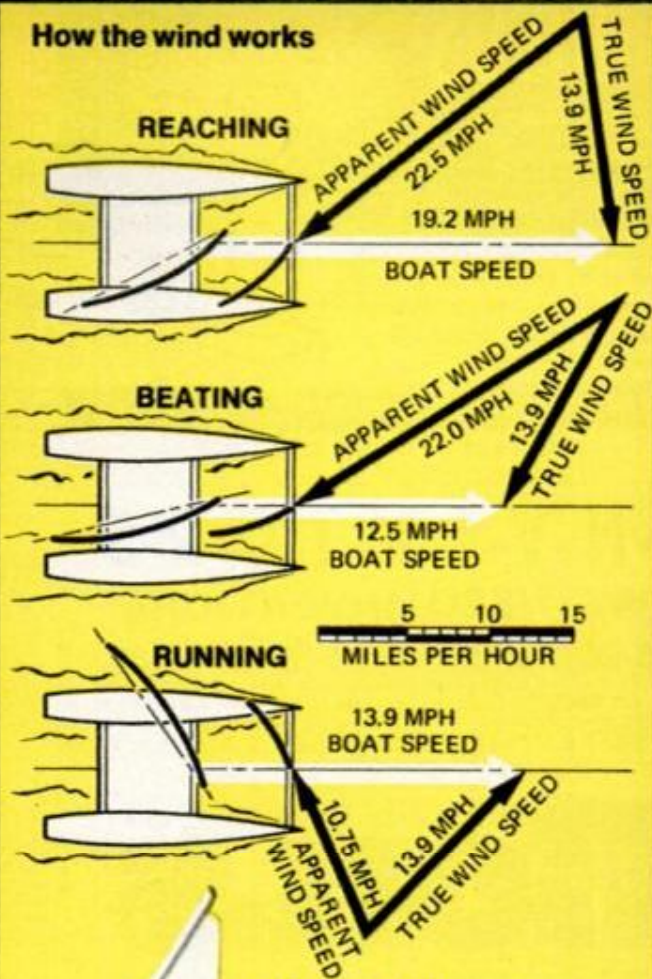
There is a general misunderstanding that sailboats move only because the moving air pushes them downwind. It seems illogical that an object could move faster than the force moving it.

That was true in the days of old square riggers and before man learned to sail into the wind. But now the answer involves the difference between the true wind velocity and the apparent wind velocity.

True wind seems obvious enough. It is simply the speed of air passing a fixed point. It may shift around a bit, but it

HOBIE CAT, from Coast Catamaran, San Juan Capistrano, Calif., has been officially clocked at 26 mph

How the wind works



BROAD REACH gives racing catamaran highest speed, as shown by the vector diagrams

Faster than the wind

Efficient sails and multihulls make some boats swifter than the breezes that push them

By N. M. IYE



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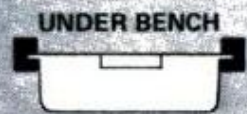
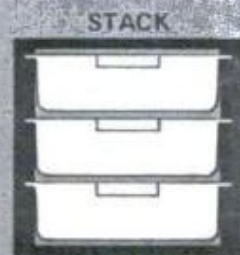
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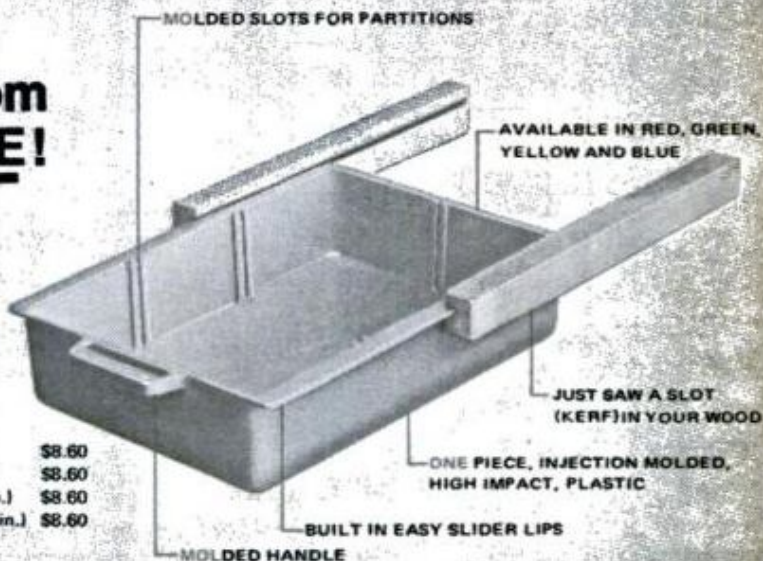
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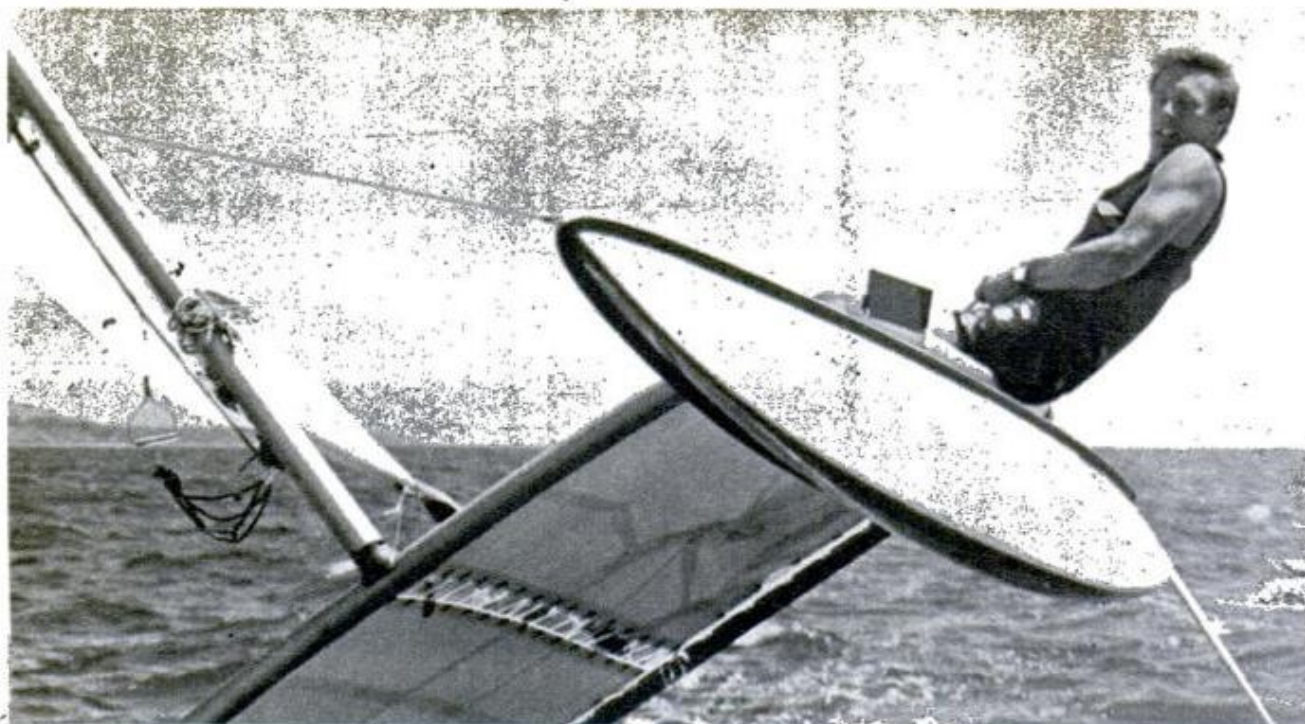
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HIKING OUT on one flying hull of a swift Hobie Cat in a brisk wind is the designer of the boat, Hobie Alter

usually has a general direction or heading.

Apparent wind is something else. Suppose you are walking or running. On a calm day you will feel the wind directly in front of you. But suppose there is a 10-mile wind blowing from your right. As you run forward at about 5 mph, you will feel the apparent wind shift to the right front quarter of your face. You know the wind is still coming from the right, but adding in your forward speed makes the apparent wind shift up ahead—so it comes in from a forward, as well as side, angle. If you increase your forward speed and the side wind stays the same, the apparent wind shifts even farther ahead.

This is what happens with a boat. With an iceboat the runners traveling over a hard, slick surface meet little resistance going forward. With a sailboat the hull must displace water that is heavy and also meet friction resistance caused by its wetted surface. Keeping the boat light so it displaces a minimum of water and reducing the area that is wet make it possible for a boat to move faster. Keelboats, even sophisticated ones, are weighty, so displace equally large weights of water and put up substantial frontal area resistance as well. The combination makes it impossible to outspeed the wind.

But with lightweight, highly-streamlined catamarans the story is different. Since the hulls skim the surface, the faster they go the faster the apparent wind becomes. Even when going downwind,

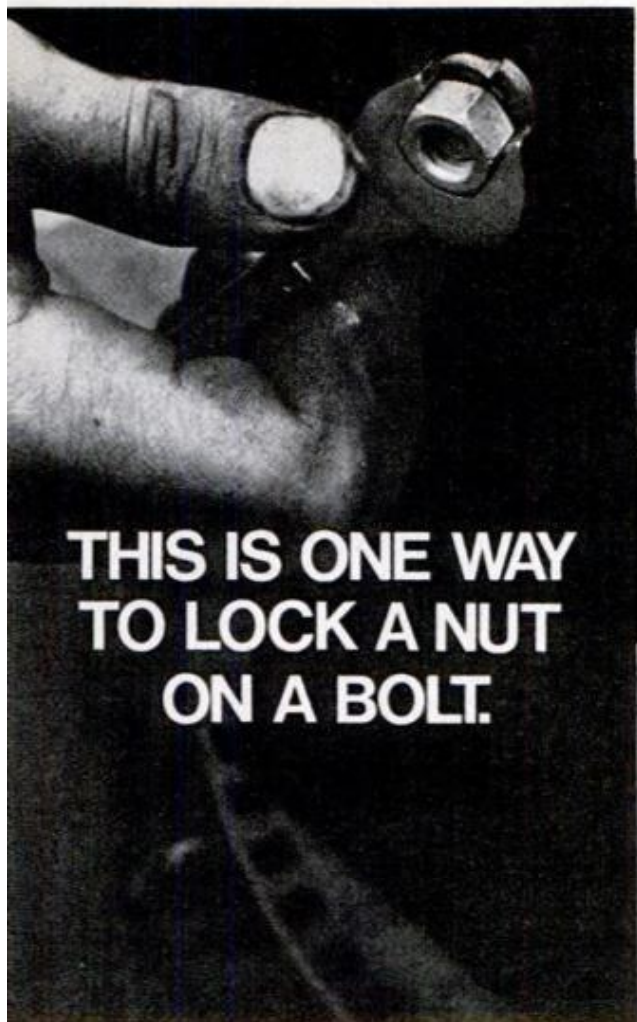
iceboats and racing catamarans tack from side to side to get the most speed from the apparent wind. The result: Even though the total distance from side to side is much greater than the straight-line distance downwind, they can cover the straight-line distance in less time than if they merely drifted.

As diagrams on page 158 indicate, the highest apparent winds are achieved on a broad reach, and as the speed builds up and the apparent wind moves forward, the fastest heading of the boat moves away from the true wind. At its highest speed the boat is actually going away from the true wind but still into the apparent wind. All the time the angle of the boat to the apparent wind stays almost the same, no matter what the course is in relation to the true wind. At its best speeds, the angle of an iceboat may be 10° to 20° off the apparent wind.

More exciting are relative speeds. For an iceboat, speeds up to 50 or 60 mph are possible with winds of only 15 mph. On a conventional sailboat, speeds to 6 mph are possible with 10-mph winds. High-performance catamarans have reached 35-mph speeds with 25-mph winds.

This last figure points up the drag of water friction that holds a sailboat back. Possibly when hydrofoils and more advanced sails are developed, the relative speeds of waterborne boats will approach the almost dragless efficiency of iceboats and even soaring gliders. ★★★

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Story behind the stern drive

Today there's a
wide choice of
prices, horsepower

By JIM MARTENHOFF



PROTOTYPE Volvo I/O is demonstrated for Great Britain's Prince Philip and party after Miami-Nassau test. Inventor Jim Wynne wears white cap, PM's Bill McKeown is handling the stern lines and yachtsman Skip Allen is riding the 17-foot Thunderbird bow



HOTTEST OFFSHORE MACHINES, the Don Aronow Cigarettes, use stern-drive power. Rautbord's Fino mounts 525-hp MerCruisers

MOST BOATMEN call it the stern drive. Others prefer outdrive. Some say it is an inboard-outboard, a hyphenated mouthful usually abbreviated to I/O, pronounced "eye-oh." It's also been tagged with short and ugly titles when it misbehaves, usually as a result of careless maintenance by the owner. But hordes of happy skippers consider it the best of two propulsion worlds—a powerplant with the combined advantages of an outboard-drive unit and an inboard engine. A look at its features may indicate that it would be best for your boat, too.

That's what Miamian Jim Wynne had in mind when he began working on the idea in 1958. He had graduated from MIT with a master's degree in 1953, worked five years for Mercury testing outboards at its proving grounds in Wisconsin and Florida, and then returned to his home town as an independent marine engineering consultant. He had seen inboard-outboard combinations before, he recalls, but none had been successful. "They didn't do everything an outboard motor could do, yet it seemed like there could be a good market for something that combined the best features of an inboard engine and an outboard lower unit."

Wynne wanted to mate the four-cycle inboard with the outboard's tilting and steering propeller. The four-cycle engine, he felt in 1958, offered better fuel consumption, no smoke, better idling. "Outboards have improved considerably since then," he notes, "but at that time the two-cycle engine was still a somewhat temperamental fuel gulper and prone to smoking and plug-fouling at idling. Plus, you could get more horsepower with an inboard."

He also felt it would be desirable to get the engine inside the boat where it was more accessible for repairs and maintenance: get it out of the salt spray that plagues big outboards hung over transoms, and eliminate a cut-down stern that could swamp a boat. Yet



1930 STERN DRIVE, from Johnson Outboards and Penn Yan Boats, came too soon and was depression victim

a new rig should retain great advantages of the kicker—maneuverability, since it steered with the power thrust from the propeller rather than a rudder; plus tiltability, whether striking an obstruction, beaching the boat or loading it on a trailer.

The idea had seemed logical to other inventors, too, but the predecessors Wynne knew of all seemed to lack something: they didn't tilt, or had steering problems, weren't reliable or introduced too much torque into the steering system. Wynne decided to use a double universal joint in the drive to permit transmission of power even with a unit that tilted and swung side to side, somewhat similar to the arrangement for front-wheel-drive cars.

In February, 1958, Wynne cobbled up a unit in the garage of his Miami home. He was 28, with no money coming in, so he worked single-handed, and somewhat secretly. "I used the lower unit and driveshaft housing of an outboard, welded some plates on top of it to take a right-angle gearbox, bought a universal joint, welded up a frame to mount the whole thing on a transom, and looked around for an engine," Wynne remembers. The little Volvo Penta was available as a straight inboard and he ordered one without the marine reverse gear, which intrigued the home office in Sweden.

Wynne borrowed a boat from the late Woody Woodson, founder of Thunderbird Boats, and single-handedly installed his new drive. "Early one morning when no one was around I launched it at Pelican Harbor, fired it up, and it performed well,

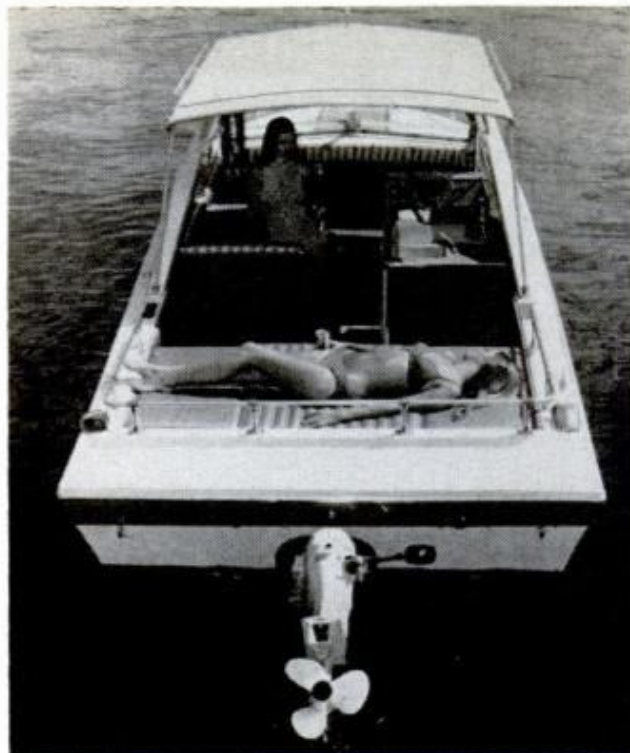
steered nicely and did everything I'd hoped for." For only five minutes. Then Wynne's rubber boot around the universal joint, improvised from an inner tube, tore open. But first problems were very minor and he got 25 to 30 mph from the rig.

Later that year Jim Wynne went to Denmark to join boatbuilder Ole Botved in an attempt to cross the Atlantic in an outboard-powered boat. Botved was hanging a pair of Johnson 50-hp outboards on his 22-foot Coronet, but Wynne took time out to visit Sweden and Harold Wiklund, then as now the president of the Volvo Penta division of the giant Volvo corporation. After two days Wynne signed a contract for production of his stern drive and recalls that Wiklund thought him wildly optimistic in his estimate that 1500 stern drives could be sold in a year.

Then Wynne returned to Denmark and set out across the Atlantic. Their little boat ran near a freighter and had to be hoisted aboard briefly during a bad storm.

"It was a plenty hairy Atlantic passage," Wynne recalls, and still has a dapper red beard as a souvenir of the crossing. "The trip couldn't have improved my credibility with Volvo either; here was some nutty American with a stern-drive idea crossing the Atlantic by outboard."

The rest is history. Volvo developed a running prototype, introduced it at the 1959 New York Boat Show, and almost collapsed when nearly 4000 orders came in. Another shock came when Wynne took Volvo's only prototype back to Miami with him, mounted it on another 17-foot Thunderbird, and test-ran it successfully in the 1959 Miami-Nassau Ocean Powerboat



HIGH TILT to lift outdrive unit above water level is a feature of OMC line of stern-drive powerpacks

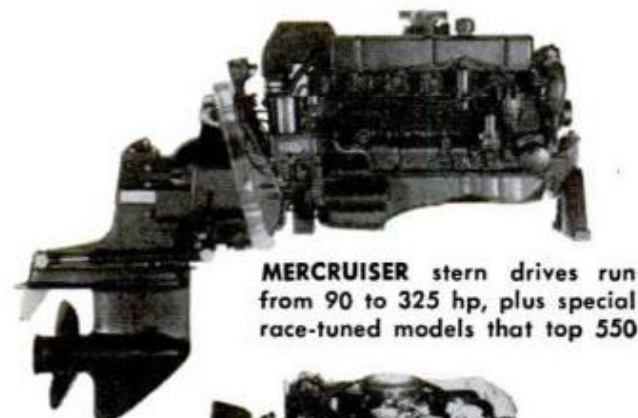
Race. His crew was Bill McKeown, now outdoor and boating editor of *Popular Mechanics*, and the two took 17 hours of open ocean in a rough passage to Nassau but finished fourth overall.

In 1960, Wynne and McKeown piloted a Hunt-designed 24-foot deep-vee hull with a pair of production Volvos in the marathon. That was the mad year when Sam Griffith and Dick Bertram won the Miami-Nassau with the famed *Moppie*, a 31-foot Hunt deep-vee. They completed the stormy crossing in eight hours. Wynne and McKeown were second, two hours later. No other boat finished until the next day. If any powerboat racing even in modern times can be tabbed as the most significant, it is that one. It established the deep-vee, developed by Ray Hunt, and the stern-drive engine, invented by Jim Wynne.

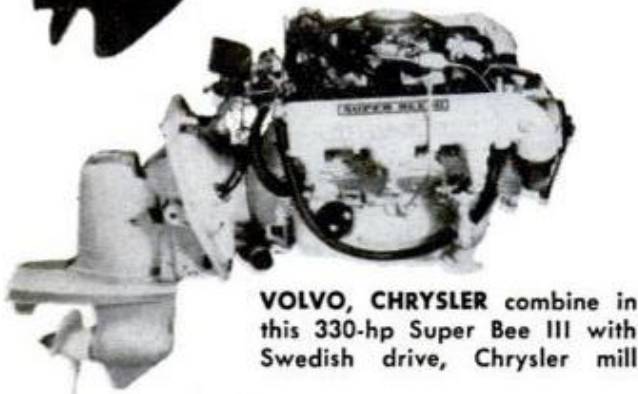
Mercury was first to follow, introducing its MerCruiser stern drive in time to win the 1962 Miami-Nassau, Outboard Marine Corp. quickly followed, as did Chrysler, and one year sales almost reached 40,000 units. Inevitably, there were some poorly engineered applications. Some boatbuilders viewed it as a universal power package for installation by unskilled labor and it went into some large hulls designed to remain permanently afloat in salt or dirty fresh water without galvanic corrosion protection.

Today the market seems to have stabilized, with well-established stern-drive manufacturers working closely with boatbuilders, and the future appears bright. Units are particularly suitable for larger trailerable craft and a host of horsepowers are available in gas or diesel models from low to over 500-hp hot racing blocks.

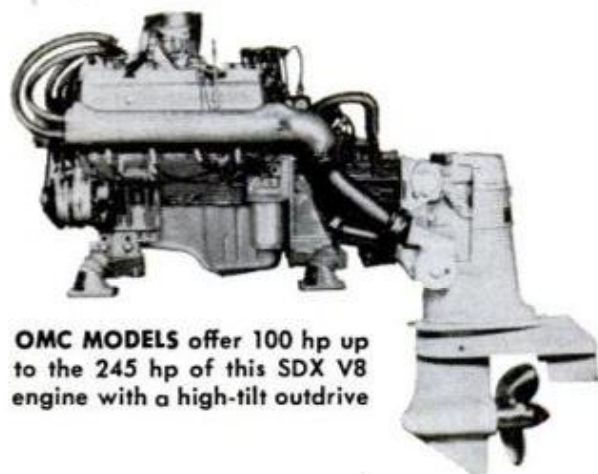
Choice can range from 90 to 325 hp for standard MerCruiser models, plus racing units of 550. Chrysler provides Volvo engines and their own, matched to Volvo outdrives, in horsepowers from 130 to 330, and Chrysler/Nissan diesels of 65 and 100 hp. Volvo diesels of 75 and 106 come from Sweden, as well as gas models at 115, 130 and 170 hp, and the Volvo outdrive is also mated to several private-brand engines. OMC stern drives from Outboard Marine come in six models of 100 to 245 hp. A boatman now has a healthy husky I/O selection from which to choose. ★★★



MERCUISER stern drives run from 90 to 325 hp, plus special race-tuned models that top 550



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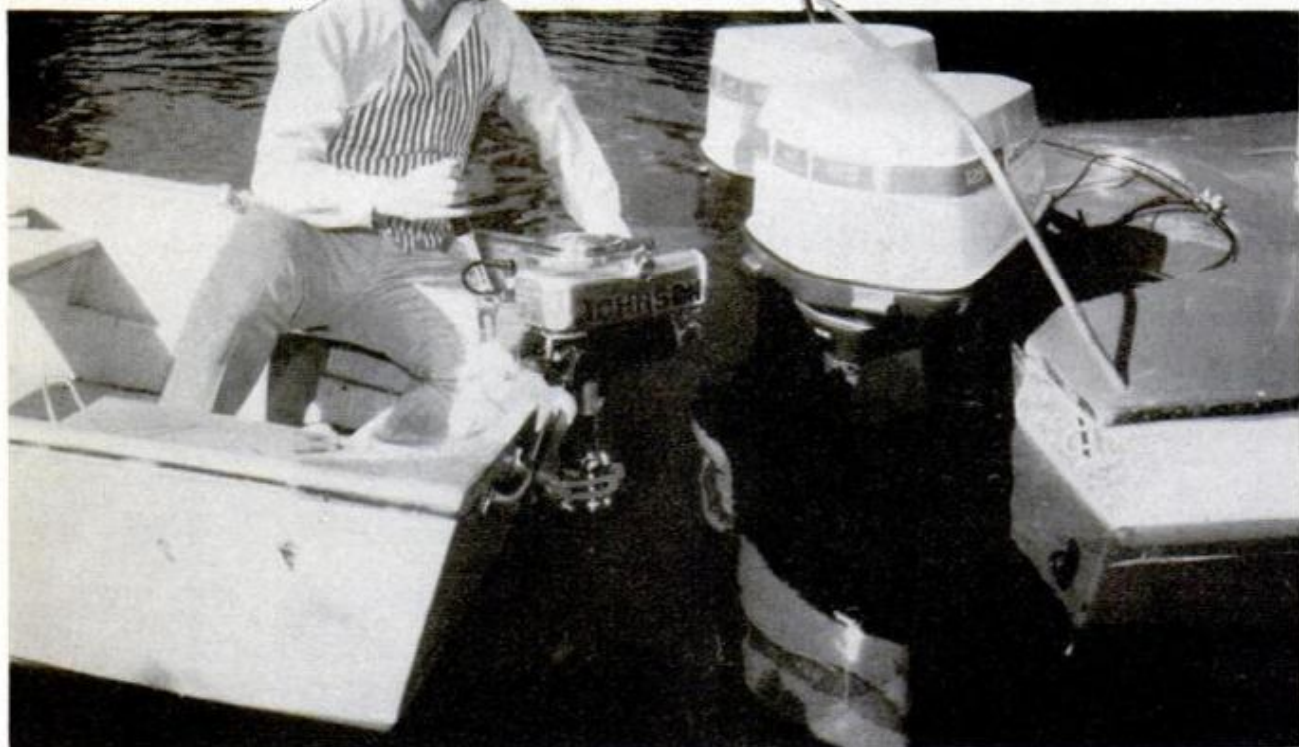
This outboard is sprightly at 50

By BILL McKEOWN, Boating Editor

Boating in the good old days was loud and slow—but also fun, we found, in our test of Johnson's anniversary antique

Photos by Jerry Imber

LIGHTER WEIGHT for easy lugging along was brag of ad for "Water Bug" of 1922



EARLIEST JOHNSON KICKER with two horses of power proved noisier than a herd of 250 hp from a pair of this year's biggest. The 1922 flyweight needed 17 pounds per hp but the new big ones shown take but two

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(Please turn to page 180)

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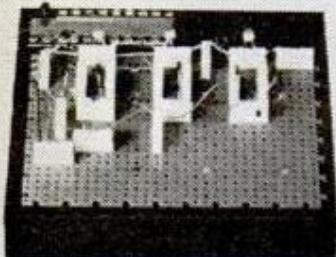


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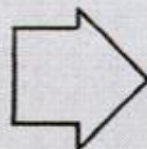


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OCTAGONAL LAMP TABLE

(Continued from page 156)

bevel flat on the table and the point of the bevel against the saw fence. Clamp nails are designed to draw the joint together as they are hammered in. Apply glue to all joints.

Lay out the tabletop on a piece of $\frac{3}{4}$ -in. fir plywood by striking a $12\frac{1}{8}$ -in. radius and drawing an octagon. Carefully miter an edging of solid wood ($\frac{3}{4}$ x 1-in. walnut) and glue it to the plywood all around, [\(see drawing, page 156\)](#) flush with the top. The edging hides the plywood edges and provides solid stock for shaping.

To cover the top, cut decorative laminate in octagon shape roughly $25\frac{3}{4}$ in. across. When you cement it in place, keep it centered, $\frac{1}{4}$ in. in from the edge.

To rout the $\frac{1}{8}$ -in. decorative surface groove around the top, you'll need a jig. It's simply an octagonal ring of $\frac{3}{4}$ x 1-in. pieces made to fit the perimeter of the top. All joints of the jig are glued except one—left open ($\frac{3}{16}$ in.) so the jig can be pulled with a C-clamp to hold it in place. Here a couple of ears (wood blocks) glued to each side of the open joint will accommodate the clamp. Notice that the jig is positioned to project $\frac{1}{4}$ in. above the top to provide a lip for the router base. The groove is made with a $\frac{1}{8}$ -in. veining bit set to just barely cut into the laminate—not more than half its thickness. Distance of the groove from the edge is determined by the router's base diameter. If it's 5 in., the groove would be $2\frac{1}{2}$ in. from the edge.

Shaping the outer edge completes the top. The original was shaped with a Stanley No. 5708 cutter. In detail A the thickness of the laminate provides the $\frac{1}{16}$ -in. shoulder of the profile. Take about three passes to shape the complete profile and move the router slowly, particularly when you start cutting into the laminate, to avoid chipping. Complete the edge by careful hand sanding.

Carved panels are glued in place one at a time with contact cement. Apply the cement to the very edge of each panel, top and bottom, and decorative laminate (none along side edges of the molded panels). Also apply cement to the center panels and laminate scraps. The first panel must be positioned squarely if the final one is to align properly with the rest. It's wise to make a dry run by fastening all eight panels in place with tabs of masking

tape. Then apply guide placement strips of masking tape to the laminate along top and bottom edges to be assured of perfect alignment of all eight. These strips also serve as lines to follow when you apply cement to the laminate. If the plywood panels of the shell were cut and joined accurately, the carved panels should fit with no space showing between abutting edges. If you wish, the plywood can be stained dark along the joints before the panels are cemented in place.

The top is attached to the base with screws through four wood blocks glued to the base on the inside at the top.

We used Johns-Manville Melamite laminate to cover the table: Carpathian burl on top and ranch pecan on the sides. The eight carved panels can be purchased for \$22 postpaid from United Southern Associates, Box 5521, High Point, N.C. 26262. To get the right color, ask for panel KR-50070.

The only part that needs hand finishing is the shaped edge. After sanding it smooth, apply walnut stain and let dry. Then apply two coats of Pierce-Stevens Wood Lore or Gaston's waxing lacquer, sanding lightly between coats. Finally, apply stain only to the $\frac{1}{8}$ -in. groove in the top with a small brush. ★★★

GUARD AGAINST BURNOUTS

(Continued from page 121)

leave it there during use. The Sonalert will now go on whenever voltage drops to the preset level. As soon as it does, shut off your airconditioners and other heavy-drain equipment until line voltage returns to normal as indicated by the meter. The Sonalert can be temporarily silenced by turning the TRIP control fully counterclockwise, opening switch SW1. When power returns to normal, reset the TRIP control to its original position. The Sonalert is self-powered by a 9-volt transistor-radio battery so it is independent of house current. Hold the battery in place by fastening it to the meter housing with a heavy rubber band.

Most of the components are readily available from local radio-parts stores or by mail from Lafayette Radio, 111 Jericho Turnpike, Syosset, N. Y. 11791. If you have difficulty locating the SCR and three diodes, these can be purchased for \$7.50 postpaid from Inventive Electronics, Wykagyl Station, N. Y. 10804. ★★★

INSTANT 'SHAPER'

(Continued from page 142)

cutter. Normally, the fence is used with surfaces of both halves in the same plane, but they can be offset as desired—by loosening the bolts holding the junction-box halves together. The fence assembly is centered with respect to the cutter, and holes for the 1/4-in. clamping bolts are located near edges of the cabinet top. A second set of holes is drilled near the back edge of the top to provide an alternate fence position.

Make a guard ring to fit over the fence gap, which can also be used on an extension arm when nonstraight edges are being shaped. The loop, made from 1/8-in. rod, is soldered to a brass plate drilled for 6-32 mounting bolts. The extension arm, made from 1/4-in. plywood, is stepped to bring it nearer the cutter and improve rigidity. Bolts holding the guard and extension arm should be in one half of the guide fence only so you can adjust the other half for depth of cut.

Because the router switch is not easily reached when the cabinet door is closed,

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you'll need an outside control. This consists of a single-pole switch and outlet (provided with ground connection) housed in a surface-mounting switch box screwed to the cabinet side. The router is plugged into the outlet.

A sizable assortment of cutters suitable for forming edge moldings, smoothing edges and other shaping chores is available. For use without a guide fence, as in cutting moldings along irregular edges, there are bits with pilots or shoulders to limit the cut. The setup illustrated had no tendency to "walk" because vibration is light. If desired, you can use C-clamps to anchor the cabinet on a table or bench.

Fingers should, of course, be kept away from cutters. Instead, various work hold-downs—such as springy steel strips—can be designed as needed, mounted on the fence and supplemented by push sticks to hold work against the cutter.

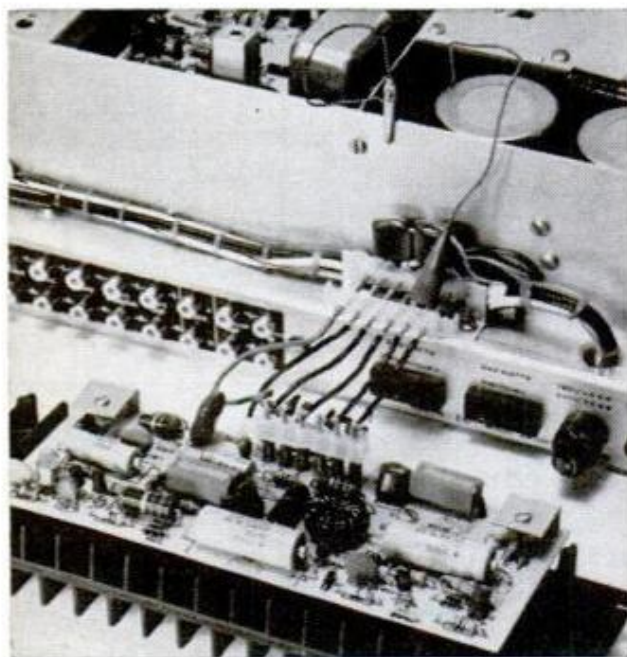
Your shaper cabinet can be finished conventionally. For the top, an easy finish is a sealer, such as thinned shellac, followed by two polish coats of floor wax. The rest of the cabinet can be varnished or painted a color. ★★★

\$700 RECEIVER IN A \$400 KIT

(Continued from page 109)

let you use the preamp and power amplifier sections separately. Each of the inputs—even the built-in tuner inputs—has its own level control, accessible through holes in the bottom plate. And even with the input sensitivity at maximum, this amplifier wouldn't overload on the output signal from my TV's audio section, as all my previous amps have. (Heath lists the input overload point as 10 volts in!) The sound is crisp, clean and quiet on all inputs: Heath lists signal-to-noise as -60 db. on FM; -63 db. on phono; and on other inputs, -75 to -90 db.

There's plenty of power, too. Continu-



EACH OUTPUT STAGE is on a separate circuit board, mounted on a common heat sink. Extender shown here allows in-circuit meter checking (note clip leads)

ous power, with both channels operating, is 60 watts per channel with an 8-ohm load, 100 watts into 4 ohms—so you get more power when driving two 8-ohm speakers per channel than when driving one. The speaker terminals take instrument-type plugs as well as bare wires.

All the basic features are there, including dual tuning meters, switchable loudness compensation and a tone-flat switch—even a button that mutes all but stereo FM stations, but I'd have gladly swapped it for high and low filters.

All told, my only gripes were the pointers on the balance, tone and volume knobs and tuning scale—they're too hard to see. Everything else is fantastic. ★★★

LEAR'S STEAM BUS

(Continued from page 118)

relatively little heat to raise it to 1100° F. at only 150 p.s.i., at which temperature it vaporizes and absorbs a large amount of heat. It is then expanded in a turbine or other engine to a pressure of 25 p.s.i. and a temperature of 60° F., at which it gives up its heat as it condenses to liquid and is pumped back into the 150-p.s.i. boiler to repeat the cycle. The theoretical efficiency of this cycle is such that, barring undesirable side effects or exorbitant cost, the discoverer of the fluid would become wealthy and famous and a new steam age would dawn. But after all these years no one has found anything that even comes close.

Steam, Wankel or gas turbine?

Is steam as much out of the running as an alternate power source as Detroit has said it was? There are obstacles and as yet unsolved problems that seem to stand in its way, to be sure, but probably not. For one thing, those long associated with the conventional engine tend to forget that emissions controls and lowered compression ratios have drastically reduced the power and fuel economy it enjoyed just a few years ago, bringing it within striking distance of naturally clean but basically less efficient alternate engines. And those automobile engineers who are grappling with future emissions standards are the first to proclaim that things will likely get worse.

Indications are that automakers are grooming the gas turbine as a replacement for the diesel in heavy-duty vehicles such as trucks and buses should emission standards, in effect, outlaw it. (Diesels tend to be heavy emitters of oxides of nitrogen, the most difficult of all pollutants to control.) If Detroit throws in the towel in trying to clean up the conventional engine, competition between powerplants for passenger cars possibly may come down to steam and the darkhorse Wankel engine. And for heavy-duty vehicles, it could be a three-way tug-of-war between those two and the gas turbine, with the lowest emitter getting the nod in both categories.

Of course, the odds against everything working out so neatly in favor of steam are large. But there's a chance, and to Bill Lear that's reason enough to forge ahead full bore. ★★★

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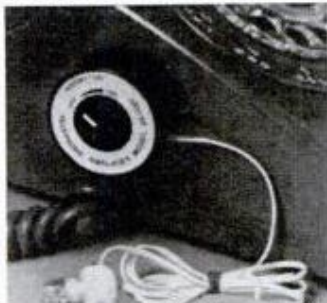
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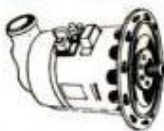
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ELECTRONIC 'EYES'

(Continued from page 90)

several inches away from the transmitter. The system works by triangulation. The angle between the transmitted beam and reflected light determines the obstacle's distance—the wider the angle, the closer the object.

Until recently, laser detectors have been confined to the so-called "seeing-eye canes" made for the Veterans Administration by Bionic Instruments, Inc., of Pennsylvania. To provide sufficient vertical coverage, the canes incorporate three laser beams—one pointed down, one ahead and one up. Together they provide a means of establishing the height of an obstacle as well as its distance. The rub is the cost—more than \$4000 per cane.

Laser device in eyeglasses

Now, however, the same company is working on a smaller, more compact laser device that, like Mims's, is built into a pair of eyeglasses. While details are not yet known, it may well be considerably cheaper since it presumably would not require three separate laser beams as the canes do.

Another approach, still in the laboratory stage but offering promise, is the ingenious TV system being developed at the Smith-Kettlewell Institute in San Francisco (see *The blind "see" with TV*, page 82, Jan. '72 PM). In this system, a small TV camera worn on the user's head becomes his "eyes." Signals from the camera are translated into thousands of tiny tingling electrical pulses that stimulate the nerve receptors in a patch of skin in the same way that light rays stimulate receptors in the retina of the normal eye. The electrical sensations are transmitted through the nervous system from the skin to the brain where they form a mental image corresponding to the scene viewed by the TV camera. These images are admittedly crude and shadowy, but they help to give the user an idea of what's ahead. With improvements in the system's sensitivity, it's possible that electronic eyes may someday become literally a reality—perhaps even small enough to fit into the space of an artificial glass eye.

In cases where corneal transplants have failed or can't be performed, a British surgeon, Dr. D.P. Choyce, has come

up with a clever means of inserting a plastic lens in the eye in much the same way as a camera lens is screwed in place. A threaded plastic socket is first implanted in the eye, forming a flange. When eye tissue has securely grown around the implant, a threaded barrel-shaped plastic lens is screwed into the socket, completing the operation and restoring sight.

Blind helped to read faster

Not all of today's research for the blind is aimed at navigational aids. Two spectacular recent developments enable the sightless to read faster and more easily than ever before. One is a small portable device about the size of a shoulder-strap tape recorder with a tiny hand-held photoelectric sensor on the end of a cord. The user simply runs the sensor along a line of printed type. Optical images formed by the photoelectric sensor are translated into corresponding shapes in rows of tiny vibrating pins. If the letter scanned is an A, the pins vibrate in the shape of an A. The user keeps a finger pressed lightly against the pins and thus can feel the changing shapes of letters as the sensor is moved along a line of type.

Called the Optacon, the device is being developed at Stanford University in California. It not only eliminates the need to translate books and other printed matter into braille—an expensive and limited proposition—but it increases reading speed, too. With practice, users eventually exceed the 150-word-per-minute rate generally considered maximum for braille. Being portable, the device can be used anywhere—even to read a menu in a restaurant or a magazine on a train. Biggest drawback at the moment is its cost—\$5000 each for handmade prototypes.

A similar aid, called the Optophone and developed in England, is under study here by the Veterans Administration. It uses a moving beam of light to scan printed words and translate them into coded musical tones, somewhat like Morse code. A user listens to the tones and deciphers their meaning in much the same way as a code operator. Unlike the Optacon, however, it is not designed for portable use.

Whatever the system, the marvel of electronics is bringing the sightless closer to seeing every day—a miracle thought beyond the scope of human achievement only a few short years ago. ★★★

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OUTBOARD SPRIGHTLY AT 50

(Continued from page 168)

first against the compression," suggested photographer Jerry Imber as we wound up the old familiar length of clothesline around the old familiar flywheel to rope her through a few times first for pictures before settling down to the starting battle. (Remember the early morning scene of a fisherman far out on the quiet lake as he pulled and pulled on the starter cord while soft profanity floated in over the water?)

Jerry had had one of the first Johnsons when he was a youngster, back when our antique was considered just an outmoded old clunker for a kid rather than for a museum. He had run his on a boyhood camping trip down the winding Suwanee River. "Pull the rope part way several times to let the flywheel bounce against the compression so gas can prime in through those big old ports," was Jerry's starting recipe.

We set the spark to start, pulled the cord partway to rock the flywheel and then roped her through. Bang, and she was firing like mini-firecrackers with the skiff tugging at the mooring lines before Jerry could get a picture. And so we cast off, holding onto our borrowed straw skimmer as we blazed along at an estimated two knots. Just as well we hadn't lined up a banjo for this 1920s boating scene. How could that pretty girl up in the bow ever hear it?

A neat little water pump for engine-cooling water was on the lower unit, we noted. Motor speed was controlled by setting the spark rather than a throttle. Turning the engine full pivot for reverse, you got a reminder to hold the gas tank rather than cylinder heads as you burned a hand. Though we didn't have them, accessories in the catalog included a stern bracket to bolt on a canoe, or an inboard/outboard mount so the lower unit could be bolted up through a hole in the keel.

No wonder the motor was the lightest of its day. Previously the Johnson brothers had built what were probably the world's first metal and single-winged airplanes.

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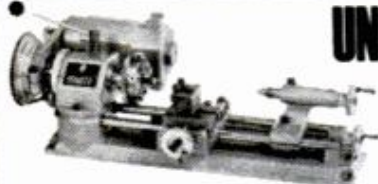
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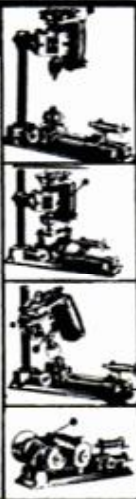
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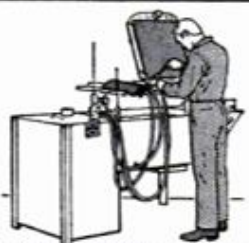
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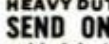
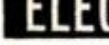
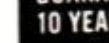
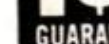
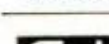
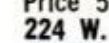
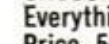
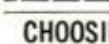
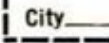
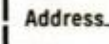
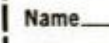
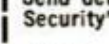
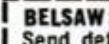
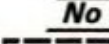
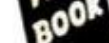
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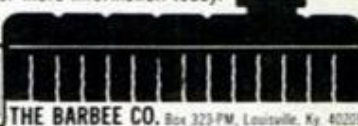
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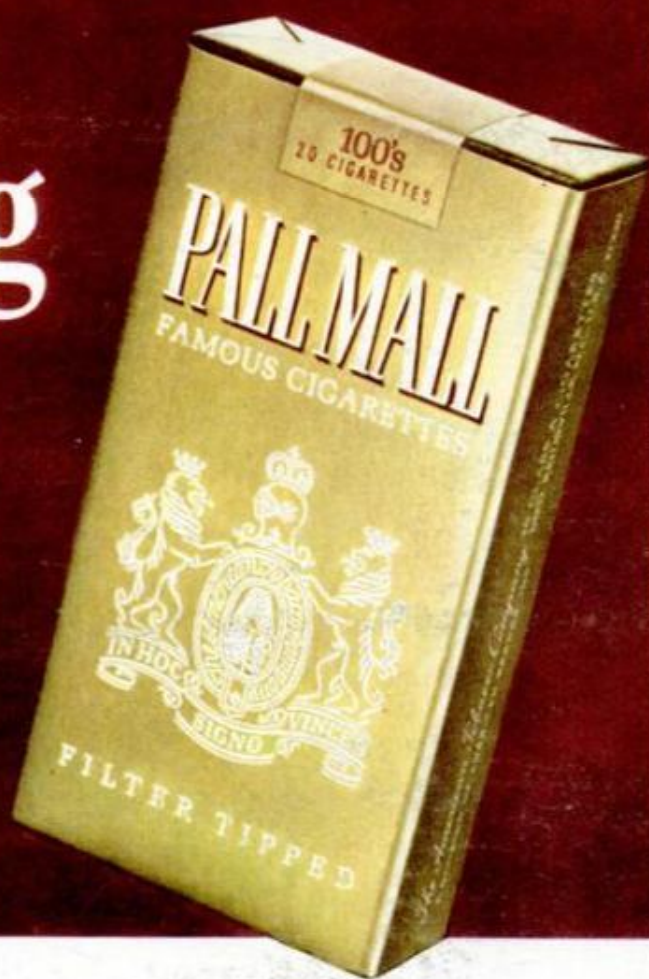
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