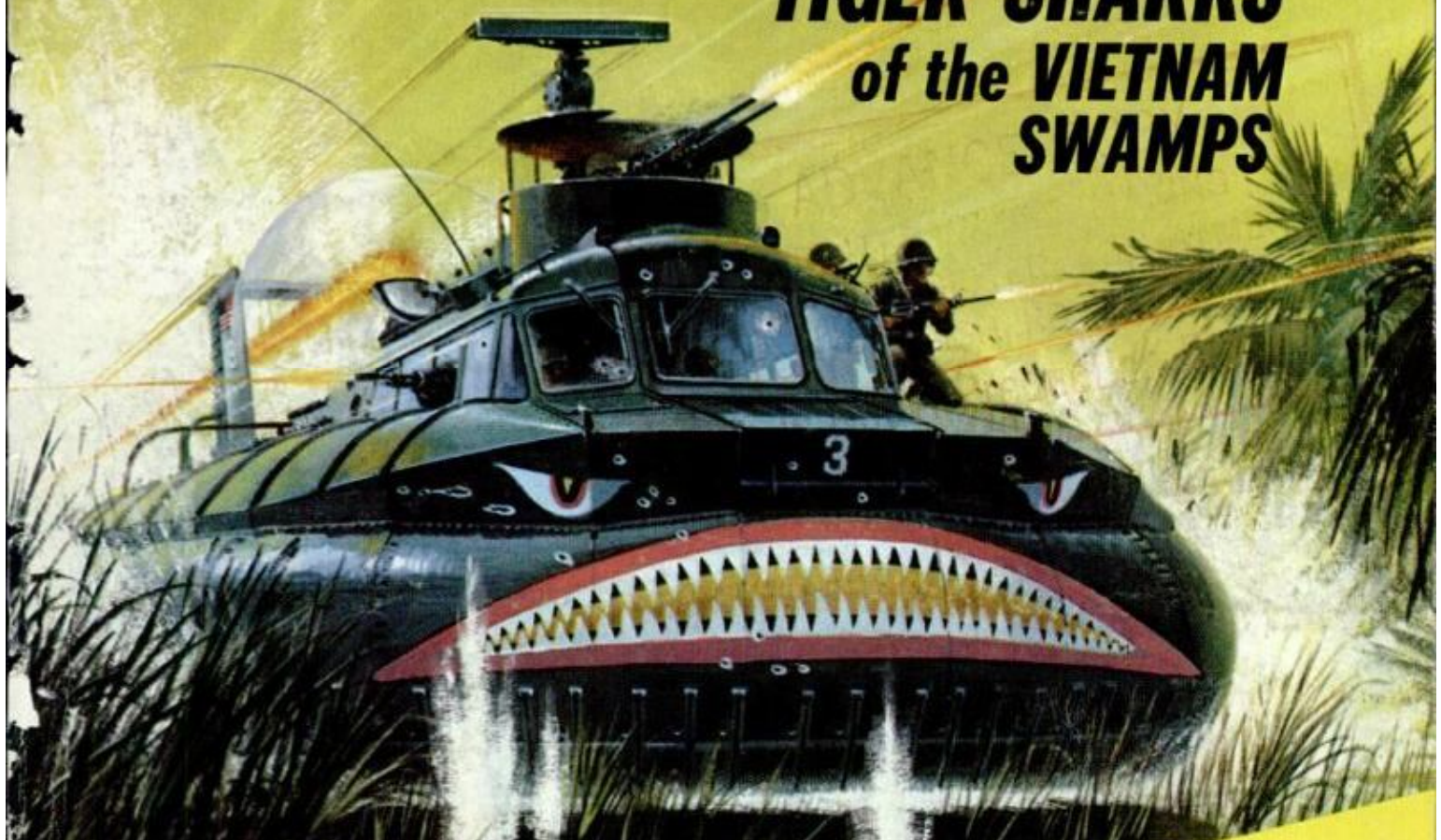


POPULAR MECHANICS

NOV. 1967
35 CENTS

'TIGER SHARKS'
of the VIETNAM
SWAMPS



What's New in
COLOR TV?

50 GREAT IDEAS FOR YOUR **FAMILY LEISURE CENTER**
SPECIAL 24-Page Tear-Out SECTION

**Time Bombs
Full of Oil**

100 Sunken Tankers
That Can Pollute Our Beaches


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Getting the Most from a Portable Jigsaw

Build a Cart for Your Shop Vacuum • Gordon Johncock Tests the Javelin

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So they got an Autolite coil. Almost a carbon copy of the one you buy.

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POPULAR MECHANICS

**SPECIAL
SAVE-IT SECTION**



50 GREAT IDEAS

FOR YOUR **FAMILY LEISURE CENTER**

LEISURE CENTER, family room, rec room—whatever you call it, it's where everyone likes to be most of the time. It's where the kids like to have their parties; where it's easy to play host and you don't have to worry about spills or frills. It's where the action is: a game of pool, the big game on tv, the big sound of hi-fi, the big screen that pulls down for home movies. Your leisure center may develop from an enclosed porch or patio, a garage conversion or a basement or kitchen remodeling. This 24-page special section offers dozens of great ideas that can make your leisure center the best-liked room in the house.

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takes the hard work out of paneling a room



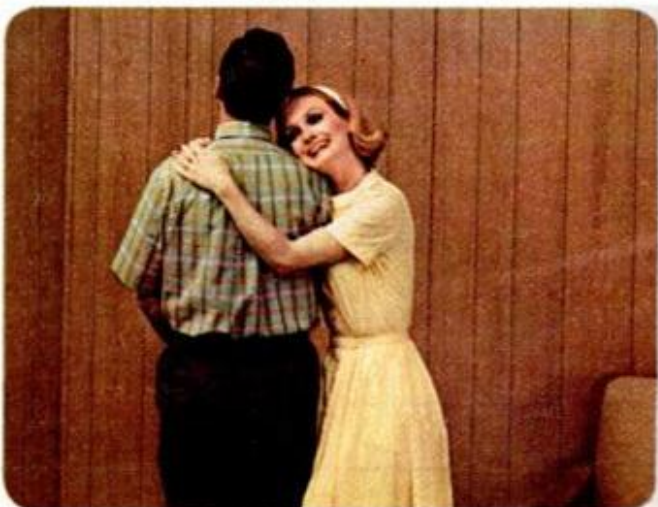
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PLANNING YOUR LEISURE CENTER

IDEA: A pass-through between an existing kitchen and new playroom is handy for serving snacks. Here, a counter along the wall provides a food-preparation area with plenty of storage underneath. Note the built-in barbecue—one of many easy-to-install prefab units

By **PROF. JAMES T. LENDRUM, A.I.A.**
*Head, School of Architecture,
University of Florida*

A noted architect tells you where to look for space, what to put in it, and how to get the most fun per square foot for your investment

FOR THE FIRST TIME in history, we have free time to do with as we see fit. This relatively recent development has suddenly made a great change in our housing requirements—we need *space* for leisure now that we have the time.

The concept of a home leisure center is so new that few of today's houses have provision for one. The separate family room is showing up in some new homes, but is still rare. For

most of us, room for leisure-time activities must be ingeniously and imaginatively created by adapting existing space. For some, an unused basement or attic may be the answer, but there are many homes with slab foundations and shallow-pitch roofs where even these possibilities do not exist.

Fortunately, you may have more space than you realize. There's that two-car garage sitting out there—400 or 500 square feet of space that isn't

Basement
with a 'View'

IDEA: Giving a windowless basement the look of a garden patio is a neat way to solve the problem of underground space. At left, a wall-mounted photo mural of a mountain range gives the illusion of a distant view, while a planter box in front of it suggests a long, low terrace wall

IDEA: Basement floor looks like a flagstone patio, is actually a vinyl floor covering in random slate pattern

IDEA: Grooved plywood used for fencing becomes wall paneling above, redwood-stained for an outdoor effect

IDEA: Entranceway at rear is screened off and covered with artificial grass to add to the outdoor appearance

IDEA: For parties, a garden cart filled with ice makes a big roll-around soft-drink cooler, as shown at left

being lived in. Often such a garage can be turned into a spacious leisure center while you add a relatively inexpensive carport to shelter the cars.

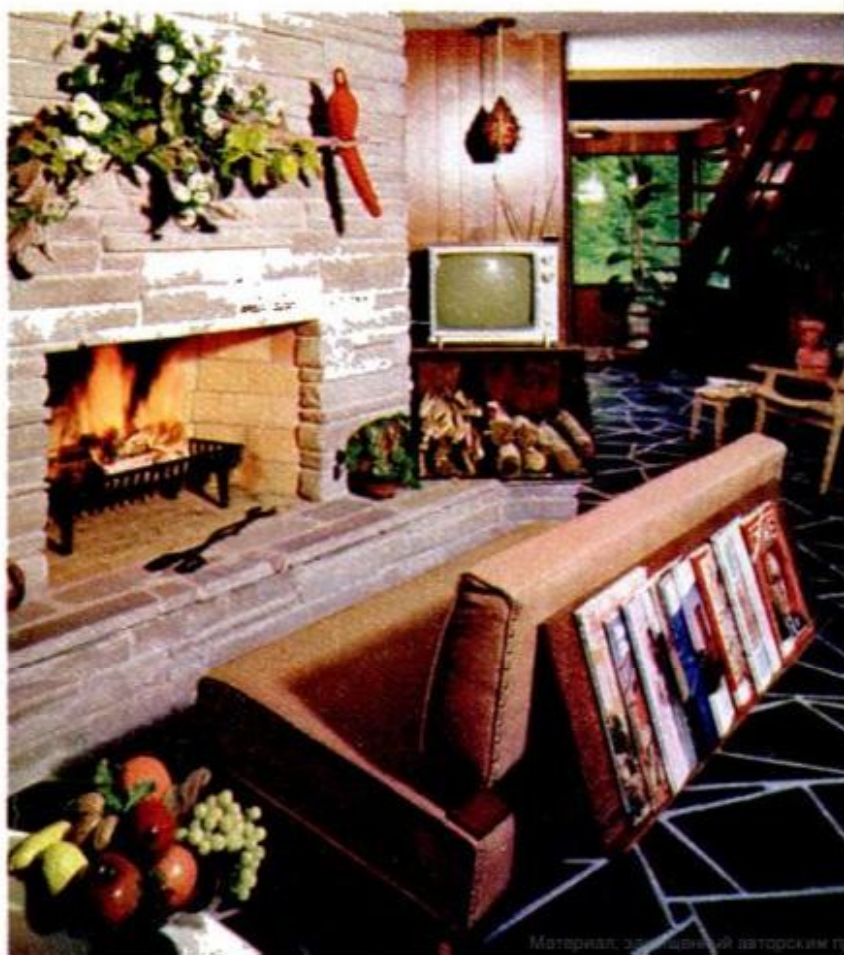
An infrequently used porch is an ideal candidate because it requires no new foundation work. If it's already roofed over, all you have to do is enclose the sides and add some form of heating. Or perhaps there's an open breezeway between the house and garage. Closing this in is another way to get year-round recreational space at a little cost.

One important thing to remember is that a leisure center doesn't necessarily have to be a separate room all by itself, nor does it always have to be the same place for all members of the family. It can be any room, or part of a room, that

can be made to serve a double purpose. It might be a dining room fitted out to permit game and hobby activities when meals aren't being served. It might be one end of a large living room partitioned off to provide a game and TV nook for youngsters while the grown-ups are entertaining in the main room.

For Mom and Pop, their leisure center might be a small portion of the master bed-

IDEA: Angling a short wall section out from the fireplace, as shown at right, makes it possible to enjoy the fire or watch TV from the same seat—you just turn your head slightly to see the screen. At the rear, a modern open-tread staircase replaces a closed-in well, giving the room a feeling of spaciousness. Note the wood box below the TV and the slanted magazine rack mounted on the back of the sofa





IDEA: A wall-size entertainment center like this can house everything needed for hi-fi listening as well as other hobbies. Here, roll-out shelves make it easy to get at heavy gear like a movie projector or a tape recorder

room set up as a lounging corner for quiet reading, TV-viewing and other hobbies. Where two youngsters are close in age and of the same sex, they might share one bedroom, freeing a second bedroom for use as a game room.

In planning your leisure center, one of the most important needs to bear in mind is an easy access to food. Whether you use it for family get-togethers, teen-age blasts or adult entertaining, there will be a lot of refreshments to serve.

For this reason, the ideal location for your leisure center is next to the kitchen. This way, you can install a pass-through between the kitchen and playroom, or perhaps remove a portion of the wall entirely, to give you a direct route to your food-preparation facilities.

Where there is no other room available, the dining room itself, or dining ell, is a logical choice for conversion to a multipurpose entertainment center since it's usually near the kitchen. As a formal dining room, it's used only briefly once or twice a day; as a combination meal and recreational center, it earns its keep full-time.

If you are converting a basement to a playroom, give serious consideration to the advantages of adding a small second kitchen. A refrigerator,

(Please turn to page A21)

NOVEMBER 1967



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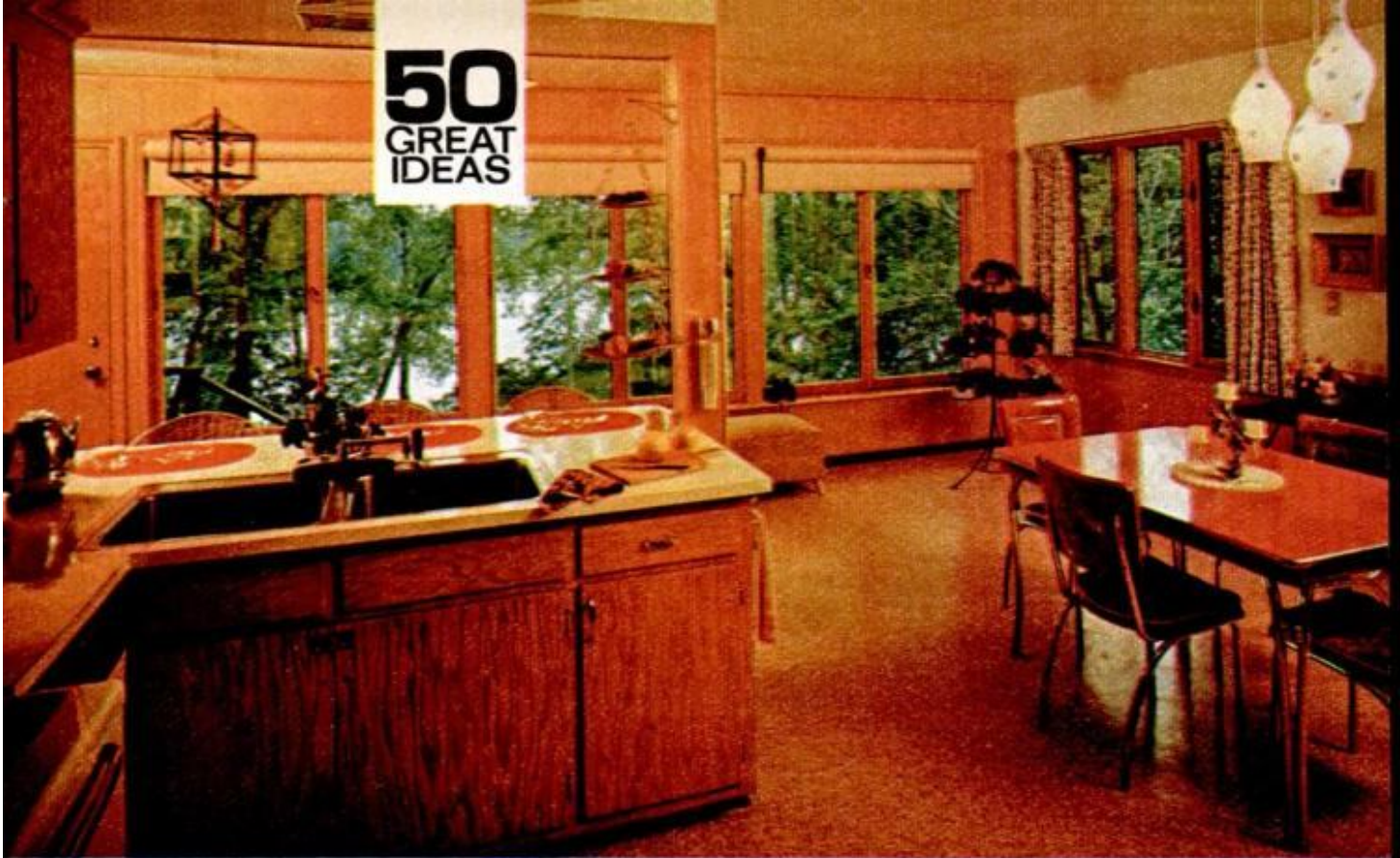
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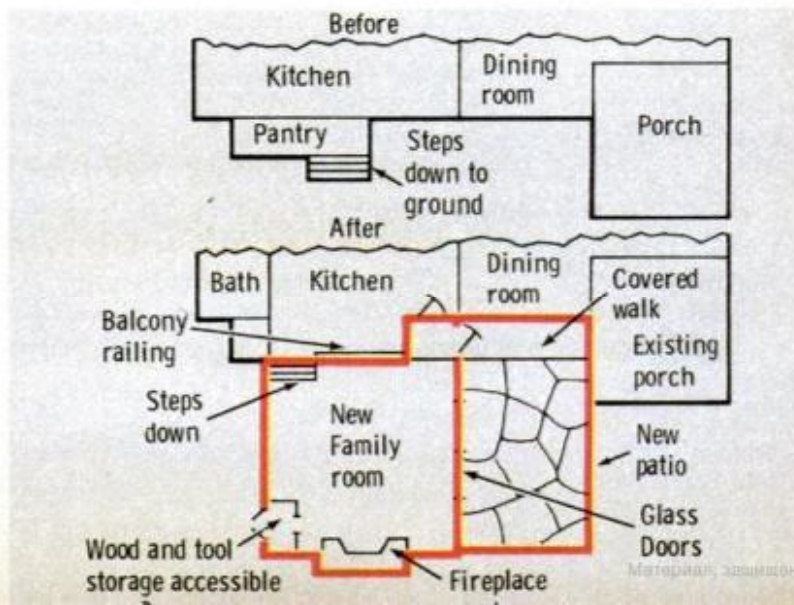
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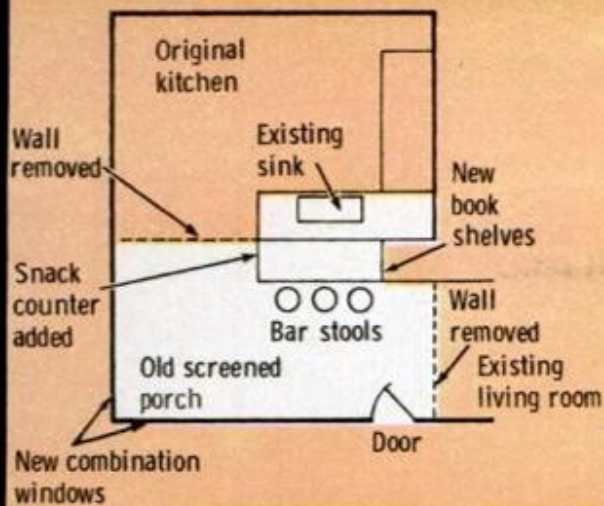
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Extend a Kitchen and You Get a Family

IDEA: A new wing off an existing kitchen is an ideal spot for a playroom since it's handy to food and at the same time is kept separate from the quiet side of the house so noise-making isn't a problem. The L-shaped extension shown here and on the opposite page is placed on a slab at ground level a few steps below the kitchen. This saves cost of a raised foundation and creates interesting sunken effect shown at right. Below, view through doors of new room shows patio outside





IDEA: Closing in a screened porch is an easy way to get a family room at little cost. In the plan shown here and on the facing page, the porch was next to the kitchen and the wall between them was removed, creating a combined kitchen-dining-play area. An existing kitchen counter was enlarged to form an island snack bar dividing the kitchen and play areas

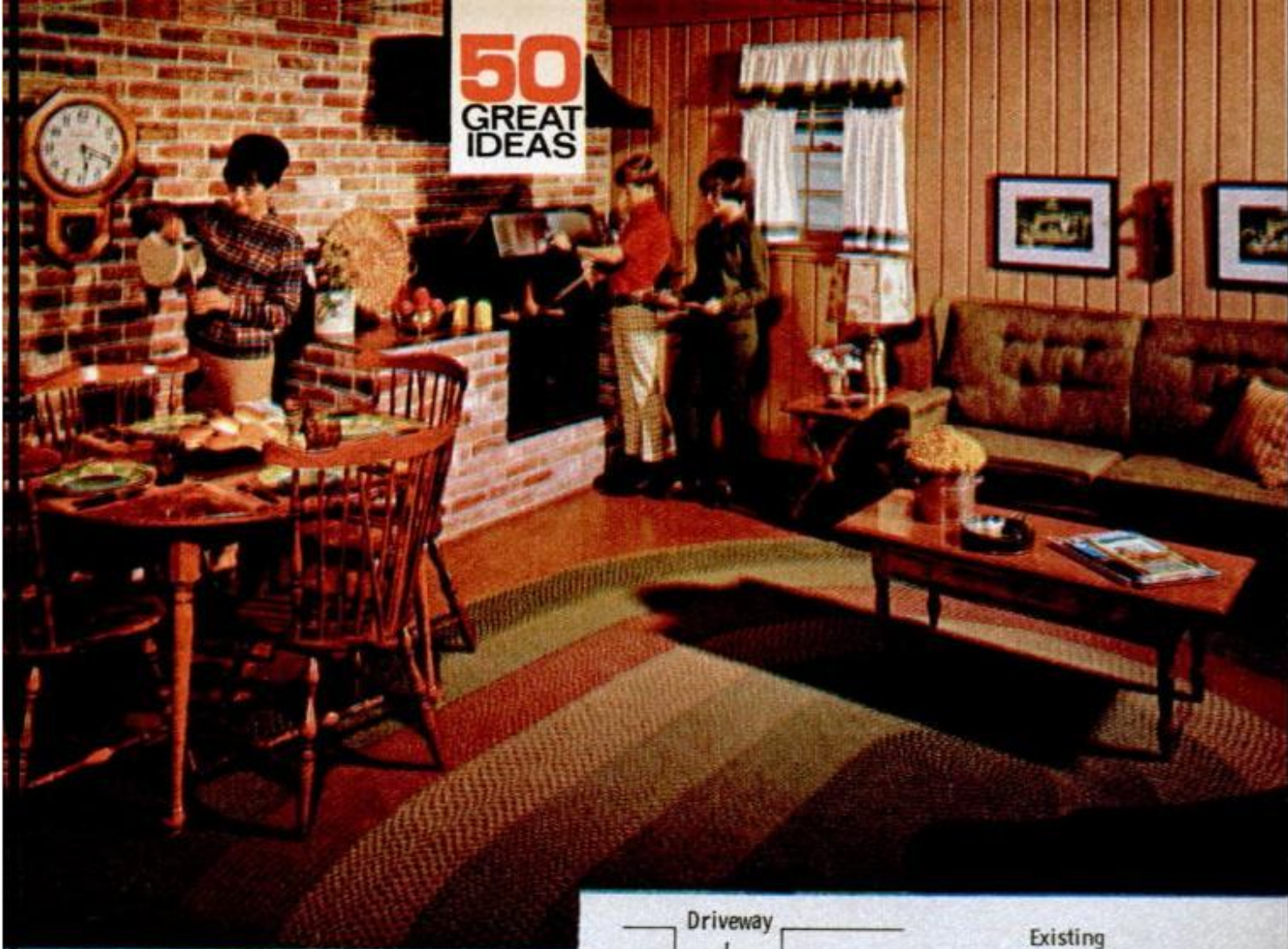


Room with a Built-In Food Supply

IDEA: This attractive balcony overlooking the family room (foreground below) is one advantage of locating a new wing at ground level. Balcony area is used as a breakfast nook convenient to both kitchen and playroom

IDEA: A fireplace barbecue permits indoor "cookouts," costs little since it shares the fireplace chimney. Another bright idea: Corner cupboard at the right stores tools and firewood, is accessible from either inside or out

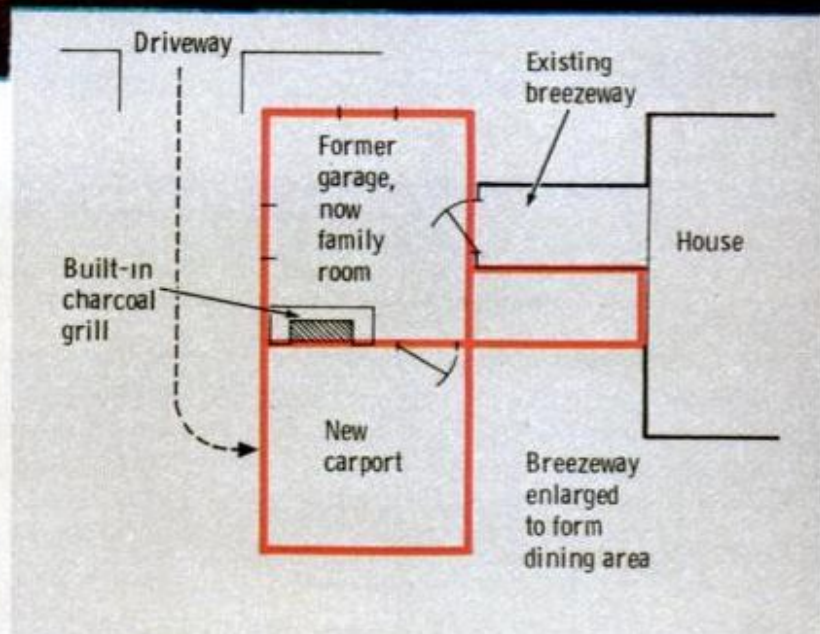




Need Space? Move into the Garage

IDEA: Wall in the open end of a two-car garage and you have a spacious family room 20 or more feet square. In the conversion shown here, a rustic brick wall with a built-in barbecue unit closes off the old doorway. A hood over the barbecue incorporates an exhaust fan, eliminating the need for a chimney flue. Wood wall paneling and cork floor covering create a warm, informal atmosphere.

IDEA: Adding a carport not only solves the problem of what to do with cars displaced from the garage, but it also creates a sheltered drive-in area adjacent to the new leisure center—a welcome feature in bad weather. As shown at the right, a carport can also be combined with an open patio to provide a variety of recreational areas linked together. In this case, the original breezeway, no longer needed, has been widened to form a dining nook next to new hobby room.



Ask these 6 important questions before you buy a home billiard table

1. WHAT'S THE BEST SIZE? Depends on what you want. Miniature or toy tables (under 3½' x 7') can be fun—but you won't get anything like real billiard action. Professional tables are 4½' x 9' or 4' x 8'. If 4' x 8' is still too big, get a 3½' x 7' . . . and make sure it comes with 2¼" balls and regulation cues.

2. WHAT KIND OF BED SHOULD THE TABLE HAVE? The table bed must be rugged and flat. At one time, all good beds were slate; but, modern science has changed that. Brunswick's Permalevel® and Levelite® beds give you all the playing qualities of slate—plus portability—at lower cost. These fine tops don't need levelers because we build 'em level to stay level—and

warrant them in writing against warp and sag. (Of course, we have the finest slate tops, too.)

3. WHAT TYPE OF CUSHIONS AND CLOTH ARE BEST? In 120 years of building fine billiard tables, Brunswick has yet to find an acceptable substitute for 100% live rubber cushions and good, 100% wool cloth. Our \$2,500 tables have them. So do our \$295 tables.

4. WHAT KIND OF ACCESSORIES COME WITH THE TABLE? All accessories should be regulation size and type to assure top playing qualities. Brunswick supplies costly, premium quality, American made, cast phenolic balls . . . sturdy hardwood cues . . . bridge, triangle, and chalk.

5. WHOM DO I CALL FOR SERVICE? Most tables have warranties running from a year to a lifetime, but unless the manufacturer is around to back them up, they're worthless. A warranty that requires you to ship the table back to the factory is a nuisance. With the Brunswick warranty, if you need service, just call your local Brunswick dealer. He's authorized to handle everything.

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TYPE OF BED	Honeycomb	Honeycomb	Permalevel®	Permalevel®	Levelite®	Levelite®	Slate	Slate	Slate
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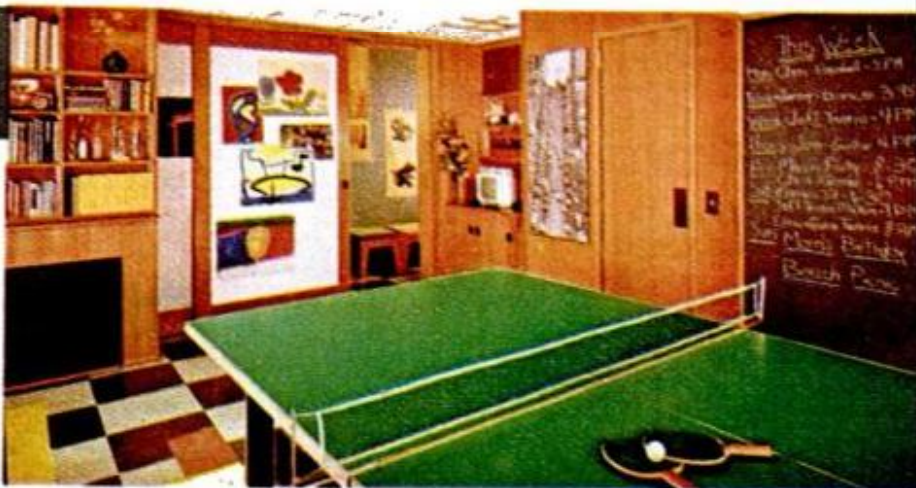


IDEA: A shallow wall niche like the one at left lets you store sports gear in a way that creates a decorative showcase at the same time. You could do the same with guns, fishing rods, bows and arrows, rackets, athletic trophies, a dart board—anything that makes an interesting display. Combining bright paint for the niche with wood-grained wall paneling produces a very colorful effect

IDEA: A low cabinet along a wall is a good way to get extra storage space as well as a countertop for displaying nicknacks or serving refreshments. It's also ideal for hiding old radiators, pipes or other obstructions that might be encountered in a cellar

Put Your Walls to Work

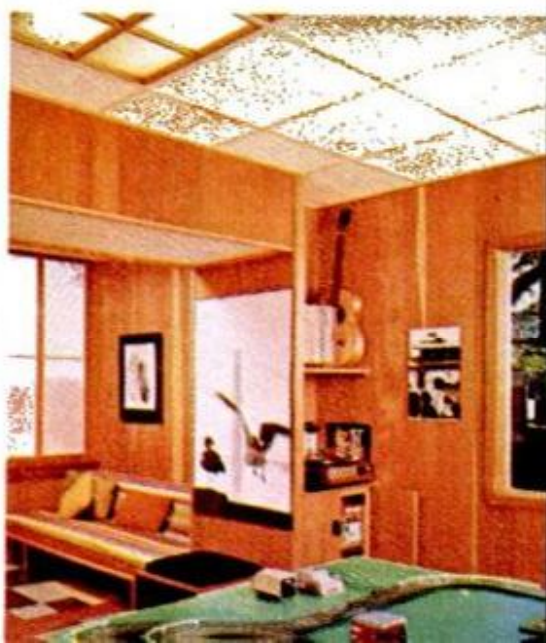
IDEA: Lively walls make your playroom seem gayer and more cheerful. The room at right sports colorful children's paintings, a dramatic photo enlargement, and a chalkboard for family messages and youngsters' spontaneous drawings. The chalkboard is made by coating overlaid plywood with special chalkboard paint. The ping-pong table, also made of special overlaid plywood, doubles as an all-around hobby table for model road racing and other activities, as shown at right below. Plans for table are available for 50 cents from Simpson Timber Co.



IDEA: Divided family room below has a "rumpus" area at one end for youngsters and quiet alcove at other end for grown-ups to sit and talk



IDEA: The playroom at left boasts a tiny kitchen made by closing off an alcove with a low wall to form a convenient pass-through and serving counter. Built into the wall next to the opening are compartments to house hi-fi equipment and a pair of speakers. A curtain sliding on a ceiling track pulls across to hide the whole works from view when not in use. The kitchen is reached through a separate side door off an adjacent hallway. Another smart idea: The mobile TV caddy makes it easy to roll set anywhere in the room and also doubles as a serving cart



IDEA: Looking for a simple way to brighten up a basement family room? Try a Japanese-style look. Here, the walls are painted white, and one is cleverly covered with strips of black tape to simulate a Japanese shoji screen of paper

IDEA: Large table at right is actually a flush door black-lacquered to carry out the Japanese theme. Benches with lift-up tops for storage completely surround the table and are covered with multicolored pillows for another Japanese touch. The effect is modern, smart, inexpensive to create



Room Dividers Help You Create Usable Space

IDEA: Colorful plastic panels form the divider at the left, making a screen that's eye-catching as well as functional. Wide wood framing creates shadow-box shelves. Plastic is Celotex's Decorene, sold in several styles and colors

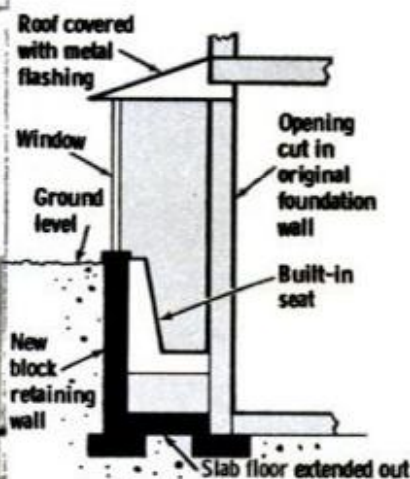
IDEA: An open-work divider like the one at right below suggests a wall without making you feel closed in. This one, made of square posts with random plywood spacers, screens off a stairway and creates a small shelf-lined reading nook



Brighten Up a Basement with Glass



IDEA: Knocking out a wall can turn a dingy cellar (left) into a cheerful, sunny family room with a view (above). The job isn't difficult if part of your basement is at or near ground level. Here, a glassed-in corner with a prefab fireplace "makes" the leisure center

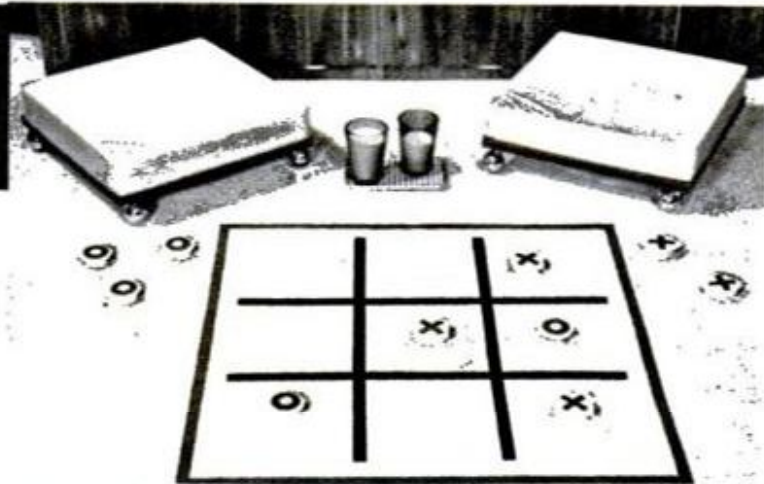
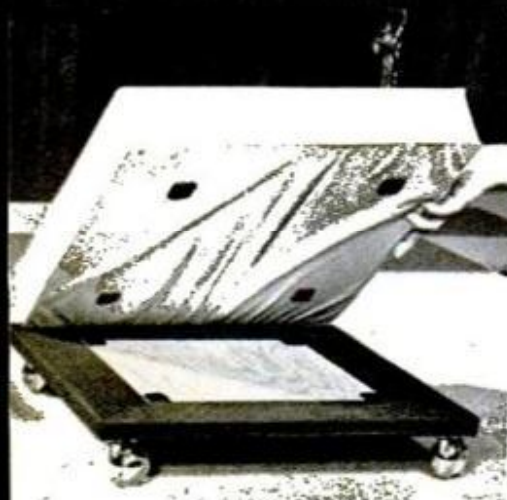


IDEA: If your basement is partially exposed, one way to give it the look of an upstairs room is to dig away the earth along one wall and build in a bay window, as in the diagram above. The bay adds seating space, makes room seem larger



IDEA: Cover tiny cellar windows with translucent plastic, back-lighted for an attractive effect at night

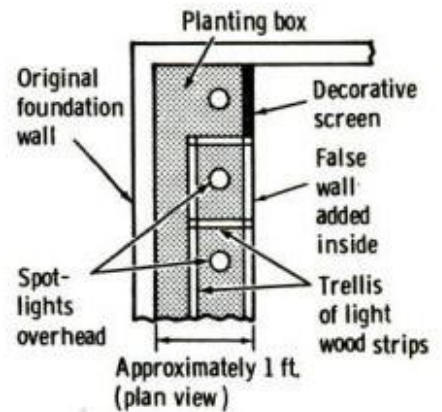
Make the Floor a Game Board



IDEA: Roll-around pillows are great for a gang watching TV or playing games on the floor. These are 3/4-in. plywood squares fitted with ball casters. Stock cushions are held on with small pieces of Velcro tape. Game courts can be laid out with colored vinyl tape, with wood drawer pulls for markers



'Window' in a Concrete Wall



IDEA: Open grid along top and side of room divider above relieves the stark look of a solid wall. Low counter doubles as a nicknack shelf and snack bar. Walls are Marlite plastic-faced hardboard

IDEA: The "picture window" at left above isn't a real window at all. It's a patch of concrete cellar wall painted blue with spotlights shining down on it and a false wall on the inside, as

shown in the diagram above. The clever dodge produces the effect of sunlight streaming in with a bright blue sky beyond

IDEA: Colorful new carpet tiles let you create your own eye-catching patterns to liven up a den or playroom. They make it easy to fit wall-to-wall carpeting into odd-shaped areas, can be rearranged into new patterns whenever you wish or taken with you if you move. The tiles, made by Ozite, are 12 inches square and come in a variety of colors. The bar shown at right has an ingenious hinged front that swings up to form a dining or buffet table. For a view of the table raised and details on how the tiles are installed, see the next page



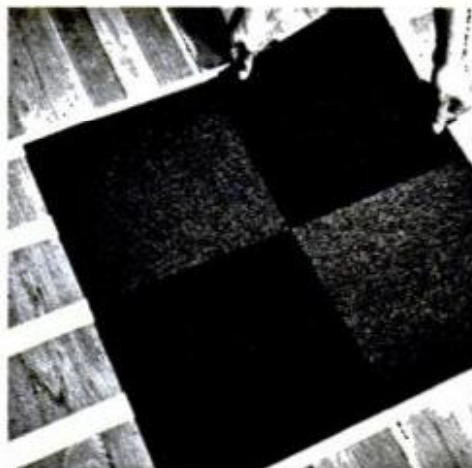
IDEA: The dual-purpose plan at left provides a TV corner at one end and a sewing alcove for Mom at the other. The short divider wall not only helps to separate the two areas, but is also ideal for housing the TV set and hi-fi equipment. The record changer is mounted on a slide-out shelf, with record storage underneath. Add a built-in screen and you'd have a good spot for viewing slides and movies. The room shown here is the result of converting a little-used front porch. Plans for room are available from National Gypsum Co. (Gold Bond Add-A-Room No. 15)



**50
GREAT
IDEAS**

IDEA: Swing up the hinged front of this unusual bar and—presto—you have a handy snack table for serving guests. Screw-on legs are added after the table is raised. The open compartment in the left-hand side of the bar stores four stackable dining chairs. The novel bar top was made by pouring a clear casting resin over old printing plates and letting it harden to form a smooth, marproof plastic surface

How You Lay New Carpet Tiles



DETERMINE THE CENTER of the room with chalk lines and lay strips of double-faced tape spaced on 6-in. centers so they fall at the middle and edges of each 12-in. Ozite tile (left, above). Position the first tile on the chalked

lines and press it down (center). From here on, it's more fun than work—you just keep adding tiles (right). Trimming around obstructions is easily done with a razor knife or scissors. Seams between tiles are practically invisible



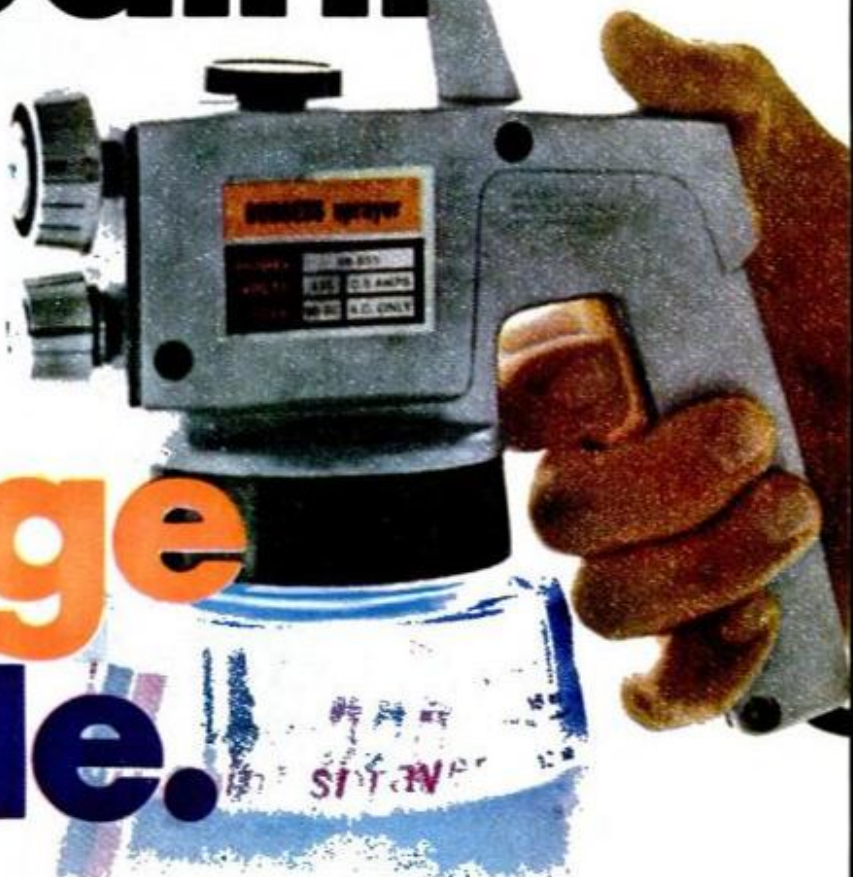
IDEA: This multilevel dining nook combines a kitchen pass-through counter with a lower table for eating so everything is kept neatly in one spot. The table and shelves are given a built-in look by covering their angled supports with scraps of paneling to match the walls—in this case, a wood-grained Masonite



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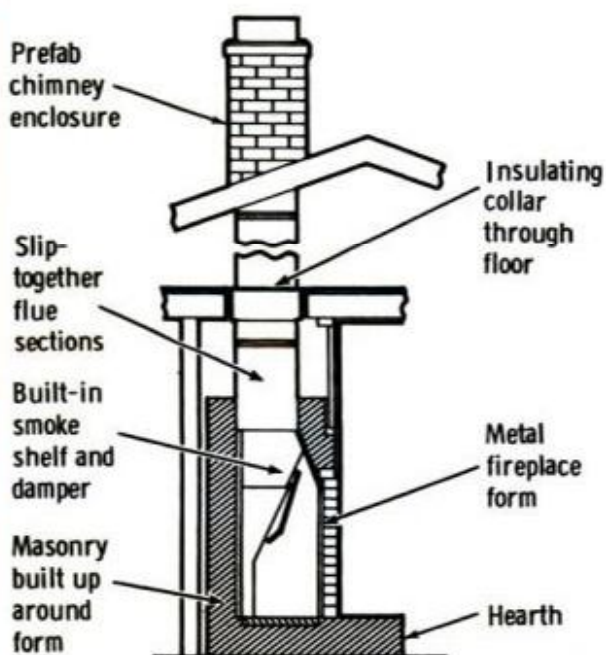
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IDEA: This combination kitchen-playroom is divided by sliding wood doors. With the doors shut, the kitchen is closed off for food preparation. Opening the doors in effect brings the kitchen right into the playroom for easy serving of family meals or party refreshments. The island counter just behind the doors serves as either a kitchen counter or a party snack bar depending on whether sliding doors are open or closed. "Floating" overhead cupboards are supported by thin metal poles

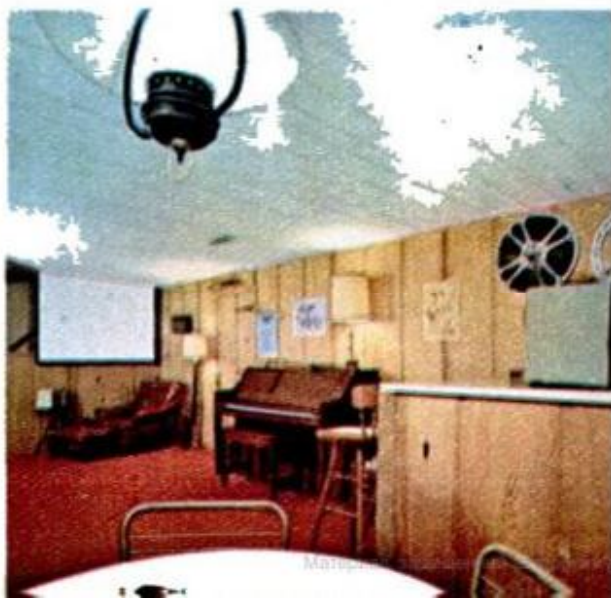
**50
GREAT
IDEAS**



IDEA: Want a fireplace, but think it's a big job? The handsome one at left was built into a playroom wall using a metal form to speed the masonry work and simple slip-together flue sections. Heatilator unit used here is one of several types. If you don't need a masonry job, consider another choice: a free-standing prefab fireplace



IDEA: This double-duty basement bar offers a perfect arrangement for showing slides or movies. Projector stores under counter, is quickly set up on top for show. Built-in screen at the far end of the room (right) takes only a second to pull down






















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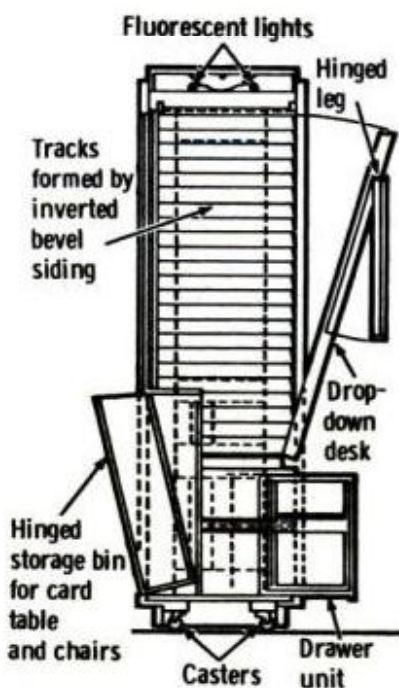
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IDEA: Flexible storage is the keynote of the unusual wall unit at right. Its partitions are made of grooved Texture One-Eleven plywood, forming a series of tracks on both sides of each partition. Various desk, drawer, cupboard and record-storage units are made to fit between the partitions and slide in the grooves. The units can thus be slipped in anywhere and moved around as you wish. Plans for the wall are available for 10 cents from American Plywood Assn., 1119 A St., Tacoma, Wash.

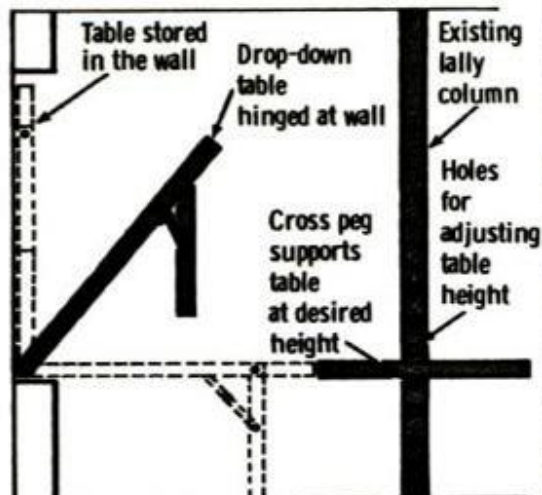


IDEA: Like the wall above, the one at left also uses a clever system of tracks to support interchangeable slide-in storage units. In this case, strips of ordinary exterior bevel siding are nailed to the wall's partitions upside down to form a series of closely spaced rails. The unit also has a drop-down desk and a novel card-table storage bin at the rear. Plans can be obtained for 10 cents from Western Wood Products Assn., 526 American Bank Bldg., Portland, Ore. Plans for the hobby center below are also available from Western Wood Assn.



IDEA: This hobby center has a drop-down work table and compartmented storage in narrow cupboards. Plans are available for \$1 from Western Wood Products





Two-Way Leisure Center for Work or Play

IDEA: The convertible room at right, above solves the problem of where to find play space—it's equally suitable for doing the laundry or throwing a party. Washer, dryer and other appliances are tucked under a counter and concealed behind colorful doors when not in use. For a view of the room dressed up for a party, see the cover photo on this booklet

IDEA: A lally column becomes a support for a table above, and a second wall-hinged table swings down to join it, forming a large work surface. The column-mounted table rests on a removable cross pin so it can be raised or lowered. The room, designed for Armstrong Cork Co., also features a dropped acoustical-tile ceiling simulating rustic exposed beams

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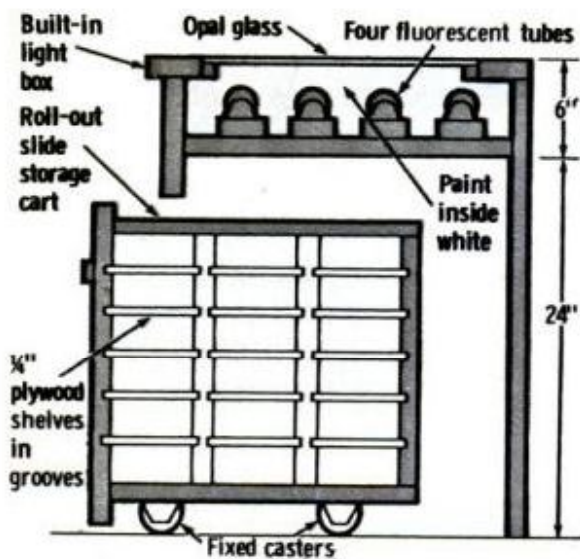
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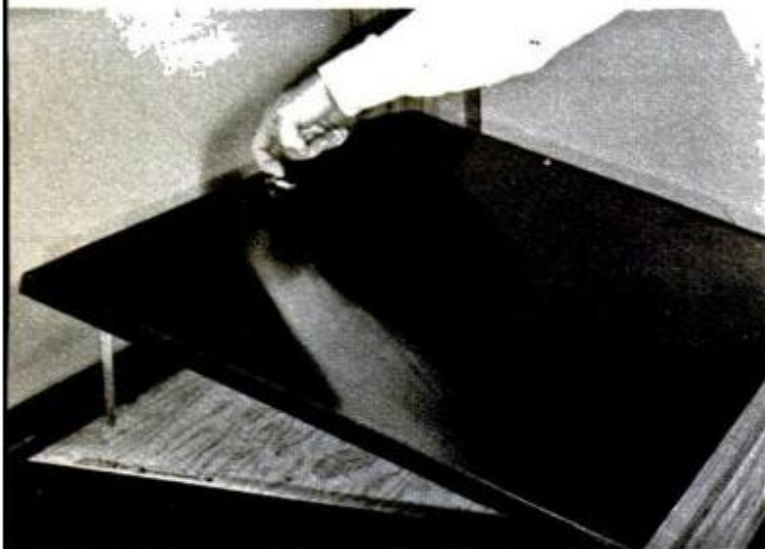
50 GREAT IDEAS

ADD YOUR OWN EDITING CORNER FOR SLIDES AND MOVIES

IDEA: Having your own light box built into a counter makes it easy to sort slides into interesting sequences. Diagram below shows a typical arrangement. One important tip: For proper light diffusion, use opal glass or milk-white plastic—not frosted glass

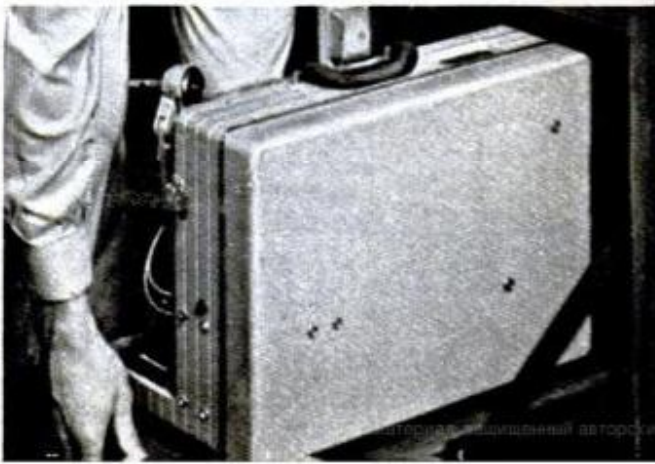


IDEA: This mobile bin stores dozens of slide trays in shallow drawers, can be rolled anywhere to put on a show



IDEA: The hinged countertop above lifts up to become a handy drawing board for a den or playroom. Two brass strips pivoted at the edges drop down to support the board at an angle. To collapse board, you just fold the strips under and let it fall flat

IDEA: The heavy movie projector at right pops out and up on a disappearing shelf made with the same kind of spring-loaded hardware used to mount typewriters and kitchen food mixers. Pull down screen at other end of the room and you're ready for movies



sink and cooking surface will let you prepare drinks and snacks without constantly running up and down the stairs. If your basement is only partially below grade, you can often dig a sunken patio outside and put in sliding glass doors. This gives you access to the outside, opens up the basement to light and air, and creates an attractive indoor-outdoor recreational area.

Where a basement is too far below grade to dig all the way down to floor level, you may be able to remove some of the earth near the top of the walls and install larger windows. This will help to brighten up the basement and make it more cheerful. Other ways of giving basement walls a pleasant "view" are shown in the accompanying photos and drawings.

If there is no way you can expand into a basement, attic, garage, porch or other existing space, it may be necessary to build an addition onto your



IDEA: Built-in game center along one wall of a playroom makes it easy for youngsters to entertain themselves while grown-ups are relaxing elsewhere. Shallow shelves store toys and games neatly, while the cork-paneled wall provides safe backdrop for dart-throwing contests and serves as general bulletin board. Note handy seat at end

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PLANNING YOUR LEISURE CENTER (Continued)

house. Again, a location near the kitchen is the best choice. Pushing out a kitchen wall is an ideal way to get a new family room with a built-in food supply. Frequently, the kitchen and rec room can be combined, with an existing kitchen counter doubling as a snack bar for the new entertainment area.

Whether you build a new room or adapt existing space, a fireplace can do a lot to add warmth and cheer to a leisure center. Many types of prefab fireplaces and fireplace building forms are available to make the job easy. If you decide on a masonry fireplace, don't overlook the opportunity of in-

IDEA: A large game table can be useful for other things than play. Here, plywood leaves quickly convert a pool table to a roomy dining table. Tops are sold for some tables, like this popular type, or you can make your own



IDEA: Recessed shelves in the divider wall at right solve two problems in one: They provide valuable storage space and avoid the danger of protruding surface-mounted shelves that might interfere with active game-room play

IDEA: The low half-wall at right helps to screen off the entranceway from the game area without the closed-in effect of a full wall. A planter box built into the top and illuminated by a ceiling spotlight adds a dramatic decorative touch to the playroom

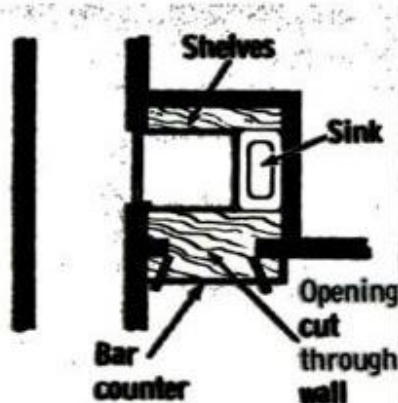
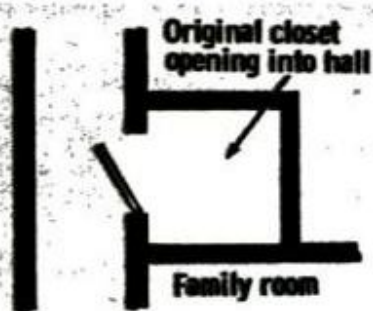


corporating a charcoal grill to share the same flue. There are also built-in barbecue units that do not require a flue. They fit into a countertop and need only an exhaust fan to remove the smoke. Cooking picnic suppers indoors can provide year-round family fun.

In organizing your space, remember that flexibility is the key to making a multipurpose room work efficiently. You will want to switch quickly from one activity to another as family interests change. This means you'll need plenty of space to put things neatly away. Full-height storage walls will house a variety of sports and hobby gear as well as provide niches for delicate equipment like a hi-fi amplifier,

record player and tape recorder. Counter-height cabinets give you additional storage space plus a bench top for working on hobbies or serving snacks.

You'll want some way of showing slides or movies without having to drag out the equipment and set it up each time. One handy arrangement is to have a pull-down screen at one side of the room and the projector on a slide-out shelf at the opposite side. You just lower the screen, pull out the projector, dim the lights and you're ready to go. The photos and drawings in this booklet offer many other ideas that can help to make your leisure center both fun and efficient.



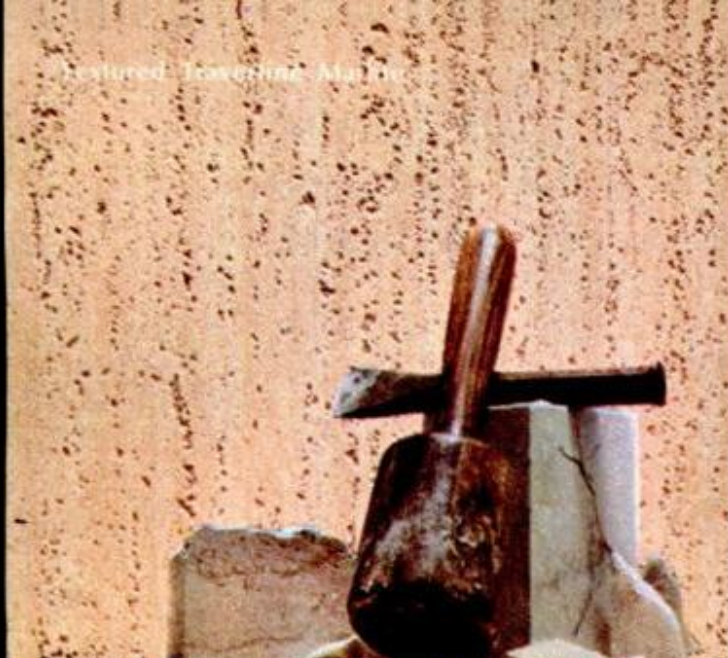
Before

After

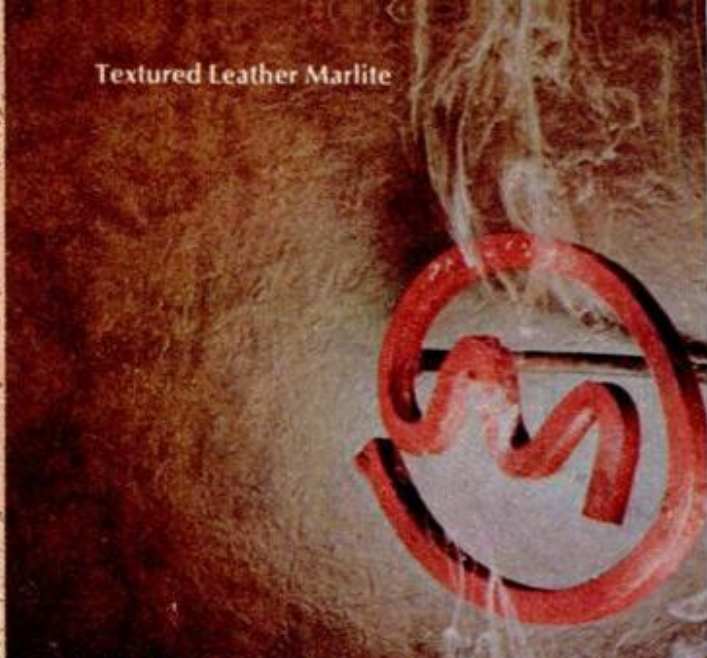
IDEA: An old closet can become a nifty built-in bar this way. Here, an opening was cut through the closet's side to provide a pass-through into the playroom, and the wall was stone-paneled for a rustic look. The bar is entered by the original hallway door. If your closet faces inward, you can achieve a similar effect by splitting the door so the top half opens and the bottom half remains closed with a small shelf on top for a bar



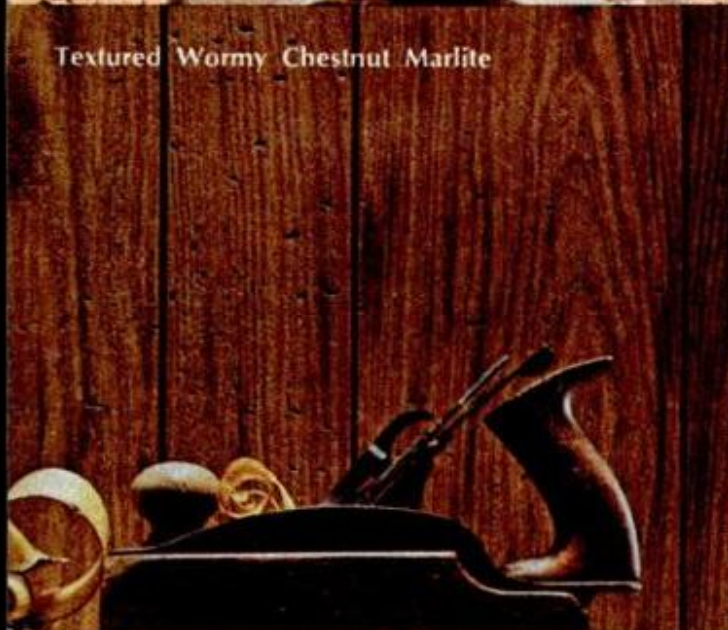
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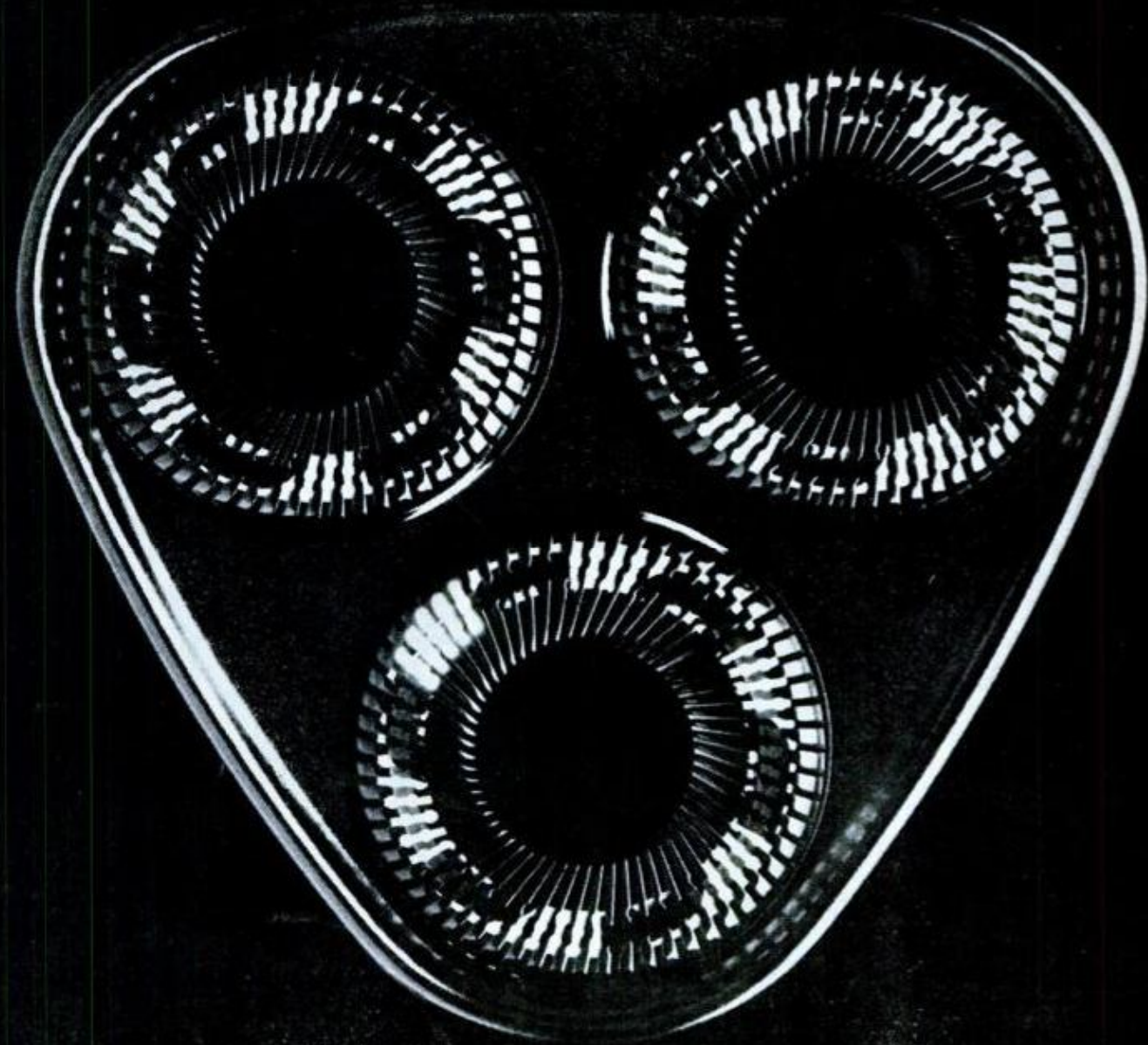


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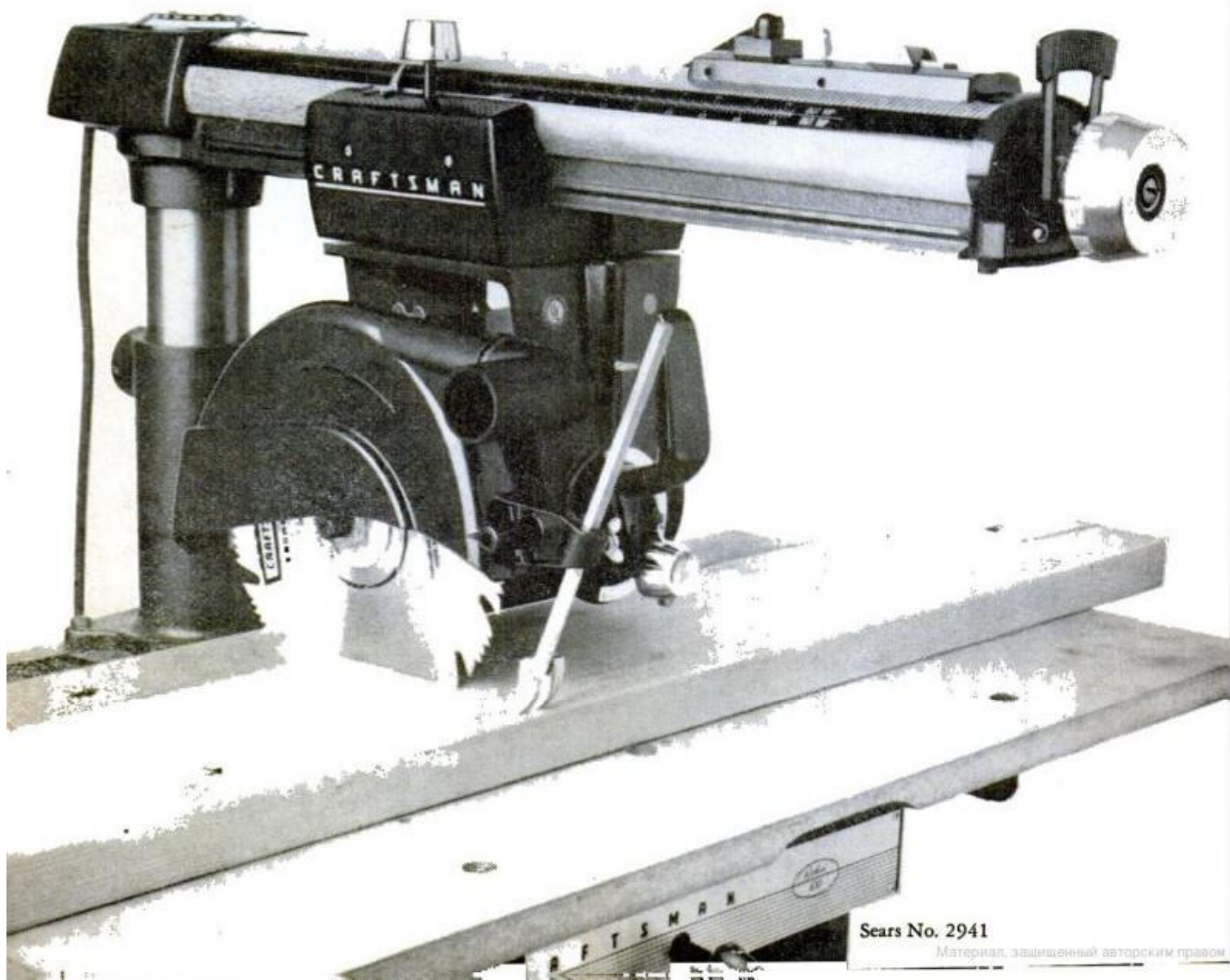
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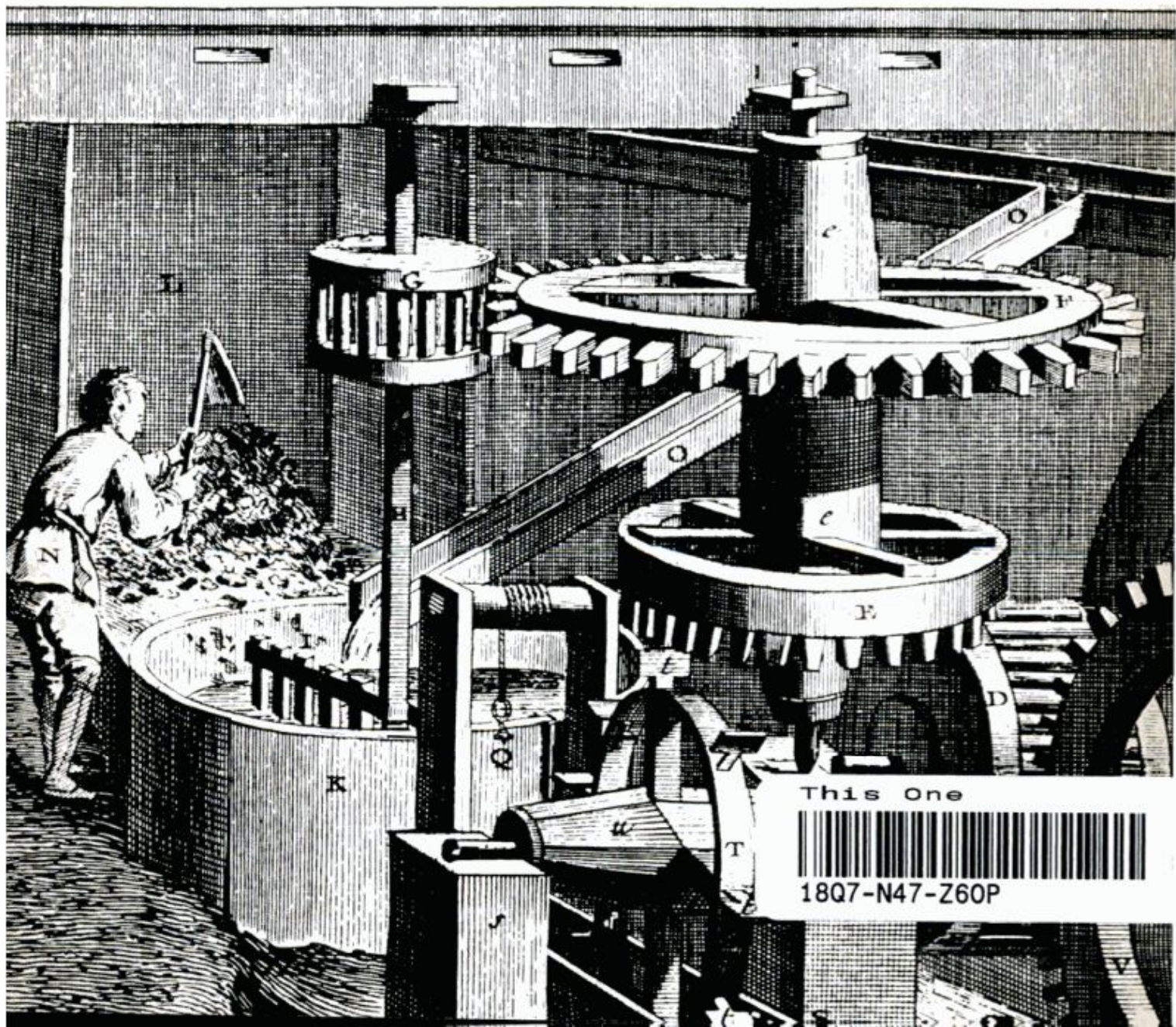
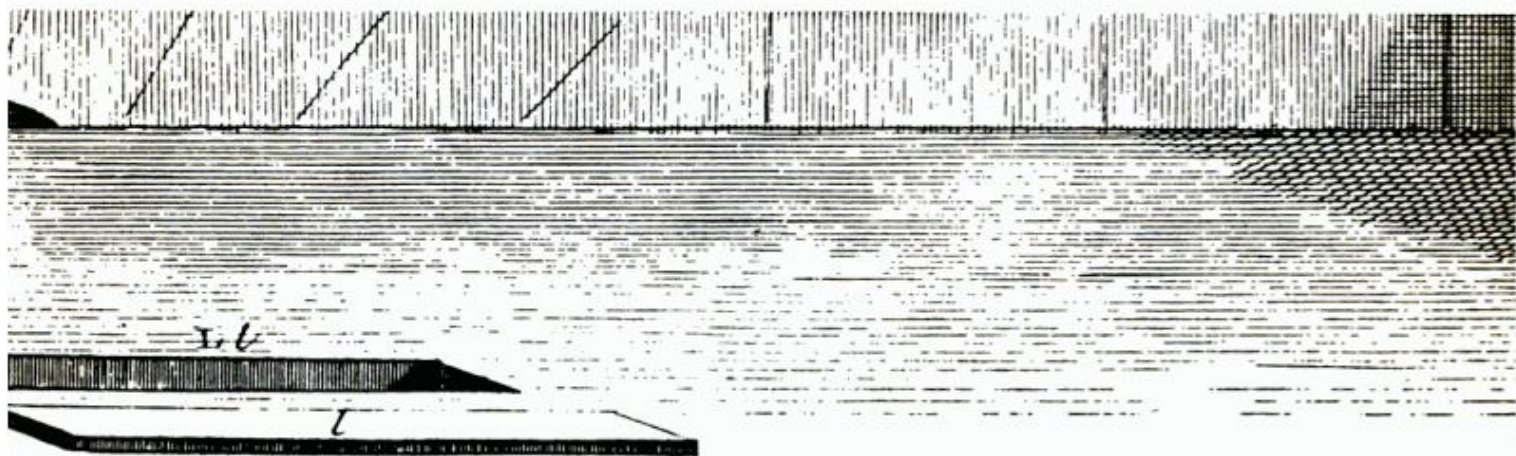
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NEXT MONTH IN POPULAR MECHANICS

Rodger Ward Tests the Dodge Charger. Last Month *PM* agreed with Dodge: This is a "tough" car (*The Really New Ones*, page 101, October). See if Rodger Ward has the same opinion after he wrings one out.

Through Yellowstone on a Snowmobile. Dan Fales, outdoors editor, tells what it's like to travel 135 miles around Yellowstone Park in a snowmobile caravan.

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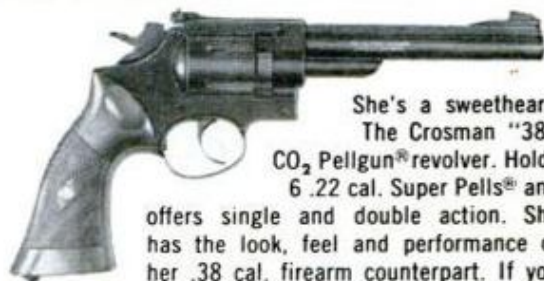
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LETTERS

TO THE EDITOR

Slow down on speeders

Editor Robert Crossley's introductory comment on *How Fast Is Too Fast?* (page 71, September PM) indicates an interesting mixture of emotions.

My own reaction to the idea of the "excitement of high-speed driving" is that such activity should be subjected to the same restrictions as those governing the discharge of high-powered firearms and kept in areas of no risk to the public.

The term "masculine satisfaction" is also offensive when used in connection with "commanding a high-powered automobile" if such command is to be exercised on the public highways. A mature man does not surrender to the desire for self-indulgence that will jeopardize the life of less skilled and weaker individuals who happen to be sharing the highways with him.

On the other side, the Naders and the Goens also baffle me.

A very recent bulletin received from the office of Col. H. N. Kirkman, director of the Highway Patrol Div. of Florida's Dept. of Public Safety, indicates that highway accident fatalities have dropped since 1950, from one every 2000 times around the Earth during that year to one every 4000 times around the Earth in 1965. I can't help thinking that this is a 50 percent reduction in fatalities and in the individual's highway mortality risk, even though a lot more people got killed in 1965 than in 1950.

Based on 1965 figures, my chance for surviving a trip from here to New York is approximately twice as good as it would have been had I undertaken this journey in 1950, so I just can't see that there is too much wrong with this performance.

Emasculation of highway usefulness by unrealistic speed-level reductions will not decrease the highway death count. The only thing that will do that will be reduction of the highway population, and the chance for that seems totally nonexistent. OKEECHOBEE, FLA. EDWARD B. SEEGERS

The federal government should give tests to drivers and only those qualified would be allowed on the superhighways. People not qualified would be limited to lower speed roads. OAKLAND, CALIF. R. J. SCHIMMEL

Why be content with palliatives or half-measures? If a 20 percent reduction in speed would save 25,000 lives each year,

(Please turn to page 8)



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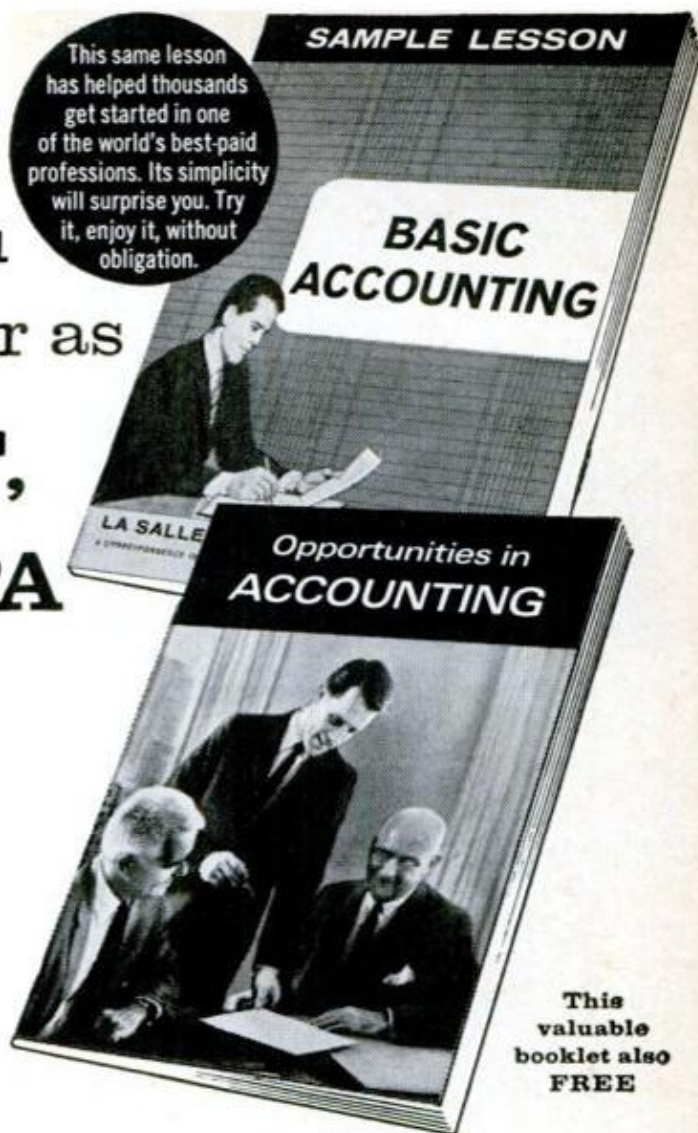
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LETTERS

(Continued from page 6)

surely a reduction of 100 percent ought to eliminate traffic deaths completely.

If we must eliminate 20 percent of something, let's make it the 20 percent of drivers who are incurable bubbleheads.

MONTGOMERY, ALA. ROBERT M. THURSTON

PS to VW

You were testing cars costing as much as \$1996 against a car that costs \$1639 in *Memo to VW: Your Competition Is Loaded for Bear* (page 84, September PM). This isn't fair, and you know it.

My 1966 VW will burn up any of them on a long turnpike trip. I don't know where the author got his mileage figures; all my Bugs have given more than 28 mpg and as high as 31 mpg. If VW is so bad, why do people like me go back and buy another and another, and why does VW sell more cars than all of those others put together?

BIXBY, OKLA.

R. C. DAVIS

It is a shame you could not include the BMW 1600 in the survey, because I feel this car is by far the greatest competition for VW in the United States.

VESTAL, N.Y.

STEPHEN J. HEYDA

The statement, "If you are planning a vacation trip in one of these cars . . . forget it, because you would be all played out by the time you got halfway to anywhere," is a biased opinion of the author. I drove a 1965 Fiat 1100D from Georgia to California and I found it much less fatiguing than American cars I have driven a comparable distance.

NAS GLYNCO, GA.

S. G. BATCHELOR

Overlooked a finder

We were interested in *Treasure Finders: Do They Really Work?* (page 112, August PM), but we were surprised to note under the listing of manufacturers your failure to mention Underground Explorations (Metrotech). Metrotech is considered one of the top instruments in the country. From the words of our customers (many of them your readers), we know that Metrotech instruments are rated among the highest quality instruments.

MENLO PARK, CALIF.

CURT FISHER

Undetected detector

In *Watch It, Speeders!* (page 61, August PM), you failed to mention that VASCAR does not send out any signals and thus cannot be detected by a radar detector.

MT. HOLLY, N.J.

J. ROBERT HUSTON

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In the Driver's Seat of Ford's Model C.

A British-made compact with winning ways

By BILL KILPATRICK, Auto Editor

I WAS PREPARED to be hard-nosed on this one. Ford of Britain was being my expansive host and I didn't want to be caught with my defenses down.

Fine food, elegant wines, luxurious digs and wave upon wave of miniskirts in a London that was never lovelier can dull a man's critical faculties. So I was *really* going to be from Missouri; they were going to have to show me.

They did. The new Cortina—widely ad-

FRONT BUCKETS come in soft, comfortable vinyl, are well contoured. Console is padded, dash uncluttered



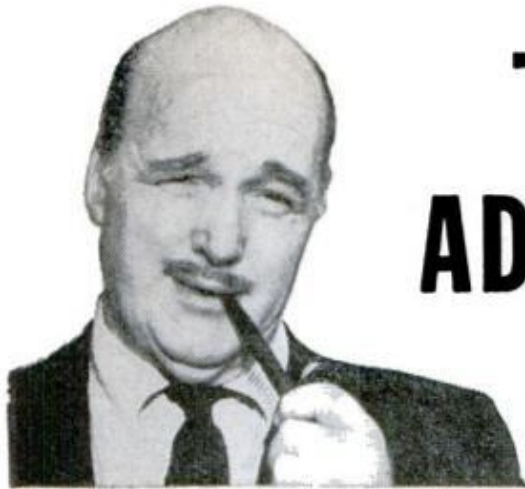
vertised in this country as "Ford's Model C."—is quite a car, much more than I expected. It somehow combines (probably through the best of British luck) the usual "something for everybody" mass-production concept with a dash of individuality—and all at a reasonably low price (about \$100 over or under \$2000, depending upon what version you order).

I drove the Cortina GT—hard—at Ford of Britain's Boreham test track. The track used to be an airbase, so there are several straights ending in some interesting and tricky corners; an ideal place to don a hero driver attitude and have at it. Besides, Bruce McLaren was bombing around that day in a new Formula 2 race car. Motivation was something I didn't need.

First off, the car handles superbly. The suspension is firm and comfortable, the front/rear weight well distributed, the steering quick and sure. I poured it on though some of the bends and never did feel that I was over my head. However, I got the feeling that if I had gone into some of those corners just a little louder, I'd have lost it. The car is tractable and a bit forgiving, but don't push your luck.

The four-on-the-floor gearbox is all

(Please turn to page 14)



TOM McCAHILL ADVISES SATURDAY MECHANICS

If you're a Saturday mechanic, my guess is you can fix the screen door, build lawn furniture, overhaul the kid's bike, and rotate your own tires.

It's a different story when that fancy electric coffeemaker stops perking or the push-button automatic washer quits halfway through a cycle. You might spend an afternoon admiring the coffee-maker's innards before giving it a permanent vacation on the top kitchen shelf.

As for the automatic washer, after the Little Lady shouts "Do something!" you'll end up phoning an Appliance Serviceman across town. He shows up in 3 days and has the washer going in one-fourth the time it took you to study the coffee-maker. He also presents you with a ticket for 30 bucks. When you consider he could make twice that selling you a new machine, you got off easy.

Maybe you never realized it, friend, but you have more Appliances around your hacienda today than you did five years ago. If you count power tools, your wife's hair dryer, an air conditioner, plus the standard stuff like vacuum cleaner, toaster, refrigerator, freezer and so forth, you probably have well over a dozen.

These electrical gadgets nowadays represent a pretty good chunk of your hard earned dollars. Did you ever stop to think it could pay you in savings and convenience to know how to fix these things? Also, it could be a great source of extra income if you're inclined to tackle the few thousand broken Appliances right in your own neighborhood.

The Appliance Repair business is easier to learn than you imagine. The National Radio Institute's Appliance Division has a downright interesting, low cost course you can take in your spare time. It covers every type of Appliance you can think of plus air conditioning, refrigeration, house wiring, electric motors — even small gas engines. There's a worthwhile section on farm and commercial appliances too.

NRI starts you with the basic principles of electricity to give you a solid background. Using clear-cut picture diagrams, they show you how various types of Appliances work, separating each into groups. Included with the course is a topnotch, professional Appliance Tester for fast troubleshooting.

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Whether or not you agree that knowing Appliance Repair could help you, I recommend you see for yourself. The coupon below will get you a free book that fully describes this unique home training. No salesman is going to call.

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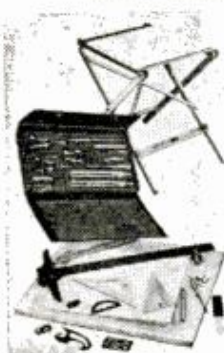
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DRIVING FORD'S MODEL C

(Continued from page 12)

syncromesh and one of the smoothest I've ever used. Clutch action is slick and light. First gear gets you going, second steps things up a bit, and it really comes on in third, the most useful (for traffic, anyway) gear. Fourth gilds the lily even more.

Seating is comfortable, legroom ample (front buckets move fore/aft five inches), head and shoulder room okay for all but an NFL all-league tackle. All-sides visibility is fine. Controls are easy to reach, instruments no nonsense and easy to read. The ride is relatively quiet, road and wind noise being at a minimum. Trunk room is surprisingly large.

In the GT version I drove, power was provided by a 91.5-cu.-in., overhead-valve in-line 4 that delivers a touch more than 83 bhp at 5200 rpm, making possible an honest 90-plus top speed. In three 0 to 60 runs I averaged 13.2 seconds, but I goofed shifting on the first run, adding a few tenths to my overall times. In the Deluxe version, I'm told the same engine puts out 65 bhp at 4800 rpm, the difference being GT's twin carburetors and better breathing.

Front disc brakes are standard (drums in the rear) and I can assure you they do the job; moving at a pretty good clip, I stabbed 'em on and off and at no point had to fight to keep things on the rails. When I slammed the brakes on full, the wheels locked, but the car didn't swerve. Brake fade throughout was negligible.

All Cortinas come with a U.S.-approved "safety package"—dual braking system, flasher, padded dash and sun visors, belts galore, safety door latches, outside rear-view mirror and so on.

I checked all the gadgets and geegaws on the GT I drove and everything worked as advertised, perhaps proof of something I felt the first time I climbed in the car—that it's finished off with obvious attention to detail. I suppose bad or indifferent workmanship is a reality in British auto production, too, but somehow one gets the feeling the people who assemble British cars (in fact, most European cars) care what they are doing. Just after World War II, cartoonist Al Capp, in his comic strip *Li'l Abner*, had a tweedy, guardsman-type, MG-owning character assure a bystander that ". . . every part that falls off this automobile is of the very best British craftsmanship." Such a knock may have been deserved, but—in general—not now.

The car is good looking, albeit quite conventional. Size is about right—not too big, not too small. If you're looking for an in-between, the Cortina is certainly worth checking out. ★★



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- ✓ To adjust for mathematically correct carburetor adjustment and thus insure maximum gas economy and

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- ✓ To locate a "miss" you need only disconnect or "short" the spark plugs one at a time with the Model BT-162 switched to the Tachometer position. You will be able to instantly identify which particular plug (or frequently its wire lead) is responsible for the malfunction.
- ✓ Cars with automatic transmissions function efficiently only if the fluid pressures are correctly maintained and since manufacturer's instructions always refer to RPM the Model BT-162 (or an equivalent tachometer) is required to properly service automatic transmissions. Incidentally, the 5,000 RPM maximum range of the Model BT-162 is adequate for all car engines without any exceptions.

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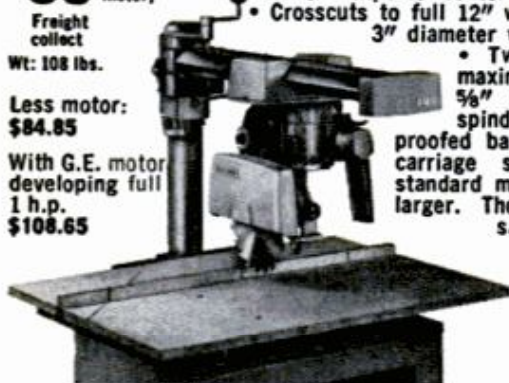
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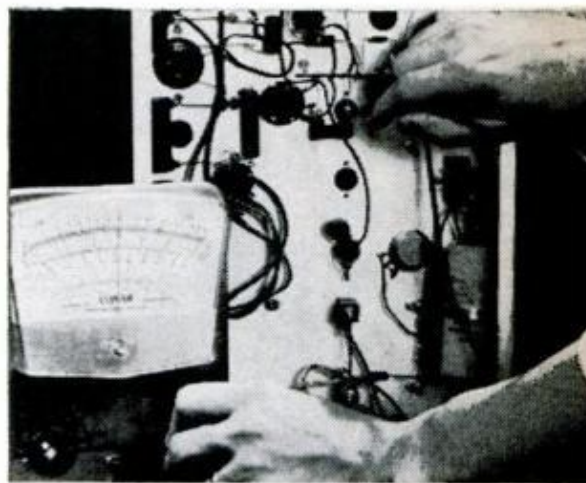
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DETROIT LISTENING POST

BY BOB IRVIN

THE FEDERAL GOVERNMENT isn't expected to arbitrarily stiffen the current standards on auto safety. Most improvements of these regulations are expected to come voluntarily, although the standards will require better brakes. But in two or three years each line of cars will have to pass roll-over, side collision and handling tests.

ARE SHOULDER BELTS SAFE? The diagonal straps have been used in Europe for years. Yet, the evidence here is conflicting. They can cause what looks like rope burns on the neck. This, and the results of simulated crashes with dummies at auto proving grounds, prompted the government to take another look at its requirement that the belts be standard equipment starting Jan. 1.

A 390-CU.-IN. V8 will be the basic engine in the AMX, a small two-seat sports car American Motors will introduce in February. The engine will be offered as an option on the new Javelin and some other AMC models.

INSURANCE IS THE NO. 1 PROBLEM for the auto industry, in the view of some top execs. One company is studying whether it could adopt an insurance plan similar to the Volvo guarantee—which amounts to a free \$100 deductible collision policy if you buy a Volvo in Sweden.

GLOOMY. That's the outlook for electric cars if a market research study by Ford is on target. The study found lots of drawbacks to a pure electric, even as a local delivery van or a shopper vehicle for the wife. Conclusion of some top execs at Ford and General Motors: A hybrid vehicle using a gasoline engine and a battery-driven electric motor has a better chance than a pure electric. In fact, one GM scientist says this is the only kind of electrified car that has any chance of succeeding in the 1970s. GM's known to have developed a working model. Because of recent and projected strides in cleaning up the gas engine, a veep at one company wisecracked, "Pretty soon the only plus for an electric will be noise abatement."

A UNIQUE LOCKING SYSTEM to thwart car thieves may be on Ramblers next year. A driver would: (1) Remove key; (2) Flip a switch located on the "A" pillar around the windshield; (3) Lock the door. The "A" pillar switch would bypass the ignition and this switch, in turn, would be locked when the driver locked the car door. Sounds complicated enough to scare off at least the amateur car thieves.

NO WINTER TIRE SHORTAGE, despite those earlier dire predictions. That's the word from the rubber companies who expect a record total of 22 million winter tires—most of them studded—to be sold this season. Studs are now legal in 41 states, including everywhere in the North.

GM INTERMEDIATES came up with shorter wheelbases on some models while FoMoCo stretched its middle-size cars. All of which prompted a Ford Veep to say: "It was like ships passing in the night."

THE FIRM THAT PLAYED THE KEY ROLE in developing the collapsible steering columns now used by all U.S. cars has been revealed as the Kopyy Tool Corp., of Ferndale, Mich. But it's now clear that GM's Saginaw Steering Gear Div. developed the original concept and in fact had been working on such a column since 1959. Kopyy built a unique set of dies for stamping out the column, starting with the '67 model, later

(Please turn to page 22)

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DETROIT LISTENING POST

(Continued from page 20)

worked with Ford on its project for '68.

PONTIAC'S RUBBERLIKE BUMPERS

on the GTO are getting close scrutiny from other auto makers. Plastic bumpers filled with air were once tried on the Bronco, with good results up to 7 mph, according to a Ford exec, but the idea wasn't practical for production. Others feel that if shiny rubber bumpers come along, they could replace conventional bumpers. Pontiac's new bumpers now are color-keyed to the car's exterior paint.

A LOT OF LEGAL WRANGLING

may get under way in January when the U.S. safety standards take effect. The red tape is likely to strangle some small foreign and domestic firms now operating in the American market. One firm has already let the word get to Washington that the government is going to have to force it to stop production. Administration officials are trying desperately to avoid being put in the position of driving some small firms out of business. Legal questions may also hold up an antiskid device. If a car using one does skid and hit another auto, who's responsible—the manufacturer? The question's posed by a company that's working on an antiskid system.

WASHINGTON

is studying proposals from several companies to build an experimental "safety car" for the federal government. Detroit—which has had about 70 years' experience—wasn't allowed to bid. It's expected to take some lucky outside company three years to design, build and crash the government's cars. Idea is to test future safety items.

BETTER KEEP A CLOSE WATCH

on the exhaust-emission-control device on your '68 car. Results from California—where they were required last year—show that your car's performance suffers even more than anticipated if the device isn't maintained.

FORD'S GOT

Detroit's first "collapsible" front end. On its intermediate Fairlanes and Montegos, the underbody was selectively weakened in front with notches, holes and creases. At the same time, the passenger compartment was strengthened by adding rails and angular braces to the underbody. The 1969 regular-size Ford and Mercury models will be the first frame-body cars built with this energy-absorbing feature. The intermediates are unitized. ★ ★ ★

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BY W. CLYDE LAMMEY

Curling floor tiles

The floor tiles in my kitchen are turning up at the corners. It first started with only one or two tiles, but now they are loosening and lifting at the corners over nearly the whole floor. Some of the corners are high enough to catch the heel of my shoe. What's the cause of this, and what can I do now?—C.A., Wash.

There are several possible reasons for the defect you describe, but I'd suspect right off that whoever laid the floor originally used the wrong trowel or cement applicator. This seems most likely, although it could be that moisture coming through the floor from underneath is the cause. Thirdly, it's just possible that the tile was laid without a proper underlayment, which, unfortunately, is sometimes done. In any case, there's no simple solution to the problem. You have three choices, none of which is a simple or desirable procedure: Take up the tile, lay a new tile floor over the old, or nail 'em down at the corners. Simplest procedure is the latter but it looks rather awful. If, however, you're all for service rather than looks, use a blued nail with a large head and drive it in at the point where four tiles share a common corner. This trick will draw down the corners, but of course, those nailheads will show.

Redo kitchen cabinets?

I have old steel kitchen cabinets, and after years of use they're looking rather dingy. I don't want to replace them, so I'd like to know of some way of making them appear more presentable with a lasting finish. Can you suggest the proper procedure?—A.Y., Minn.

Kitchen cabinets get quite a bit of service—just think of the number of times you've opened and closed those doors! To refinish them properly is quite a chore. But it can be done. First, take the cabinets down, remove all hinges and latches and go over the exposed surfaces with steel wool. Smooth any surfaces where the original finish is chipped, using an aluminum-oxide abrasive. Do a thorough job where the finish is chipped, going down to the bare metal, if necessary, to obtain a perfectly smooth surface. Any

irregularities here will show in the new finish. Then wipe and dust the surfaces thoroughly. That usually ends the preparation of the cabinets for finishing with any of the new epoxy enamels. These are relatively expensive but are well worth the extra cost. There's also some choice of color now. Take special note of the instructions on the container before applying and follow these faithfully. You can apply with either brush or spray. The later method is best as you'll get more nearly a "factory" finish. Perhaps you can rent a sprayer from a local paint dealer. And, of course, you'll want to finish all cabinets inside as well as outside.

Those robber squirrels!

I have a bird feeder on a 6-ft. post that's located about the same distance from a dining-room window. However, it's the squirrels and not the birds that are fattening up on the morsels. The post is fitted with a metal cone, but somehow the little burglars work their way over it and get up to the feeder. Is there any other way to foil them?—R.S., Ind.

Give 'em credit for ingenuity and initiative. Why scam up and down tall trees when you provide food only 6 ft. above ground? It makes sense—to the squirrels! But I'm wondering if you've attached that metal cone solidly to the post, and also if it's large enough. The cone should be at least 15 in. in diameter, depending on the size of the post, and should be hung loosely by means of a cord or length of wire so that it can tilt a few degrees in any direction. This will frustrate any squirrel trying to get a toehold at a point above the cone. Also, are you sure the squirrels don't climb up the side of the house and leap the 6 ft. to the feeder. They can do it if they have a fair foothold—getting down from the feeder is no problem. By watching closely you may discover that the feeder must be moved farther from the wall.

What is it?

I've just inherited a box of old tools and among these is one I can't identify. No one I've questioned seems to know what it is. Apparently it's made to cut small discs from some material. The number "12" shows through the rust. Can you tell me what it is and what it was used for?—H. S., Minn.

It sounds like it might be a wadcutter, made for cutting cardboard and felt wads for use with a 12-gauge muzzle-loading shotgun. ★★ ★



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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Dangerous water sport

Do you know of any reason why water should be getting into the front brake assembly of a 1962 Comet? The brakes have failed me twice since I bought the car a few months ago.—John Andrews, Albany, Ga.

I can give you one good reason, and this applies to all 1960-1963 Comets with six-cylinder engines built before April 1, 1963—backing plates that don't come into full contact with their respective spindle flanges. The cure is to install a gasket (part No. C4DZ-2044-A) between backing plate and spindle flange.

Flushing out fumes

Maybe you can tell me why there's such a heavy odor of gasoline inside my 1964 Tempest station wagon. No one else can.—Cal Funk, Houston, Tex.

Your letter touches on a common problem. Assuming gas odor is not coming from the engine compartment (a flooding carburetor, for example) that leaves one other spot: Fumes or gas itself are seeping into the car through a break somewhere in the gas-fill area. Many times, it's tough to pinpoint the exact break, so you have to apply nonsoluble body sealer to all seams. With your car, however, it's been found that a possible area of fume leakage is the seam between the gas-filler pocket and the inner wheel housing.

Putting on the pressure

I'm getting engine oil in the radiator of my 1959 Chevy, but not antifreeze in the crankcase. Mechanics tell me it's impossible to have one without the other, but a chemist definitely analyzed the sludge in the radiator as motor oil. All likely spots, including the transmission cooler and cylinder head gaskets, have been checked. Is there an explanation?—James R. Davison, Anaconda, Mont.

Here's one. Assume you have a crack in a water jacket inside the block. Assume further that the car's oil pressure is greater than its water pressure. What would be the result? Oil in the coolant; what else?

Stoking the furnace

Can I get more heat from the heater of my 1966 Dodge? I've been told there is nothing wrong mechanically, but the inside of the car is uncomfortably cold during the winter.—Duane Hickham, Madison, Wis.

The answer lies in replacing your present thermostat with one issued by Dodge that's rated at 190°. If your car is equipped with a six-cylinder engine, get thermostat part No. 2843210. The thermostat for V8s carries part No. 2843209.

Fluttering butterfly

There's a fluttering sound beneath the hood of my 1966 Pontiac Catalina that I hear when accelerating. It seems to be on the left side. I've looked for loose items, such as antifreeze tags, without success. Any ideas?—Roy H. Ritter, Charles City, Iowa.

It could be the manifold heat-control valve sounding off. A check can be made by wiring the valve's counterweight, which you'll find beneath the exhaust manifold, in the open position. If the noise disappears, you have one of two choices: Replace the valve or leave it be. If you decide on the latter, the fluttering valve won't cause any damage.

Putting your foot down

My 1965 Studebaker Hawk has had a braking problem almost from the start. The pedal is hard, and it affects stopping ability. Every possible cause I can think of has been checked. The car is equipped with disc brakes. What do you have in your files on this?—Harry Harkness, Plainfield, N.J.

I've got a modification kit that will increase the output of the hydrovac unit by 100 pounds. This will produce a softer pedal "feel" and increase braking ability. Your Studebaker dealer carries it on his shelf under part No. 1565515.

Eerie light

Here's a strange one—not serious, but
(Please turn to page 32)



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

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

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

By Victor B. Mason

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

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

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

I Have All The Money I Need

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

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

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

A Fascinating and Peculiar Business

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

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

Are You Mechanically Inclined?

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

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

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

Does Happiness Hang on Your Decision?

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

VICTOR B. MASON
1512 Jarvis Ave., Suite M-2-MT
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You don't really hammer any nails in assembling a Schober Organ, but the electronic work you do is very nearly that simple. With the clear, non-technical, step-by-step instructions for which Schober is famous, *anyone* can do the simple, enjoyable printed-circuit soldering and screw-and-nut fastening that make up one of the world's finest musical instruments. *Every* part, bit, and piece you will need is included in the kits. Every component—and the finished organ itself—is the kind of musical and technical quality you would pay twice as much for (or more) in a store. The pride and pleasure of doing it all yourself is something you couldn't buy elsewhere for *any* price!

The Schober Theatre Organ above, costing only \$1550 if you use your own amplifier and speaker system, is unbelievably pipelike—sounds just like the old-time cinema theatre organ, with 35 voices, 5-octave pipe-organ keyboards, and everything else you would normally pay over \$1,000 more for. There are four Schober Organ models, starting at \$645. Handsome walnut consoles are included—but you can save even more if you prefer to build your own. You don't have to buy the kits all at once either; you can pay as you build and spread out the expenditure.

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AUTO CLINIC

(Continued from page 30)

annoying. Why does the generator light of my 1965 Oldsmobile come on when I brighten my dash lights only? Battery and generator have been checked and found okay.—Norman Silver, Miami, Fla.

I'd say the problem isn't electrical at all. You probably have a light leak inside the instrument cluster. There's a sponge seal inside the case that could be misaligned, allowing light to shine through to the generator light indicator. It can be corrected by removing the bulb above the generator indicator and using body sealer to seal the inside bottom edge of the hole between the separator and back of the cluster. Then replace the bulb.

Surge syndrome

The car's a 1961 Renault Dauphine. The trouble is an intermittent surge at around 30 mph, which is the way a motor would act if it were overchoked or had a mis-firing plug. In other words, it runs like a barrel of water sloshing back and forth.

I had the carburetor overhauled—then replaced; rebuilt the distributor; changed wiring; eliminated the possibility of back pressure; and other stuff. What do you suggest I do now?—C. R. Hall, Independence, Mo.

Three things—

1. Check fuel pump pressure and vacuum. You could be running too rich or too lean.
2. Recheck the point setting—that's critical.
3. Make sure the carburetor shut-off is working.

Flashers after the fact

I think the emergency warning-light system which is now standard equipment on all new cars is an excellent safety device. As you know, it allows all four turn signal lights to flash simultaneously, warning of danger. But how can we owners of older cars get it installed? I have a 1965 Ford.—Dick Fischer, Akron, Ohio.

All manufacturers have issued accessory kits that will allow you to have this safety feature. And I agree with you—it's a great one. In your case, for example, and for all 1965 Fords, Fairlanes, Falcons and Mustangs, the kit is carried by Ford dealers under part No. C5M4-15B584-A. The installation is easy enough. Just follow instructions and sketch included with kit.

(Please turn to page 36)

How Renault got up off the floor.

Things were none too cheery for us a while ago. We were, as they say, getting our lumps.

But those days, happily, are far behind us. We've made a comeback.

Sales are up 85% over last year. And proceeding quite nicely, thank you.

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But most important, we built the Renault 10.

It has thicker gauge metal, thicker undercoating, and a few engineering

touches that border on the fanatical.

It delivers an honest 35 miles to the gallon.

30,000 miles between brake pad replacements.

18,000 miles or two years before you even have to consider replacing water or anti-freeze.

40,000 miles on our Michelin X tires. (\$5 more per tire, but well worth it.)

And you can pile up those miles in spectacularly comfortable seats. You couldn't get better seats if you spent \$5,000.

Yet, the Renault 10 is priced under \$2,000. Way under \$2,000.

All in all, the car is a bit better than it has to be for the money.

But then, we figure the best way for us to get back on our feet is to offer you a value that will really floor you.

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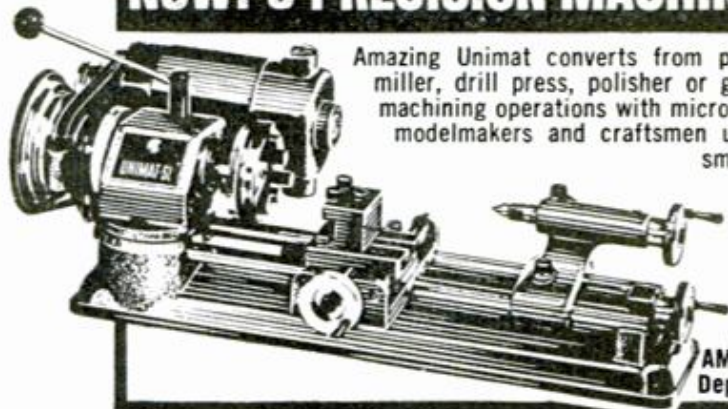
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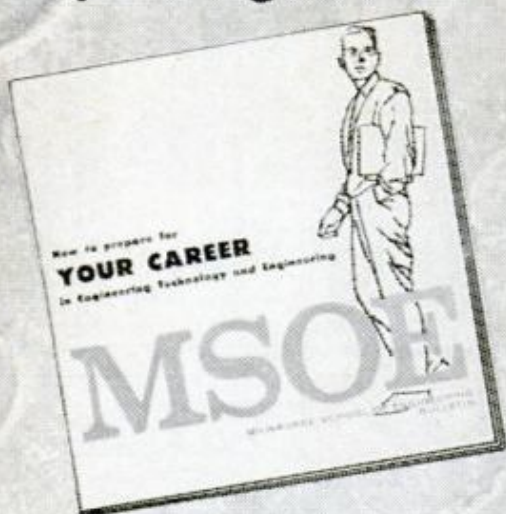
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AUTO CLINIC

(Continued from page 32)

Service Tips

● **PEELING PAINT PROBLEMS:** A rash of recent service bulletins discounts claims by some shops that minor imperfections in a car's paint can't be fixed short of refinishing the whole area. These imperfections include dirt particles, coarse "orange peel," overspray, fine pitting, sand scratches, light file and disc marks, and light sags. If you've been at loggerheads with a shop chief over this, ask him to check his bulletin file. For instance, Plymouth-Chrysler Service Bulletin 67-23-23 (5/1/67) tells how to get rid of imperfections as does Chevrolet Service News No. 5 (5/67).

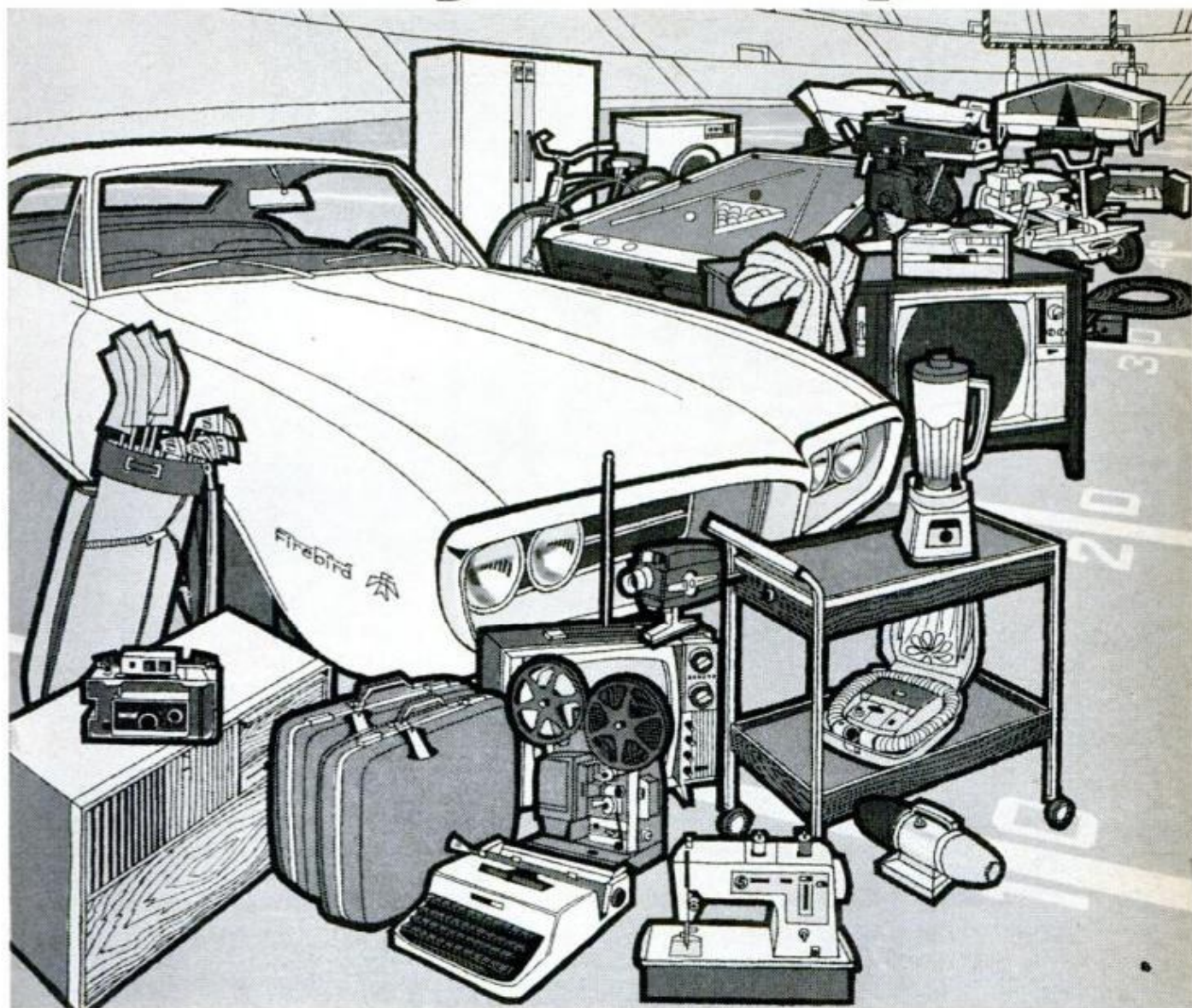
● **RAMBLER** makes no bones about it: A hydraulic-valve tappet noise which occurs for 5 to 10 seconds after starting an engine is not considered a defect under warranty. The noise may even continue slightly longer at a reduced level and gradually disappear. The noise occurs when tappet oil leaks down because of valve spring pressure. That oil which is lost has to be replaced upon starting the engine. So, if it's in your car, don't expect the tappets to be replaced free of charge. If tappets continue noisy for extended periods, though, your dealer has been instructed to replace bad ones under service bulletin No. 7, group 1000 (6/26/67).

● **'67 CHRYSLERS, PLYMOUTH, DODGES** with 383-cu.-in. engines and WWC 3-276 carburetors can get better economy on short-run driving. A service bulletin explains how. The task should be done by the dealer, because it calls for procedures outlined in the service manual, which you probably don't have. The bulletins that spell this out are 67-14-6 (5/22/67) for Chrysler-Plymouth and 67-14-5 (6/21/67) for Dodge.

● **1966-67 MERCURY AND COUGAR** owners whose cars have 10-inch front brake drums should make a special note about brake repairs. Installing the brake shoe retracting assist spring the wrong way can lead to a hung-up shoe and a loud scraping noise as a result. The correct way to install the spring is with the loop toward the wheel cylinder. ★★★

Each month Auto Clinic answers questions on car repair. For a personal reply, send 50 cents in coin to cover mailing and handling. Write Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. One question per letter, please.

Win 100 yards of prizes



Du Pont ZEREX® Anti-freeze Pro Football Sweepstakes

Just pick the AFL and NFL team you think will finish at the top of its league this year, and you may win one of the longest lineups of prizes ever offered. The first name drawn with the correct predictions wins all the prizes shown above.*

2,590 more prizes to win—even if you don't pick the teams correctly. Five 1968 Pontiac Firebirds. Ten RCA 25" color TV sets. 25 Bulova Accutron watches. 50 RCA AM-FM radios. 500 Revere Instant Loading cameras. 2,000 Thermos® picnic chests.

Entry blanks free where they sell ZEREX Anti-freeze. (No purchase re-

quired.) It gives all the details. All you do is mark your top choices, fill in your name and address and mail it. And you may be the big winner. (In Wisconsin, write your top choices, name and address on a plain piece of paper and mail to Du Pont Zerex Sweepstakes, P.O. Box 35581, Minneapolis, Minn. 55460.) ZEREX Pro Football Sweepstakes closes November 30, 1967. Void where regulated or prohibited by law.

Green Bay's Bart Starr plays the game up in the cold part of the country. His anti-freeze? Du Pont ZEREX. Because ZEREX gives you the surest protection you can get against freeze-ups. And against rust and corrosion.



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WHAT'S NEW OUTDOORS

BY DAN FALES

HIGHTAILING IT through a winter wilderness on a snowmobile can be great fun—especially at night. I remember an after-dark jaunt with some friends from Polaris up at Roseau, Minn. It was a sparkling clear evening with crisp snow to zip over. We headed for a warm cabin deep in the beautiful Minnesota woods about a half mile from the Canadian border.

Most in the party knew the way, but a few of us were totally ignorant. After scurrying over moonlit, snow-filled fields for an hour or so, several of us found we were absolutely lost—about 20 miles from nowhere.

Fortunately, we headed in the proper direction, eventually crossing a fresh snowmobile trail obviously made by friends headed for the same rendezvous.



We made it to the warm hut, where a fire roared and a thick steak sizzled. But the incident made me think about being lost, and the use of a compass.

No matter where you snowmobile, it's not a bad idea to have a compass. You never know when you may "misplace" a trail deep in the woods, or be blinded by snow-whipping wind. The Airguide Instrument Co. is marketing a special compass with liquid dampening and vibration-blocking mounts. Adjustable compensators are built in to offset magnetic effects of engine and metal frame. A pushbutton light is powered by a self-contained battery. It retails for \$9.50.

PREVIOUSLY UNTHOUGHT-OF USES are being reported for a new product originally designed to mothball chrome on

your boat this winter. Called Peel Away Boat Metal Guard, this vinyl liquid is brushed on any metal that needs protec-



tion from corrosion, pitting or rust. The liquid forms a nonporous plastic skin that can be peeled off in seconds.

But now people are doing other things with it. You can dip lines to make permanent whip ends and brush liquid on tin cans of food to prevent rusting (labels will stay on, too). Nonworking surfaces can be coated to stop corrosion of boat tools. Rims of instrument gauges can be coated also to prevent moisture getting under the glass. Peel Away is made by Marine Development & Research Corp., 381 Park Ave. South, New York, N.Y. 10016. The liquid sells for \$3.95 for an 8-ounce can large enough to do the chrome on a small runabout, or \$10.95 for a 32-ounce can—enough for a 35-footer.

A HOBBY KIT for those who like to make lures is now being put out by Worth Tackle Co. of Stevens Point, Wis. You can



make 25 different lures with this kit—some the old faithful single or double spinners; others, crazy designs of your own imagination. Anyway, the "spinner" kit has everything you need including paint, wire leaders, brushes, hooks, swivels, seven kinds of blades. It costs \$10.95. For beginners, Joe Worth, head of the firm, is making a fly-tying kit for \$3.95 and a jig-tying kit, also priced at \$3.95. ★★★



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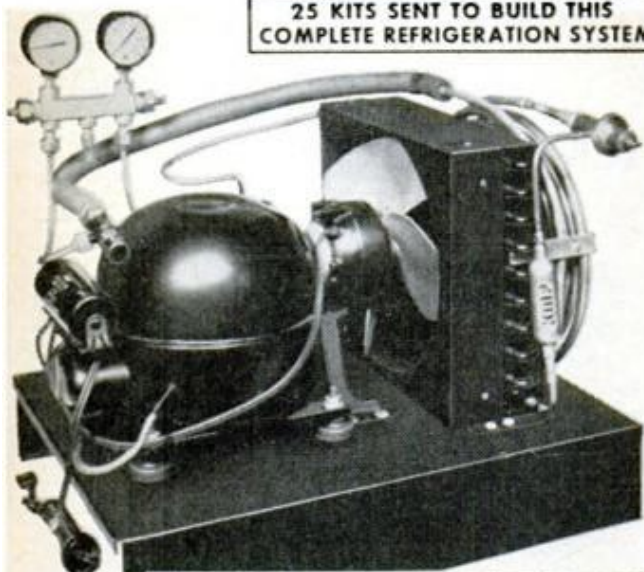
There are even rugged ball bearings at heavy-wear points. Sale ends November 25, 1967. No Money Down on Sears Easy Payment Plan. **You can't do better than Sears.**

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BY KEVIN V. BROWN AVIATION JETSTREAM

GENERAL AVIATION, in case you hadn't noticed, is more and more dominating the skies. Already more numerous than military and commercial aircraft combined—although these two get more of the publicity—general-aviation aircraft recently set another record.

Opa-Locka Airport, near Miami, Fla., recently passed Chicago's huge O'Hare International as the busiest airport in the nation. And Opa-Locka caters exclusively to business and private aircraft.

In fact, O'Hare was the only predominantly airline airport to make the first five. Kennedy International of New York was sixth, behind three other general-aviation airports.

Opa-Locka recorded 596,949 takeoffs and landings during the last fiscal year, a new record for one airport, compared to O'Hare's 588,527 operations.

What made the record more surprising was the fact that the Opa-Locka tower operates only 16 hours a day, from 6:00 a.m. to 10:00 p.m., and the airport has no instrument-landing facilities of its own. All tower-controlled operations are done under visual flight rules.

Opa-Locka has five runways, three of them east-west parallel runways facing the prevailing winds. Thus transient takeoffs and landings, and local touch-and-go operations, can be handled simultaneously on the three runways.

MORE TRAFFIC should mean more accidents, but, according to the latest figures, the chances of a fatal air crash are now about .005 in 100. Of the 112,000 accidental deaths last year, only 59 were caused in airline accidents.

More than 50,000 persons died in auto accidents, 2400 were killed by firearms and 7200 drowned in swimming or boating mishaps. Even the relatively safe bicycle was involved in nearly 700 deaths.

MORE RECORDS were also set this year by air-route traffic-control centers, the centers that direct air traffic between airports. The center at Aurora, Ill., which handles traffic in the Chicago area, handled more than 1,200,000 flights last fiscal year, including a record 5562 flights in one day. The Ronkonkoma, Long Island, center, which handles New York City area traffic, was second with more than 1,181,000 operations. ★★★

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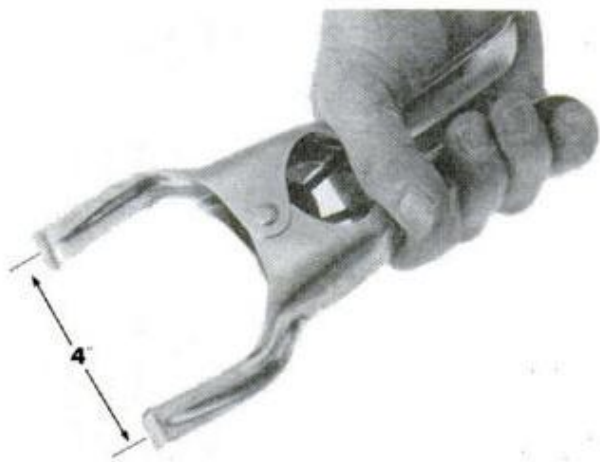
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New tools you should know about



Wide-gripping clamp

Offset, parallel jaws give this metal "clothes-pin" clamp a king-size grip of a full 4 in., plus a deep throat that's ideal for edge clamping. An extra strong spring produces a powerful grip, and grooved jaws help align and grip work on edge. Clamp is available from Arvids Iraids, 5030 Argus Rd., Cincinnati, Ohio 45224.



Cordless, hoseless sprayer

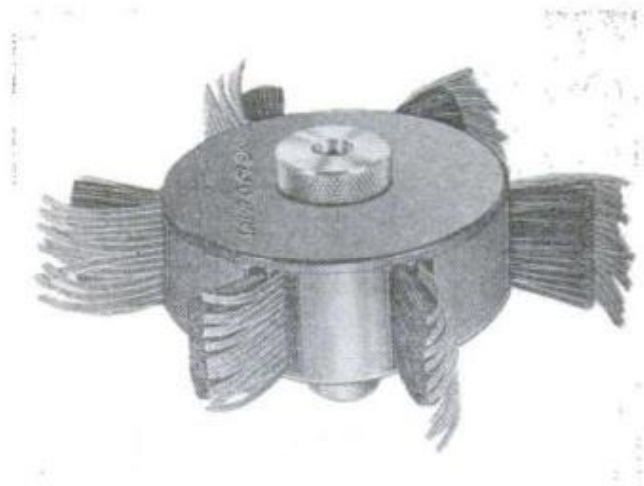
Spray oil and water-base paints, enamels, chemicals, cleaners and even insecticides without depending upon electric cords or compressor hoses. The Presto Matic spray gun operates on liquified petroleum gas (a 14-oz. cylinder will spray 10 qts. of water-base paint). Available from Ideas for Industry, 127 Nichols Drive, Sycamore, Ill. 60178.

Two-way sander

The Shopmate 1805 is a dual-action tool that can be switched from an orbital to a straight-line sander just by flipping a lever. The platen accepts $\frac{1}{3}$ of a standard sheet and moves at better than 4000 orbits or strokes per minute. The $\frac{1}{3}$ -hp motor draws 4 amps. Portable Electric Tools, 1200 East State St., Geneva, Ill.

Flexible sanding wheel

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Drivin' with Dan

How much higher will Indianapolis speeds go? What was your share of this year's Le Mans prize money? How come you don't do more stock-car racing? Dan Gurney answers these and other provocative questions

Q. *Why don't you drive stock cars?—Kenny Sampe, Anderson, Calif.*

A. For one thing, there are not enough weekends in the year and I have chosen to concentrate on Formula 1, Indy and Can-Am racing. Frankly, these three theaters are more than enough for our racing organization to attack. Racing has become so competitive and expensive in this day and age that we are constantly battling the problem of being spread too thin. I have raced stock cars on several occasions on road circuits, and I will continue to race them on road circuits whenever schedules permit and cars are available. Driving for the Wood Bros. Ford team is always a wonderful experience, and driving with Bud Moore in the Trans-Am series of races with the Cougar is hard to beat. Trans-Am racing is getting very popular.

Q. *I recently joined your Eagle Club and I am thrilled about your victories at Brands Hatch and the Belgian Grand Prix. But why did Ritchie Ginther retire from racing?—Steve Trant, Freemont, Calif.*

A. Ritchie should be the one to answer this question of course, but in my opinion, he faced a decision many drivers face sooner or later: When should I hang up my helmet? Many of us don't have the courage to make it. Ritchie made it, although he still loves racing very much. He plans to continue to contribute to and work with racing in other ways. He has vast experience and understanding of the many facets of the business. He is a very good practical engineer with an inventive streak and is a very good development man. He will be missed as a driver, but we'll hear from him in other capacities.

Q. *With speeds at Indy zooming up from about 150 mph a few years ago to possibly 170 mph next year, I just wondered how much faster they*



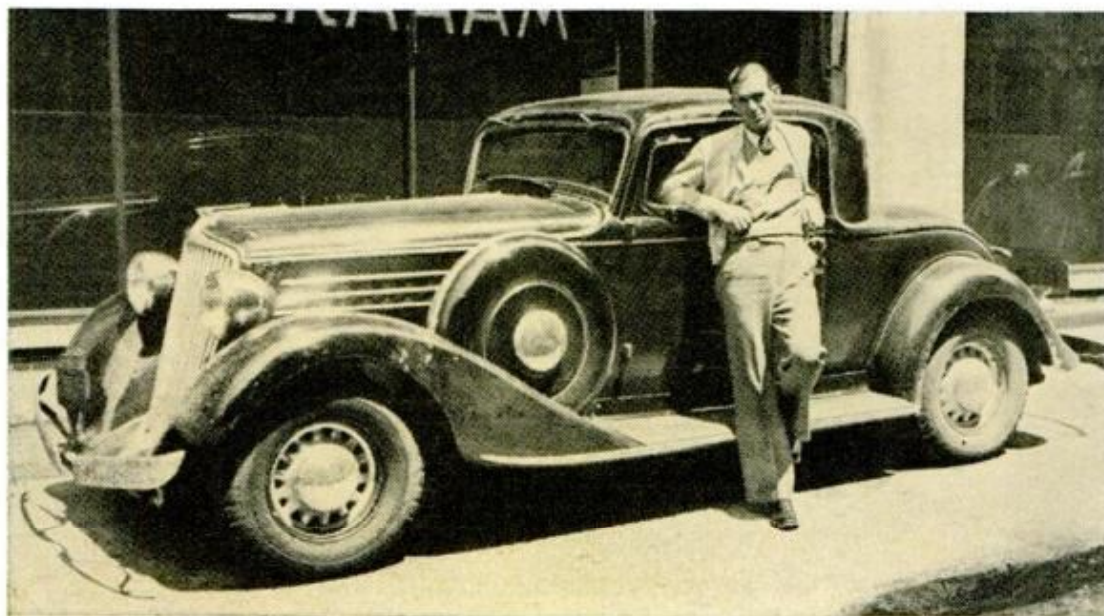
GURNEY LEADS Chris Amon and Jim Clark through a bend in early stages of recent Italian Grand Prix. Dan was forced out on fifth lap by faulty oil pump

will go. Will the speeds level off in a year or two? Also, what happened last May at Indy to Jim Clark and Graham Hill? They were both low qualifiers and failed to finish.—Steve Marovich, Kalamazoo, Mich.

A. Speeds may level off a bit, especially if the three-liter engine size is adopted. However, speeds have seldom seemed to decrease over the long history of racing. Speeds that were records a few years ago are now quite safe "touring" speeds because of the advances in tire and racing-car design; the men have not really changed much over the years. Much of this same thinking and design has found its way from racing (not just Indy) to production road cars and will continue to do

(Please turn to page 90)

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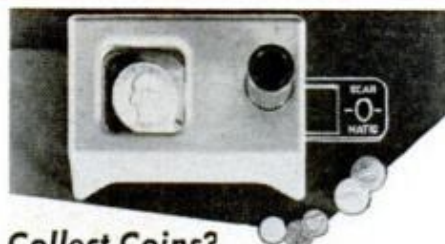
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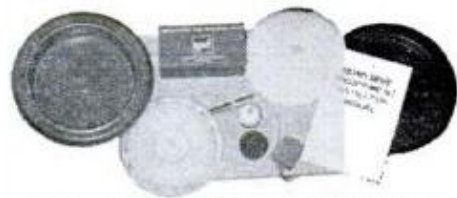
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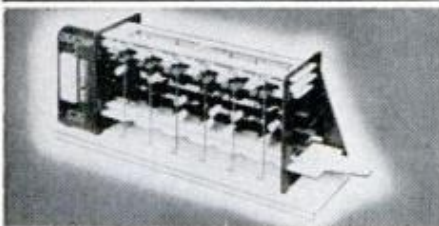
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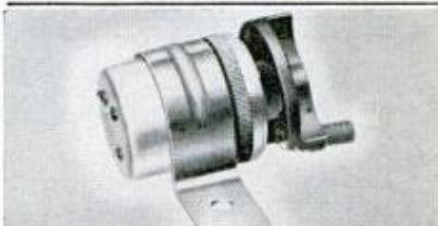
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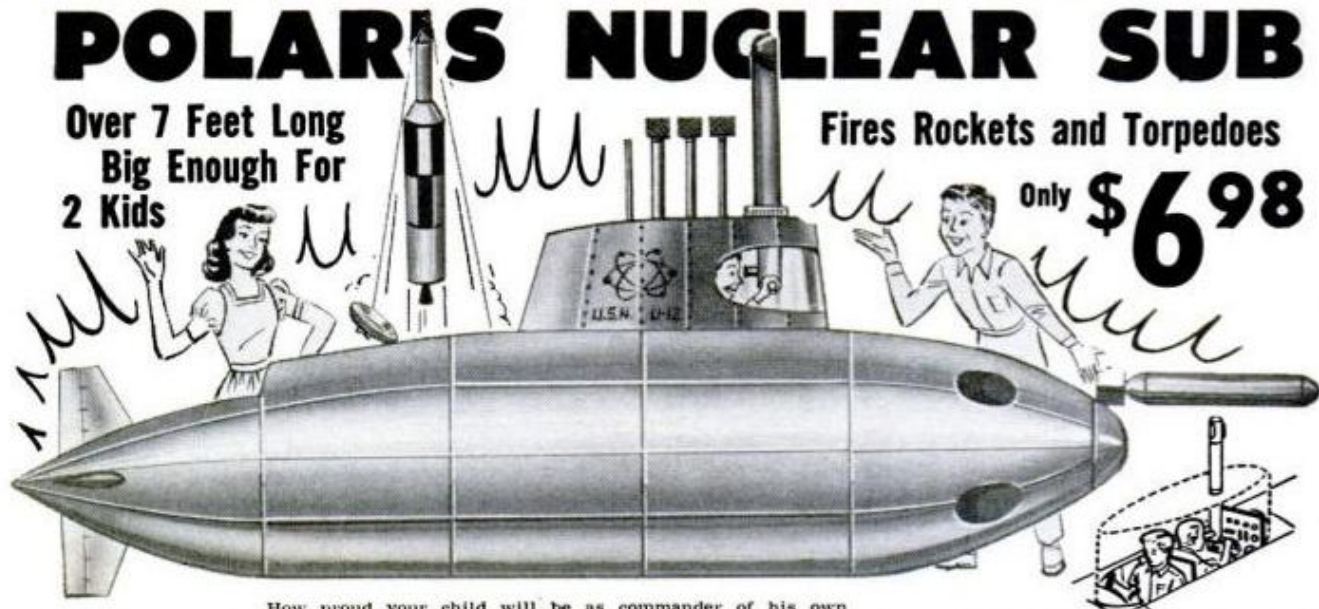
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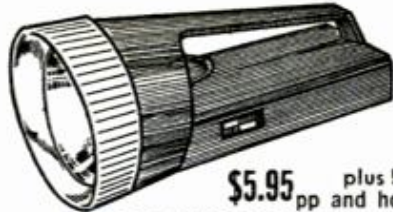


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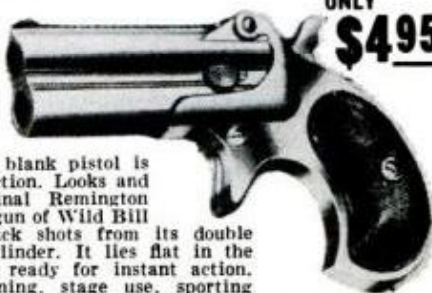
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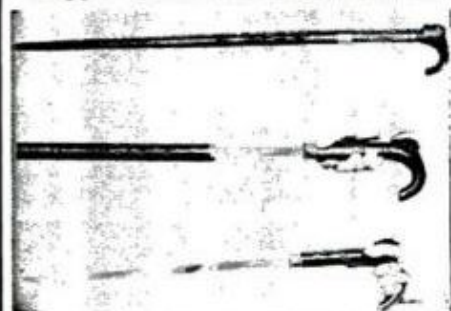
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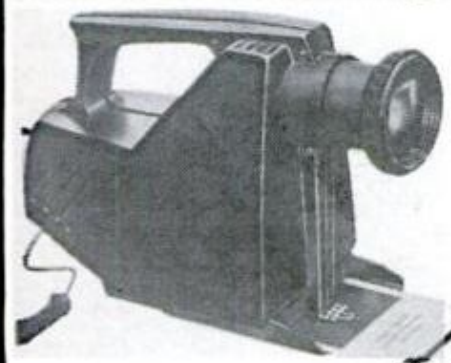
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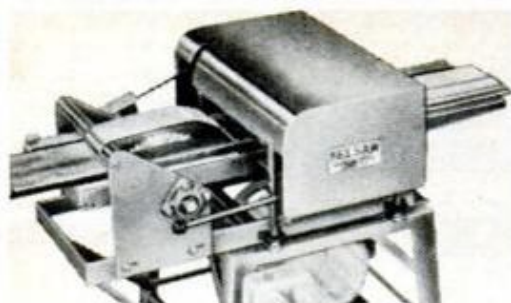
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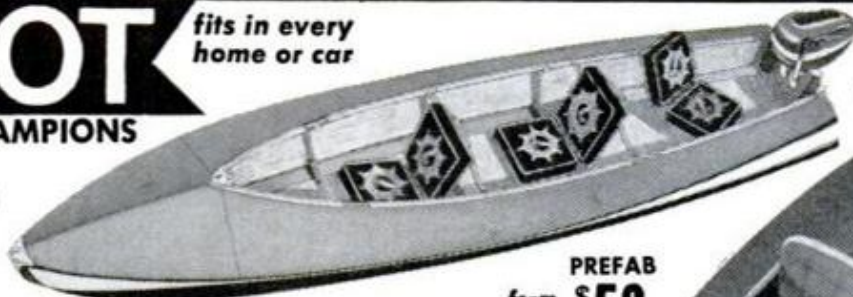
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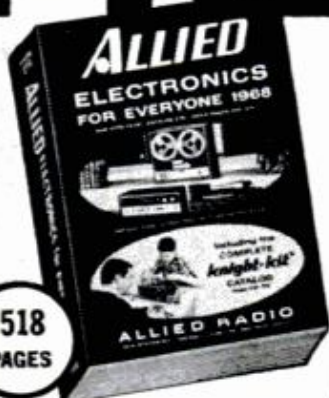
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BY M. J. PEDERSEN

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BOMBER PILOTS coming in "on the deck"—flying at around 50 feet to avoid enemy radar detection—must make split-second decisions at high speeds. To free them from the time-consuming calculations necessitated by conventional radar, a new three-dimensional radar system is designed to show not only the distance of hills and other obstacles in a pilot's path, but also their height. In addition, the system automatically indicates which obstructions the pilot will clear and which he must fly around. Patent 3,333,263 went to Algimantas Kazakevicius, Forest Dynan and Jerome Page.

PADDLE WHEELS are frequently more efficient than screw propellers, especially in shallow water. But conventional paddle wheels, whose blades radiate from a central axis, cause drag since the blades do not enter and leave the water in a truly vertical position. Earning patent 3,334,609 for Christopher Cockerell of England, a design intended for air-cushion vehicles uses two or more blades that alternately move down into the water and back out again, remaining parallel and at a fixed angle throughout each stroke.

A SUBMARINE FOR AMATEURS that is both safe and inexpensive won patent 3,335,684 for Hanns Trippel of Germany. The craft consists of a central pressure hull bolted to a catamaranlike structure. The outer structure contains the ballast tanks and diving equipment. In an emergency, the occupants could simply unscrew the bolts and the detached hull would rise safely to the surface. ★★

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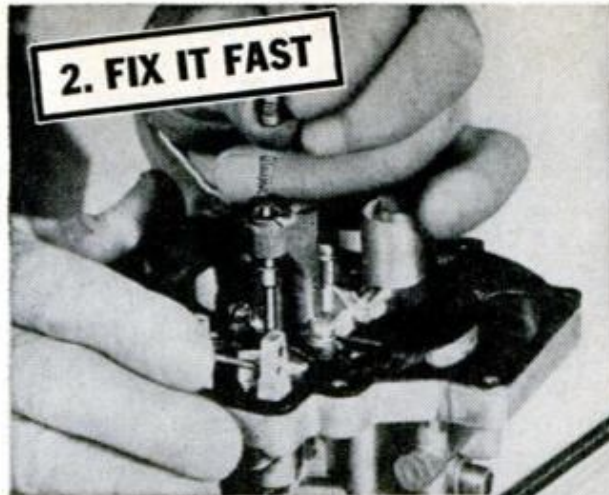
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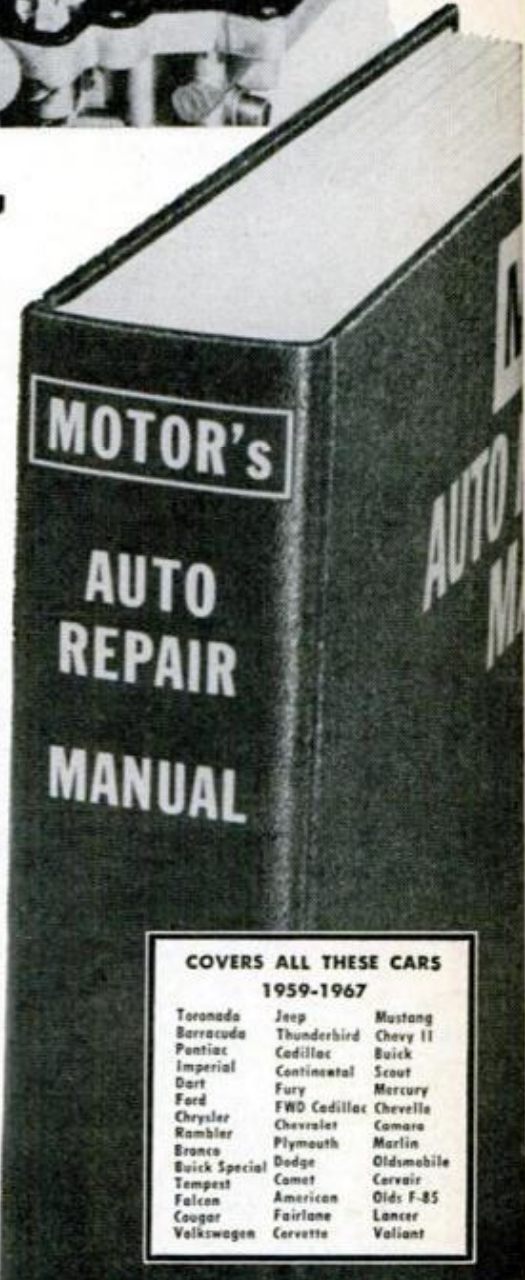
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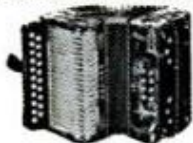
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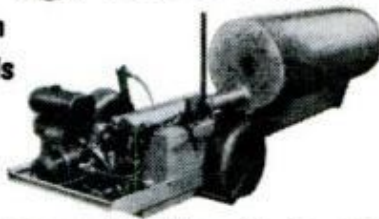
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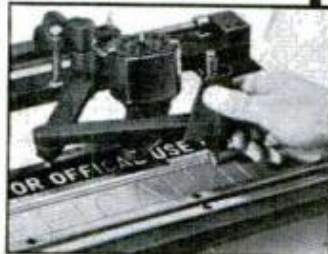
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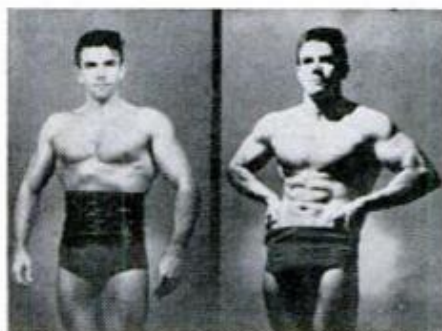
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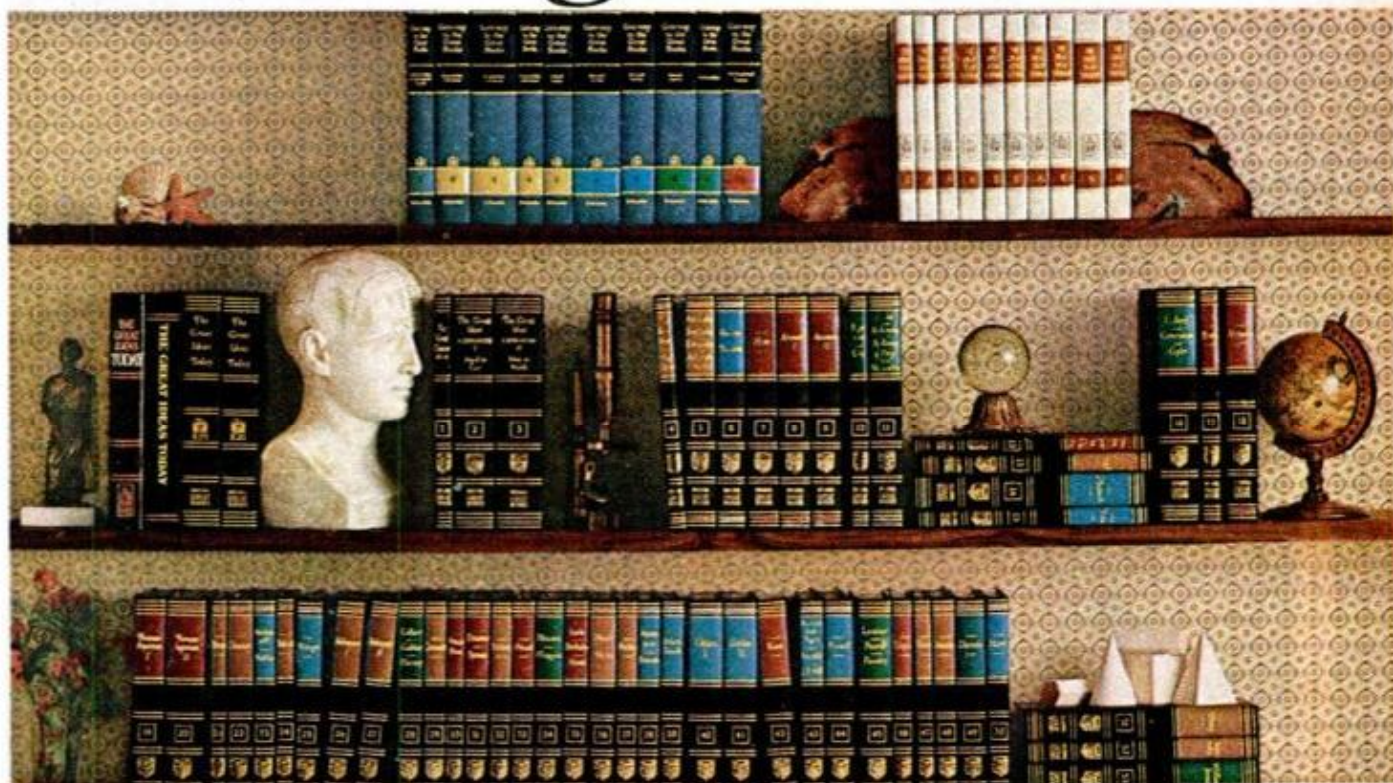
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(Continued from page 46)

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A. Why don't you try disconnecting it and see? Ask someone at a local speed shop. Try both of the gearboxes to see which you like best.

Q. *How much money did you receive for winning Le Mans in 1967? Also, are lap prizes, as at Indy, given at Le Mans and the Formula 1 races?—Don Hinkle, Worthington, Ind.*

A. All told, our car won approximately \$24,000, or about \$1000 per hour. However, my cut was considerably reduced because Ford pooled all of the team winnings and divided the total among all team drivers and mechanics, after adding an equal amount of its own money. There's no lap money at Le Mans. There is lap money at some Can-Am and F-1 races.

Q. *How much did your mechanics get paid when you won at Spa this year? Also, how much of an education do you need to become chief mechanic on a team such as AAR?—Raymond King, Dearborn, Mich.*

A. Ten percent of the prize money. It is not a guaranteed way of becoming rich. Not in F-1. It's a labor of love in many ways. No amount of education is too much. The more you have, the better you should be, provided you work as hard or harder than your less-educated competition. Skill is very important. Experience is mighty fine education. Education should never cease, of course, and today it is a big job to stay abreast of all the latest developments, techniques, designs and ideas. I'd say that you must be able to show some achievements from your past before you can expect to become a chief mechanic on any team.

Q. *I am 18 and just out of high school. Do you think that now is the time to get in racing? Should I forget college? What's the best way to get started in Formula 1 and prototype races?—Douglas Shepherd, Ypsilanti, Mich.*

A. My advice is, definitely, don't stop your education now. Go to college and take courses related to racing—engineering, design, machine technology, business, philosophy, psychology. Actually, a liberal arts education is a tremendous help, especially since you sound as though you haven't as yet made up your mind. A ballplayer starts in the minor leagues, and you will have to do the same. Gather experience carefully and studiously. You will get there if you have what it takes.

Q. *Where can I get some information on getting a license to drive in SCCA events?—John Millholland, Alameda, Calif.*

A. I suggest you write Sports Car Club of America, P.O. Box 791, Westport, Conn.

Q. *Could you tell me the requirements for a test driver for a major automotive corporation, or give me an address I can write to for information?—William Bratzel, Great Lakes, Ill.*

A. No, I'm sorry, but I cannot. I suggest you write the head of the test-driving department of any of the big companies. They may have an information department which could direct your inquiry.

Q. *Why don't they use the "Hemi" in Grand Touring or Grand Prix races? And what would be the advantage of "OHC" compared to "OHV"?—Curtis Chan Jr., Sunnyvale, Calif.*

A. I personally think the hemi-head run on gasoline is on the way out. So are two valves per cylinder. The trend is to four valves per cylinder. Overhead-cam engines also have overhead valves, making possible more accurate valve control. In a plain OHV engine, pushrods and rockers do not run as well at sustained high revs. OHC ends a lot of rod-bending loads and flexing. ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 30).

**Even if you went all-out to get your XK-E 2+2,
you still don't need the most expensive motor oil.**



Just the best.

Now that you've put yourself behind the wheel of this luxurious cat, you'll want to give it extra loving care. This means picking a really fine motor oil. Like ours. Gulfpride® Single-G. Using tests established by auto makers, we constantly check Gulfpride Single-G for its ability to protect against wear, scuffing, rusting, deposit formation and clogging. Gulfpride far surpasses the requirements of car makers in these tests. Recent tests show Gulfpride Single-G performance equals or exceeds that of four leading competitive premium motor oils. (And one of them costs 25¢ a quart more than Gulfpride.) Get the best protection for your engine. Get Gulfpride wherever you see the Sign of the Gulf Orange Disc.



Gulf Oil Corporation

BY JOHN F. PEARSON
SCIENCE
WORLDWIDE

JOG FOR YOUR HEALTH, especially if you're over 30 and out of condition. That's the advice of three Oregon physicians and a track coach who supervised a conditioning program for 363 white-collar workers. Basic routine was to jog a mile or more three times a week. Results: In 12 weeks, the 265 men who completed the program reduced their waistlines an average of 1½ inches and lowered their blood pressures varying amounts.

BIG "EGGBEATER" is being used in an experiment to clean New Jersey's muddy, polluted Passaic River. The beater, held up by three fiberglass floats, has a submerged rotary wheel that bristles with many spade-sized blades. The wheel draws 50,000 gallons of water a minute from the river bottom and churns it into millions of drops at the surface, creating a foamy fountain. By whipping oxygen back into the water, engineers hope to revive the dirty, dead river.

FUEL OF THE FUTURE for central power stations and perhaps even buses, trains and private cars may be ammonia. So says Leon Green Jr., a prominent researcher who explains that ammonia, composed of nitrogen and hydrogen, produces exhaust fumes that are mainly water and nitrogen and thus would not add to air pollution problems the way fossil fuels do. The trouble is that ammonia is hard to handle—it's volatile, tough on the nostrils and poisonous.

AUTOMATIC LASER SYSTEM for measuring the altitude of clouds has been developed by a Swedish electrical engineering company. A laser pulse lasting about 25 billionths of a second is shot straight up. If a cloud is overhead, part of the light is reflected back to the instrument's receiver, stopping an automatic timer that indicates the distance to the cloud's base.

CELLS GROWN IN A TEST TUBE can be used to rebuild outer skin layers, reports a Stanford University dermatologist who has had success working with rabbits. He has taken cells from a rabbit, grown them for 14 days in a test tube, then transplanted them back to the animal. Scientists hope eventually to be able

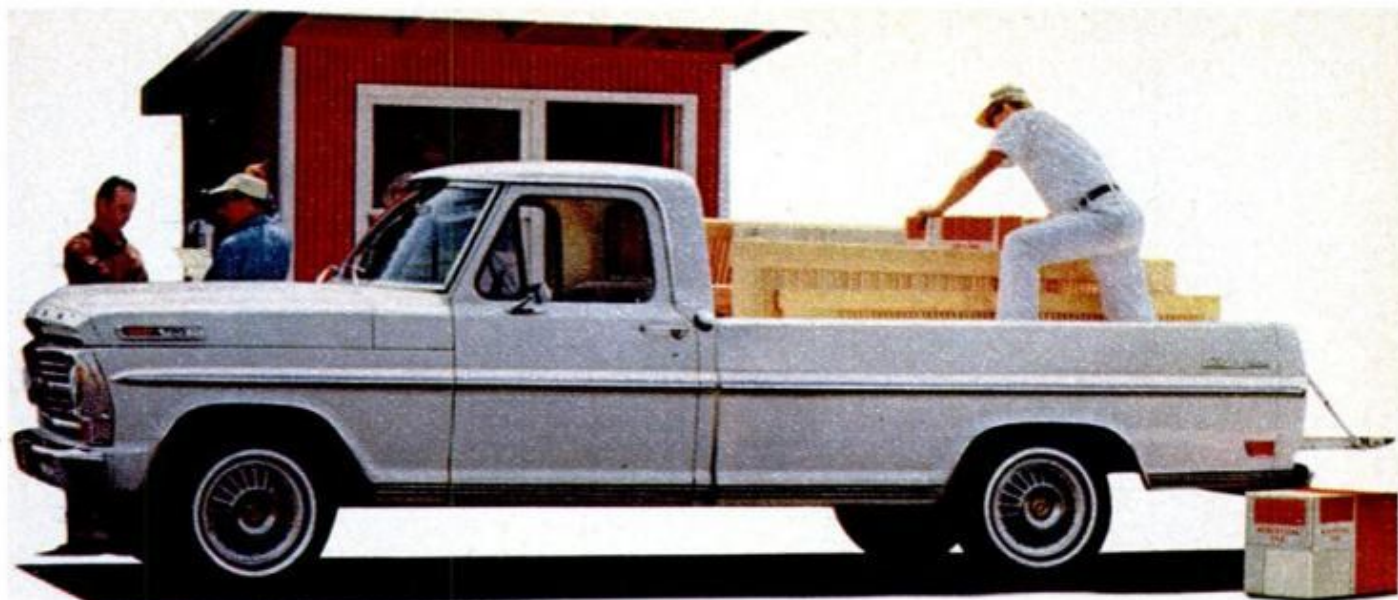
to use cultured skin cells for the treatment of wounds.

A "**BEARD HAZARD**" recently came under investigation at the Army's Fort Detrick in Maryland where researchers work on biological-warfare projects. It was feared that bearded microbiologists might unwittingly harbor dangerous bacteria in their facial hair. Volunteers permitted their beards to be sprayed with harmless test organisms and then sampled for contamination. Investigators concluded that bearded men pose a greater risk of infection than clean-shaven ones, but that they were likely to spread infection only if contaminated as the result of an accident or if exposed to a persistent contagious spray.

SMALL ATOMIC ENGINE is under study by the Atomic Energy Commission as a possible power source for an artificial heart. A radioactive isotope would produce steam by heating distilled water. The steam would power a piston engine connected to a hydraulic pump, which would impel blood through the circulatory system. Weight of the power unit, to be implanted in a patient's abdominal cavity, would be about seven pounds.

FIRST EXTENSIVE CHART of the moon's dark side has been completed by Air Force cartographers using photos taken by our series of Lunar Orbiter spacecraft and by Russia's Zond vehicle. The chart covers more than 75 percent of the side of the moon that is not visible from the Earth. The Farside Lunar Chart is published in two scales, 1 to 5 million and 1 to 10 million. Copies are available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., at 50 and 35 cents each.

OIL FROM THE HUGE TANKER *Torrey Canyon* that foundered off the English coast was cleaned up with millions of gallons of detergents. The cleaning agents, report English biologists, did tremendous damage to sea life in the area. The biologists found hordes of dead starfish, crabs, lobsters and rockfish. Some specimens that managed to survive acted as if drugged. ★ ★ ★



Works like a truck, rides like a car.

One of our better, better ideas.

Delivering on a promise like that calls for a really great idea. Like Ford's Twin-I-Beam front suspension. And now Ford offers another better idea. New Flex-O-Matic rear suspension adjusts spring stiffness to assure a smooth ride with, or without, load.

The combination makes Ford Pickups the best riding ever, yet still as tough as they come! Check into a Ford. New options, such as 360 and 390 cu. in. V-8 engines, front power disc brakes, power steering and air conditioning, let you custom-tailor your own pickup.

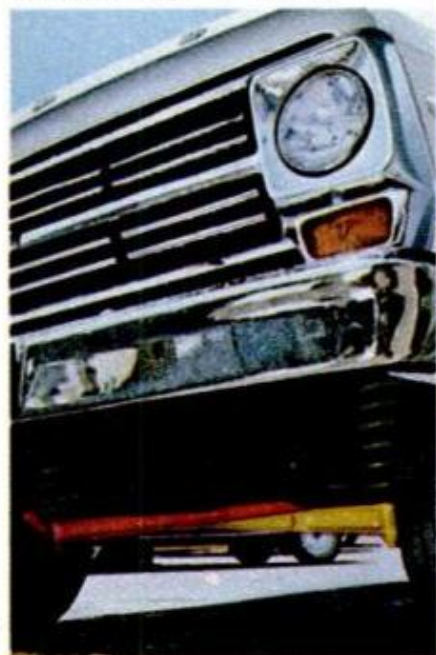


...has a better idea.

Smooth, strong Twin-I-Beam.

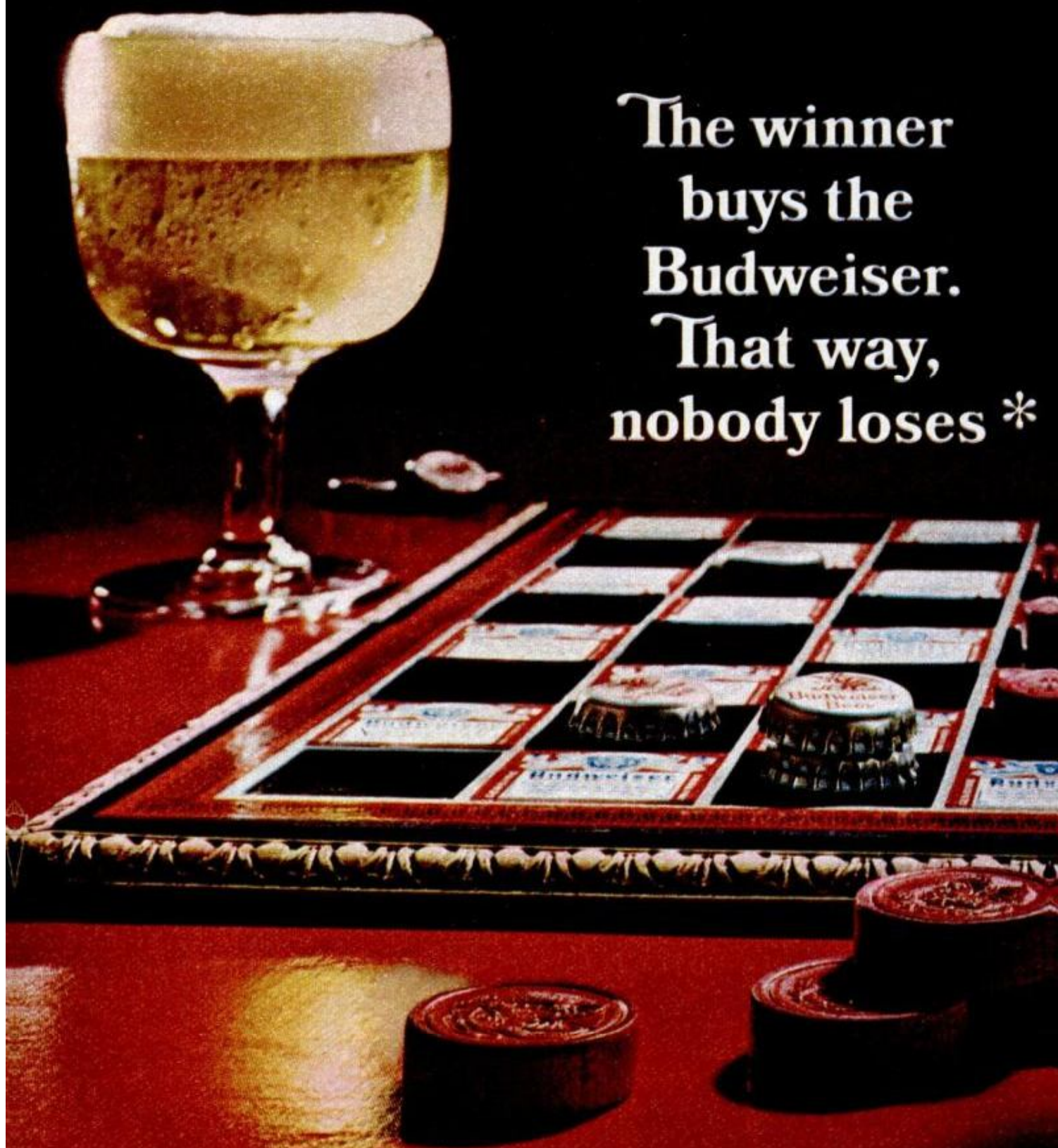
Roomiest cab of any pickup—and the quietest.

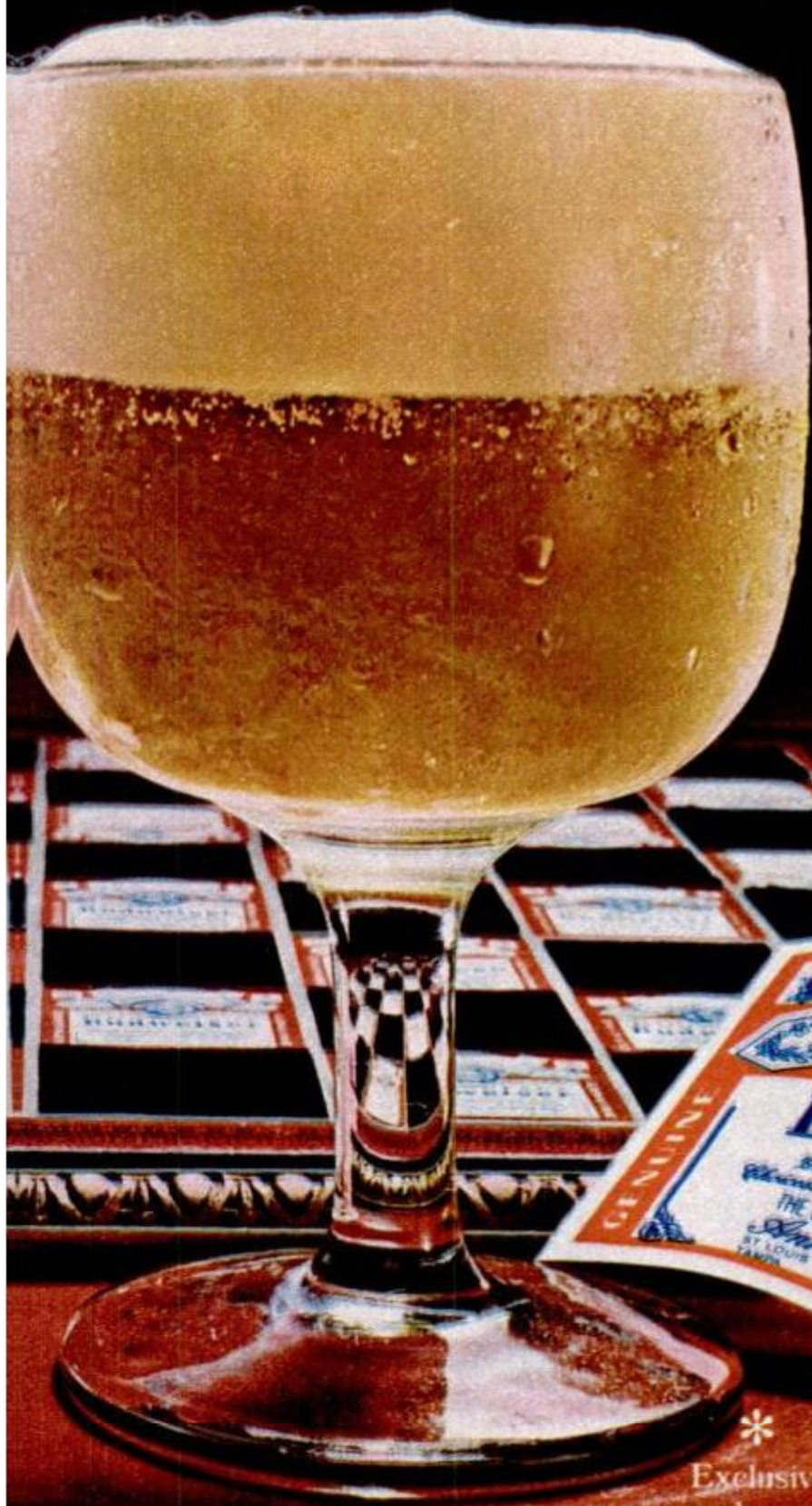
New Flex-O-Matic.



Camper Special models.

The winner
buys the
Budweiser.
That way,
nobody loses *





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Exclusive Beechwood Ageing
makes quite a difference in taste
and smoothness. That's our big play
... now it's your move.

Whips through snow like a team of huskies.

Now's a great time to be a 'Jeepster' owner! Snow? Forget it! Make your own tracks. Settle back in those bucket seats. Then, flip one lever into 'Jeep' 4-wheel drive...and make the deep stuff say "uncle"! Choose the jaunty 'Jeepster Commando' Station Wagon or bold, brash 'Jeepster' Convertible

with continental spare. 4-wheel drive and 4-cylinder engine are standard on all models. Add your choice of sporty options like husky V-6 with (or without) Turbo Hydra-Matic* automatic transmission; sports console; power brakes; air conditioning. There's also a jaunty Roadster model. And a snappy Pick-

up. All smooth performers on the road...all tougher than nails when you're out in the rough. **Holy Toledo...what a car!** You've got to drive it to believe it. See your 'Jeep' dealer for a test drive. Check the Yellow Pages.

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'Jeepster'
4-wheel drive fun cars

Sunken Time Bombs Full of Oil!

By Daniel C. Fales

**PM DIVES ON A LEAKY TANKER
TO REPORT ON A SLIMY
THREAT TO OUR BEACHES**

FROM BAR HARBOR TO BROWNSVILLE, at least 103 tankers lie rusting on the ocean bottom. Most were sunk just offshore by German U-boats during World War II. Others were victims of storms or collisions.

With an assist from *Popular Mechanics*, the Coast Guard recently inspected one off Long

Island—the British tanker *Coimbra*. She is leaking oil. PM sent experienced wreck diver Stuart Sup to take a look at her. A month later, PM and Sup gave position figures to the Coast Guard which had looked for the wreck unsuccessfully for two days.

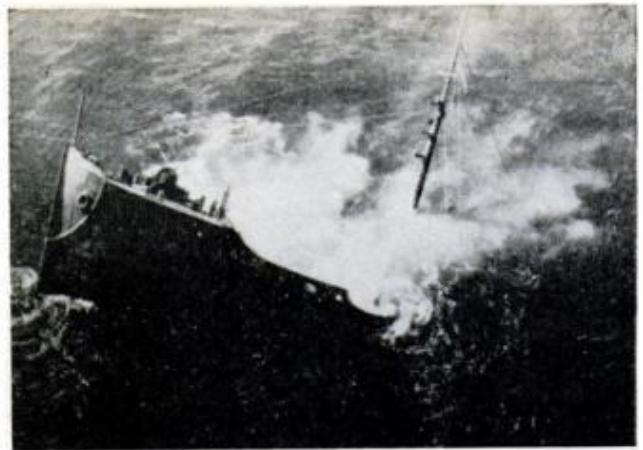
The Coast Guard says the amount of oil found on *Coimbra* is not significant. But Robert Kutzlab, head of the Ocean Systems diving team hired to help CG look over wrecks, says otherwise. He says that after diving on *Coimbra*, he reported to CG that there was no significant oil left in tanks open to the sea above the sand line. But he says that tanks below the sand line could be full of oil.

PM's investigation into the sunken tanker threat started after oil mysteriously appeared on the beaches of New Jersey and Cape Cod last spring. Here is our report.

AT SEA OFF LONG ISLAND.—It's 4:00 a.m. on a foggy morning in July, and our stubby little trawler chugs out to sea in search of *Coimbra*.

At 3:00 a.m. on Jan. 15, 1942, a German torpedo smashed home in the bowels of this British oil tanker. The *Coimbra* was outbound from New York hauling 2½ million gallons of oil to England.

Twenty-nine men died in the *Coimbra* disaster. And today it is our grim assignment to try to find her forgotten



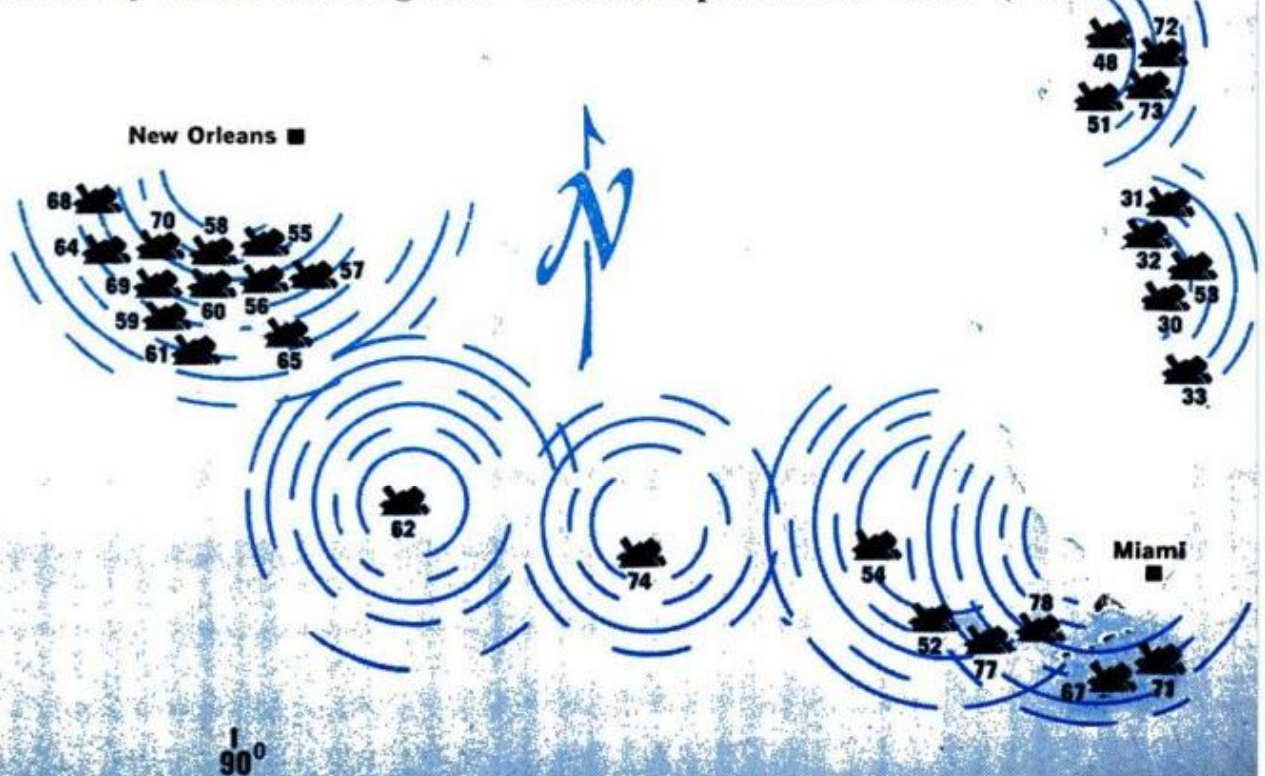
BOW SECTION of the *Gulftrade*, which sank off the coast of New Jersey after being torpedoed

hull on the sea bottom. There's a vital reason.

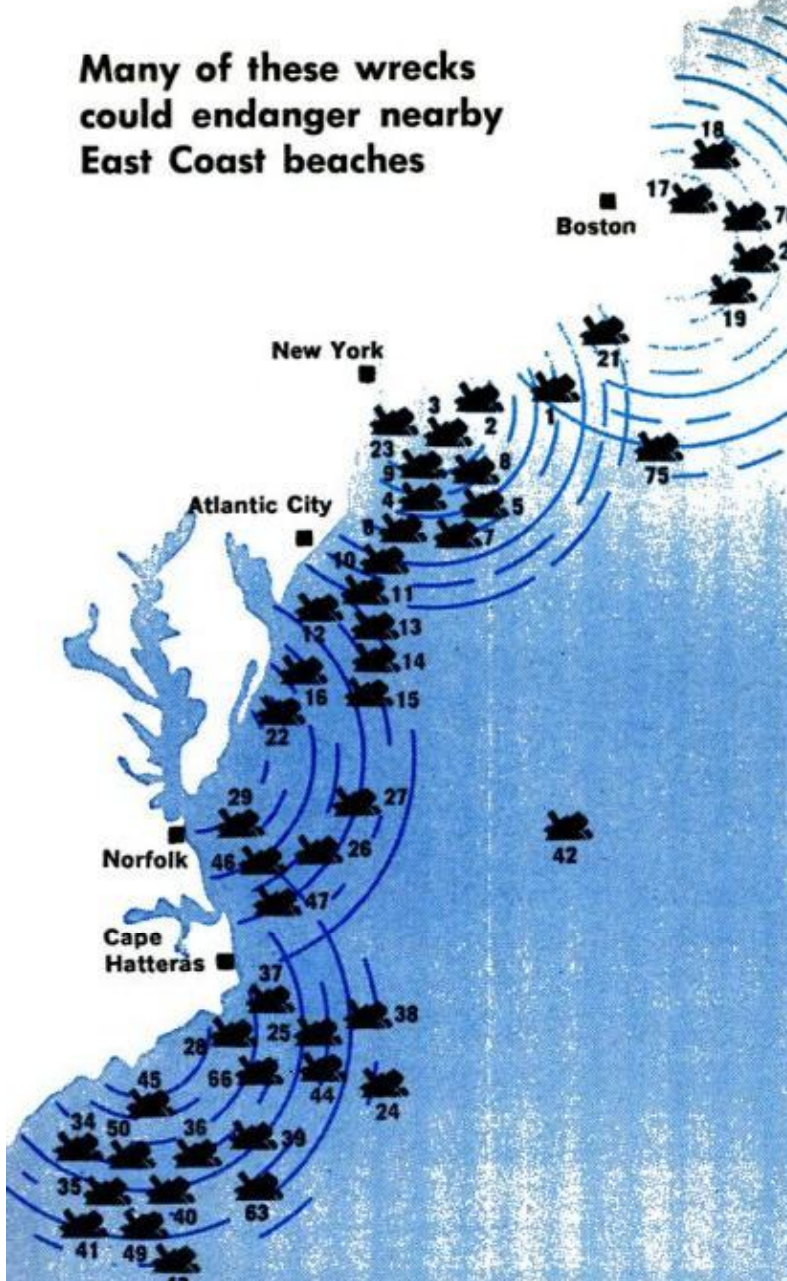
For us, *Coimbra* is now a long-lost test tube. If we can find the wreck and our divers can spot escaping oil, we'll know the *Coimbra* still contains part of her once-precious cargo. If *Coimbra's* oil is leaking, this may also indicate the condition of many of the other 102 tanker wrecks along our coast.

Adm. W. J. Smith, Coast Guard commandant, has told Congress: "We feel there is still a considerable amount of oil contained in [sunken] tanks." Experts say it might be as much as 220 million gallons—enough to spread a slick larger than the area of Texas.

Aboard our chartered trawler are PM's two veteran wreck divers—Stuart Sup and Bob Roth. (You



Many of these wrecks could endanger nearby East Coast beaches



KEY TO SUNKEN TANKERS

No.	Name	Gross Tons	Date sunk	Position	
				Lat.	Long.
1	Noiness	6000	1/14/42	40°26'N	70°50'W
2	Coimbra	4000	1/15/42	40°22'N	72°20'W
3	Maurice Tracy	2500	6/17/44	39°53'N	73°58'W
4	Gulfrade	7500	3/10/42	39°49'N	73°50'W
5	R.R. Resor	4600	2/7/42	39°47'N	73°25'W
6	Persephone	8500	5/25/42	39°46'N	74°02'W
7	San Saba	2500	10/14/18	39°40'N	73°55'W
8	Stolt Dagali	12,723	11/26/64	39°59'N	73°40'W
9	Oklahoma	5800	1/19/14	39°56'N	73°55'W
10	Barge American	unknown	1925	39°14'N	74°22'W
11	Varanger	9300	1/25/42	39°00'N	74°04'W
12	China Arrow	8403	2/5/42	38°58'N	75°09'W
13	Evening Star	8000	1942	38°51'N	74°06'W
14	Unknown	7000	1943	25 miles off Cape May, N. J.	
15	India Arrow	8400	2/14/42	38°33'N	73°50'W
16	W. L. Steed	6200	2/3/42	38°25'N	74°46'W
17	Chelsea	6500 bar.	2/10/57	42°36'N	70°34'W
18	Pinthis	11,000 bar.	unknown	42°09'N	70°33'W
19	Fort Mercer	10,000	2/17/52	41°35'N	69°57'W
20	Pendleton	10,000	2/17/52	41°35'N	69°57'W
21	Lightburn	6500	2/10/39	41°08'N	71°32'W
22	Veco	unknown	3/5/42	38°50'N	75°05'W
23	Unknown	10,000	unknown	40°10'N	73°48'W
24	Allen Jackson	6635	1/19/42	35°00'N	74°22'W
25	Malay	8205	1/19/42	35°25'N	75°23'W
26	F. E. Powell	7096	1/27/42	37°45'N	74°53'W
27	Rochester	6836	1/30/42	37°10'N	73°58'W
28	Olympic	5335	1/31/42	36°01'N	75°30'W
29	E. H. Blum	11,615	2/16/42	36°57'N	75°52'W
30	Pan Mass.	8201	2/19/42	28°27'N	80°08'W
31	Republic	5287	2/21/42	27°05'N	80°15'W
32	Cities Serv. Empire	8103	2/22/42	28°00'N	80°22'W
33	W.D. Anderson	10,227	2/22/42	25°41'N	80°00'W
34	Cassimir	5030	2/26/42	33°56'N	77°56'W
35	John D. Gill	11,641	3/12/42	33°55'N	77°30'W
36	Ario	6952	3/15/42	34°20'N	75°20'W
37	Australia	11,728	3/6/42	35°07'N	75°22'W
38	Acme	6878	3/17/42	35°06'N	75°23'W
39	E. H. Clark	9647	3/18/42	34°50'N	75°35'W
40	Papoose	5939	3/18/42	34°20'N	76°35'W
41	W. E. Hutton	7076	3/18/42	34°25'N	76°40'W
42	Oakmar	5766	3/20/42	36°41'N	68°50'W
43	Naeco	5372	3/23/42	33°59'N	76°40'W
44	Dixie Arrow	8046	3/26/42	34°59'N	75°33'W
45	Leibre	7075	4/2/42	34°17'N	76°12'W
46	Tiger	5992	4/3/42	36°50'N	75°49'W
47	B. D. Benson	7053	4/4/42	36°08'N	75°32'W
48	Oklahoma	9264	4/8/42	31°13'N	80°05'W
49	Tamaulipas	6943	4/9/42	34°25'N	80°05'W
50	Gulf America	8081	4/16/42	30°14'N	81°18'W
51	M. T. Ball	5014	5/4/42	25°17'N	83°57'W
52	Halsey	7088	5/6/42	27°14'N	80°03'W
53	J. M. Cudahy	6949	5/7/42	25°57'N	83°57'W
54	Aurora	7050	5/10/42	28°35'N	90°00'W
55	Gulf Pa.	8862	5/13/42	28°29'N	89°12'W
56	Virginia	10,741	5/13/42	28°53'N	89°29'W
57	D. McKelvey	6820	5/14/42	28°13'N	89°55'W
58	Gulf Oil	5188	5/16/42	28°08'N	89°46'W
59	Sun	9002	5/16/42	28°41'N	90°19'W
60	William C. McTarnaban	7306	5/16/42	28°52'N	90°20'W
61	Halo	6986	5/20/42	28°42'N	90°08'W
62	Carrabulie	5030	5/26/42	26°18'N	89°28'W
63	F. W. Abrams	9310	6/11/42	34°57'N	75°56'W
64	Cities Serv. Toledo	8193	6/12/42	29°02'N	91°50'W
65	R. Warner	3663	6/22/42	28°53'N	89°13'W
66	William A. Rockefeller	14,057	6/28/42	35°11'N	75°07'W
67	J. A. Moffett Jr.	9788	7/8/42	24°45'N	80°42'W
68	B. Brewster	5950	7/9/42	29°05'N	90°05'W
69	R.W. Gallagher	7989	7/13/42	28°32'N	90°59'W
70	R.M. Parker Jr.	6779	8/13/42	28°37'N	90°48'W
71	Gulf State	7612	4/3/43	24°22'N	80°18'W
72	Esso Gettysburgh	10,173	6/10/43	31°00'N	79°15'W
73	Bloody Marsh	10,195	7/2/43	31°25'N	78°45'W
74	Touchet	10,171	12/3/43	25°50'N	86°30'W
75	Pan Pa.	10,017	4/16/44	40°07'N	69°24'W
76	Atlantic States	8537	4/5/45	42°07'N	70°00'W
77	Unknown	8000	unknown	25°00'N	82°18'W
78	Unknown	7500	unknown	25°00'N	82°00'W

read about some of their adventure-some buddies in *They Dive For Wrecks*, May, 1967, PM.)

Also aboard are three PM editors—John Linkletter, Bill Kilpatrick and this writer.

But no buoy marks *Coimbra's* ghost. No charts show her exact location. And yet we have reason to hope we can find her.

One week ago, following up a tip from a fisherman, Stu and I chartered a plane. We flew out to sea, hunting through low fog for an oil slick. Finally, we discovered a trail of oil only 30 miles south of Long Island's famed beaches. For an hour, we circled taking photographs (see page 100).

On the surface of the sea below lay a rainbow patterned slick. We flew close.

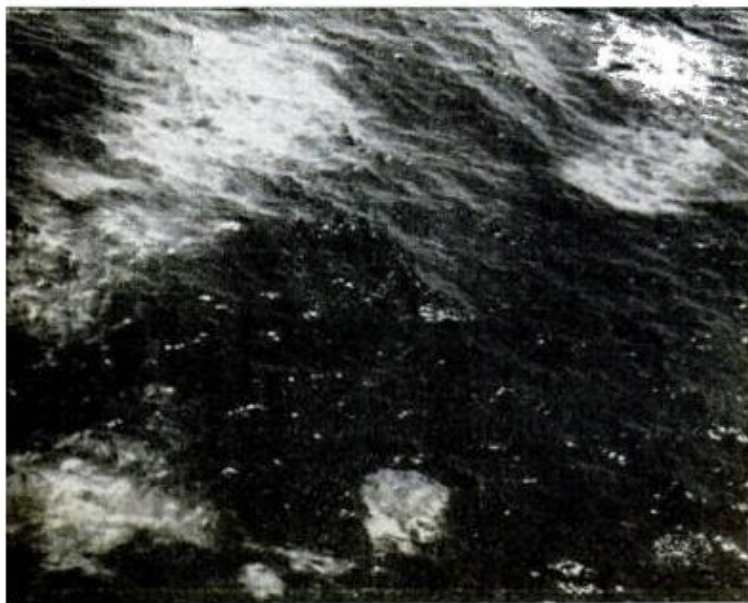
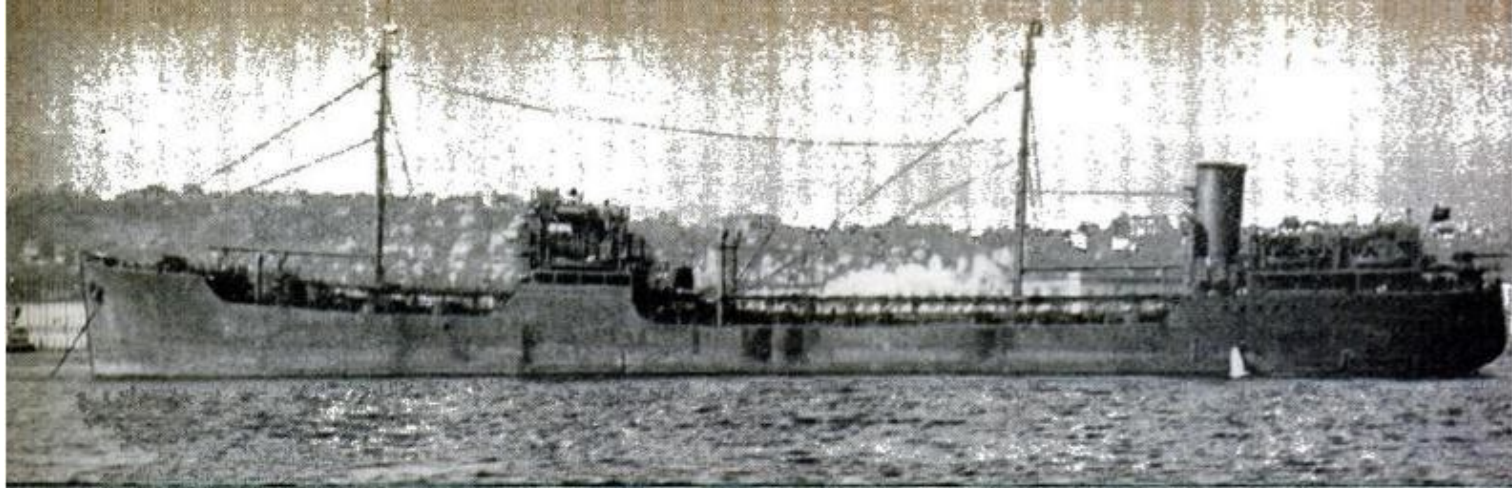


PHOTO shows the tanker *Coimbra* (top) before she was torpedoed. Drawing (above) is what PM divers saw when they went down on her wreck. This is how she lies in 180 feet of water off Long Island. Blossoms of oil (left), leaking from *Coimbra's* wreck, can be seen clearly from plane. Stu Sup (lower left) suits up for dive on wreck



Purple “blossoms” of oil were coating the sea. From the air, the blossoms seemed to be rising in several spots. But there was no discernible pattern—no clue to the outline of the ship. Within a hundred yards, the blossoms slowly blended together to form a narrow slick. This clearly visible trail led us northwest—toward Long Island’s white beaches—then curved away in a half moon toward the southwest and New Jersey. We followed it for perhaps three miles before it disappeared.

But can we find the slick again from our trawler? Is it still there?

At 11:00 a.m. the fog begins to lift. We can see about a mile. Stu and Bob have been sleeping peacefully on deck—resting for their deep scuba dive.

Suddenly a blip appears on our radar screen. It’s not moving, and is about two miles off starboard. We head for it

(Please turn to page 222)

WHAT IS THE ANSWER TO AN OIL SLICK THREAT?

Solutions to the problem run from the logical to the bizarre

1. **BIG PLASTIC BAGS** could be used to envelop a wreck. Puncture the tanks and capture the oil in these king-sized "baggies."

2. **DETERGENTS** can be used, but they're too costly and are a pollution problem in themselves. There is, however, a new chemical called Polycomplex A, being produced by Guardian Chemical Corp. of Long Island City, N.Y. This liquid combines with oil, breaking it into minute particles so bacteria, light and oxygen can attack it. This chemical is not a pollutant, the company claims, and reduces the toxicity of oil 20 times.

3. **BURNING TELEPHONE POLES** could be an answer. The principle was accidentally discovered in Tokyo Bay when an oil barge broke open and ignited. Oil was sucked up into the flames. This led to a device for clearing water of oil slicks.

Tie six phone poles together. Weight one end. Tow poles to middle of slick. Dump flammable fluid over exposed end. Toss a grenade at the poles. Bang—you have a giant wick. Heat from the burning poles "cracks" the oil enough to burn it off.

4. **SKIMMING OFF OIL** has been suggested. Take a tugboat. Trail a large plastic bag like a fish net. Drag it through a slick, collecting oil at the end of the bag. There's a ship, too, that skims oil off the surface using a scoop in the bow. But there's only one such vessel.

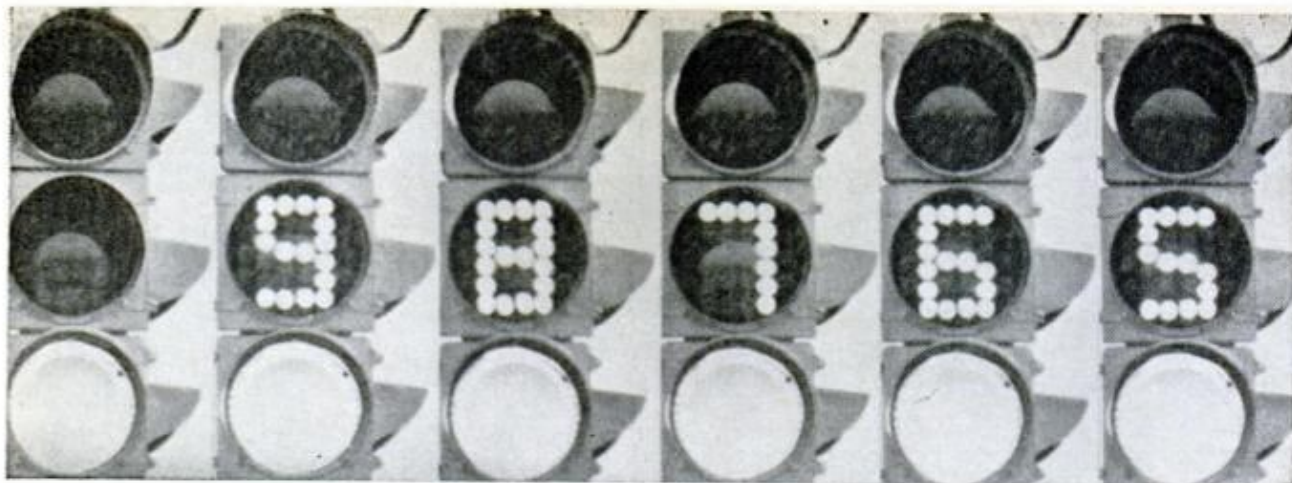
5. **DRILL INTO TANKS OF SUNKEN TANKERS.** Then tap the oil, sending it through hoses to waiting barges.

The oil-drilling industry is well equipped with knowledge and gear that could be used on tankers—especially a drill-and-flange system. Between the drill and the flange you can stretch a rubber hose. When the drill breaks through a tank, the edges of the hole clip off shear pins holding the stretched rubber. As the flange seals from the top, the rubber contracts underneath, making a tight connection.

6. **PLASTIC OIL BOOMS** can be used to contain an oil slick. These booms are made of floating foam that supports a plastic belt. This belt stops the oil slick from spreading. Though good for stopping slicks from entering rivers or bays, these booms might not really be able to trap all the oil belching from a ruptured tank under the sea. But booms, such a Slickbar, made in Saugatuck, Conn. have been successful in containing oil leaking from floating ships.

OIL ON THE BEACHES of Cape Cod is believed by some to have come from a sunken wreck. This scene could be duplicated on hundreds of other ocean beaches stretching all the way from Maine to Texas





Corner countdown for Miami motorists

Ever wonder whether you can make it through an intersection before the light changes? They're taking the guesswork out of it in Miami with a set of signal lights that have bor-



100,000-rpm broadcaster

World's smallest FM transmitter—about "24 quarters high"—attaches to 100,000-rpm turbo-charger impellers to broadcast strain-gauge readings to nearby receiver monitored by engineers of Schwitzer Div., Wallace-Murray Corp.



Electric, of course

When a power company turned automaker, it came up with the Allectric, which, of course, runs on rechargeable batteries. The car will do 50 mph and 50 miles on one charge. Maker is West Penn Power Co., Greensburg, Pa.



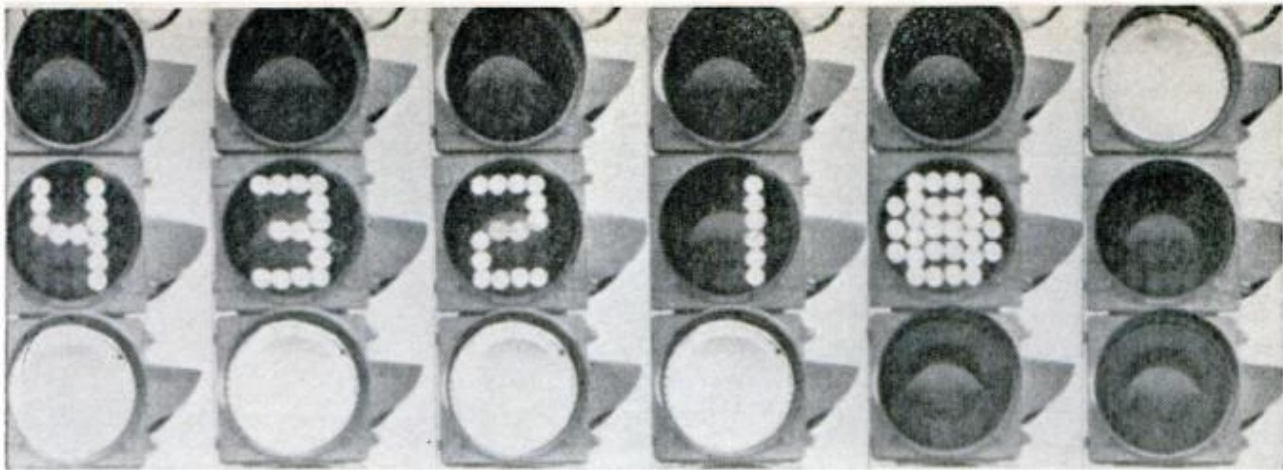
Traveling service station

Bring the service station to the car, says Michael Nielsen, Stanford design student. The proposed station on wheels would go to parking lots and service customers' cars there.



Moor rescuer

On its huge tires, the German "Sumpfsteinbock" can cross marshy terrain to do a variety of jobs. Its hydraulic crane can dig ditches, pull up trees, or (as shown) tow cars.

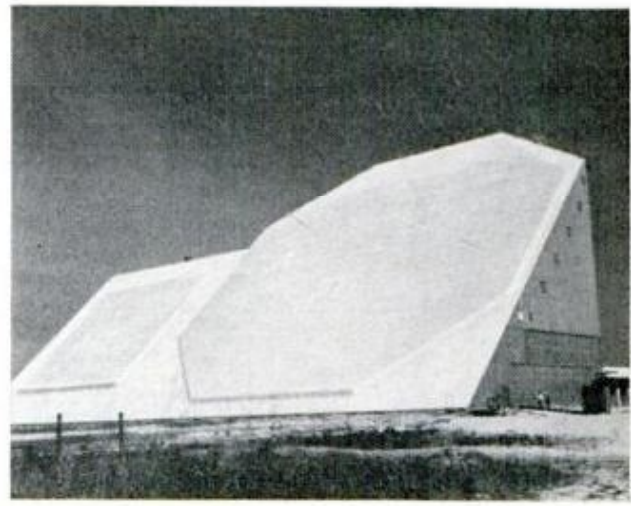


rowed the countdown from Cape Kennedy up the coast. The light gives motorists a 10-second amber countdown before it changes from green to red. Then it's all systems stop.



Bedroom hangar

Launching a five-foot model of the Zeppelin DLZ 127 from his bedroom window is Gunther Dahl, a German carpenter. Dahl made the model, which "flies" on wires that extend about 260 feet across his yard.



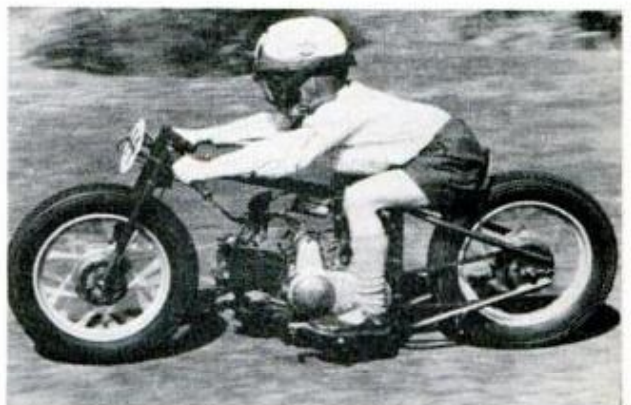
New satellite watcher

In this strange-shaped building—13 stories high and a block long—a phased-array radar scanner will watch every satellite in the sky for NORAD. The new unit will go into use at Eglin Air Force Base, Fla., in 1968.



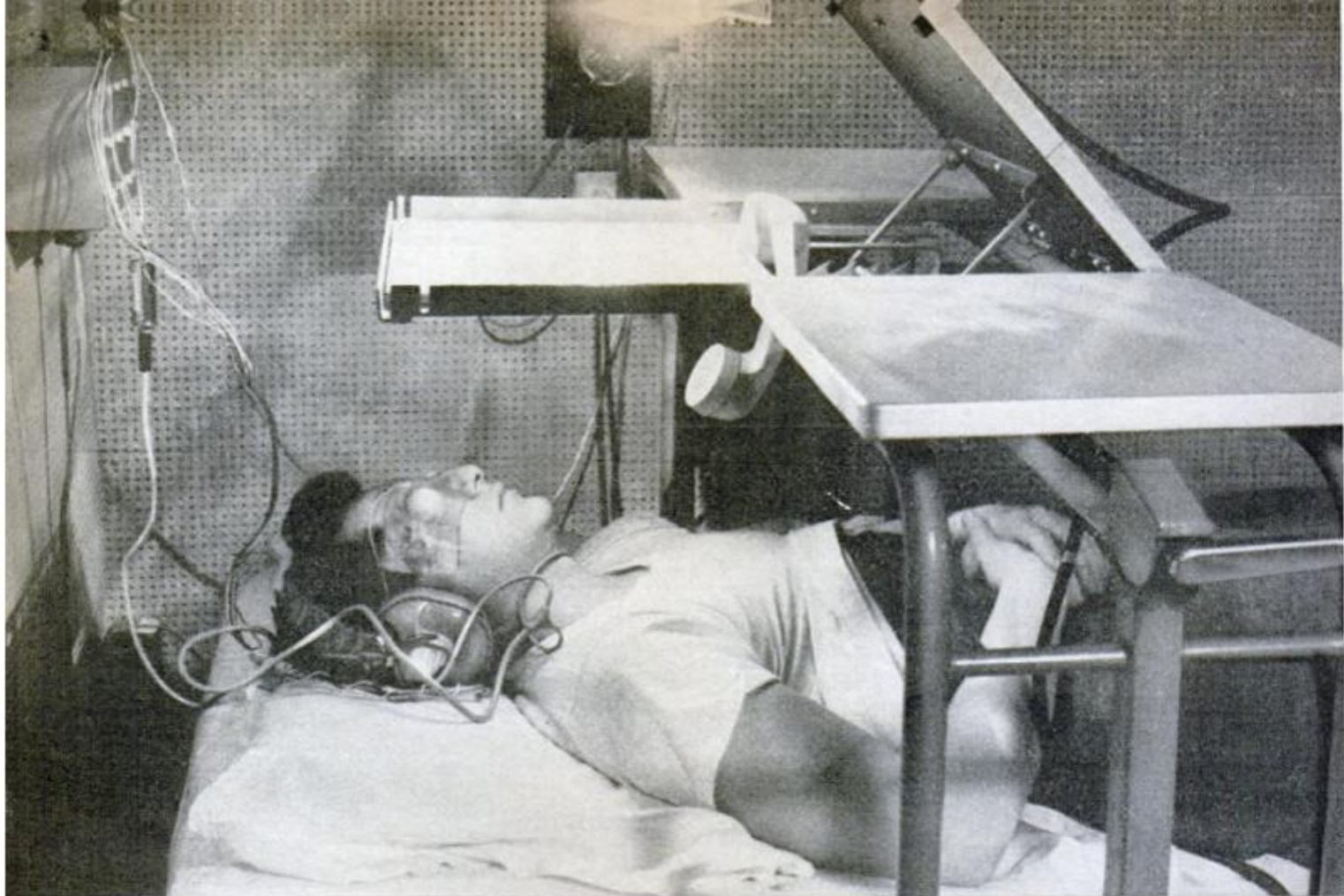
First for Britain

Britain's first Polaris submarine, the HMS *Resolution* is shown here during her first sea trials recently. The 7500-ton *Resolution* is believed to be the largest sub in the world.



Tiny two-wheel tearer

Five-year-old Stuart Heading of England is the envy of his friends with his miniature drag-racing cycle. His father, who built it, added a throttle stop to keep speed below 12 mph.



VOLUNTEER SLEEPER has electrodes attached to his scalp and eyes to record brain activity and eye movement

Eye-Opening Discoveries

By **HANS FANTEL**

Technical Art by Don Evans

THIS IS A CINCH, I figured. Other guys get fired for sleeping on the job. I'm getting paid for it.

I had just entered the brand-new Sleep Laboratory at Montefiore Hospital in New York City, where I was to spend the night as a guinea pig. I'll never find a softer job, I thought, crawling into bed and relaxing while a technician wired up my brain.

It didn't hurt. He just glued a dozen wires to my scalp, two more near each eye, and attached a ground lead to my earlobe. The wires were so light and pliant that I could hardly feel the neatly braided rig-up on my head.

Then the lights went out. My room was soundproof, and in the comfortable, silent darkness I soon fell asleep. That's when my work really began.

In the adjoining room, a 16-channel recording device sprang into action, tracing electric pulses from my brain and eye muscles. Michael Pessah, an intense-looking young man trained in both medicine and electronics, was in charge of the experiment and watched wearily through the night as the recording pens scratched the signals from my brain on long strips of calibrated paper rolling through the machine at the rate of nearly 24 inches per minute.

Sleep research of this type is still in its beginnings. But already a handful of recent discoveries have shaken up our old notions about sleep:

- Sleep is not entirely a resting state. According to recent findings, certain stages of sleep give your body more of a workout than being awake.
- People who seem to die peacefully in their sleep actually die of over-exertion



RECORDING GRAPH shows signs of mental turmoil

About Sleep

- "I dream so much I'm dead tired when I get up."

Wrong. The more you dream the better you rest.

- "I slept like a log all night."

Not true. Deep and light sleep alternate in cycles of about 90 minutes.

- "If I want a good rest, I take a sleeping pill."

No. Barbiturates produce anesthesia — unconsciousness — which is not true sleep. To some degree they poison the central nervous system.

These and other surprising new facts are contained in this article that throws light into the dark corners of sleep.

during dreams. This discovery may radically alter the treatment of many diseases.

● Dreams are not incidental to sleep. They are a vital necessity. Insufficient dreaming appears linked to depressive psychosis and other emotional disorders, including alcoholism, drug addiction, insomnia and chronic fatigue.

Through these findings, sleep research points the way to possible future developments. Among them:

(1) Effective treatment of many types of mental illness.

(2) Concentrated sleep that would cut down daily sleep requirements to two to three hours.

(3) Increased waking efficiency due to improved restfulness of sleep.

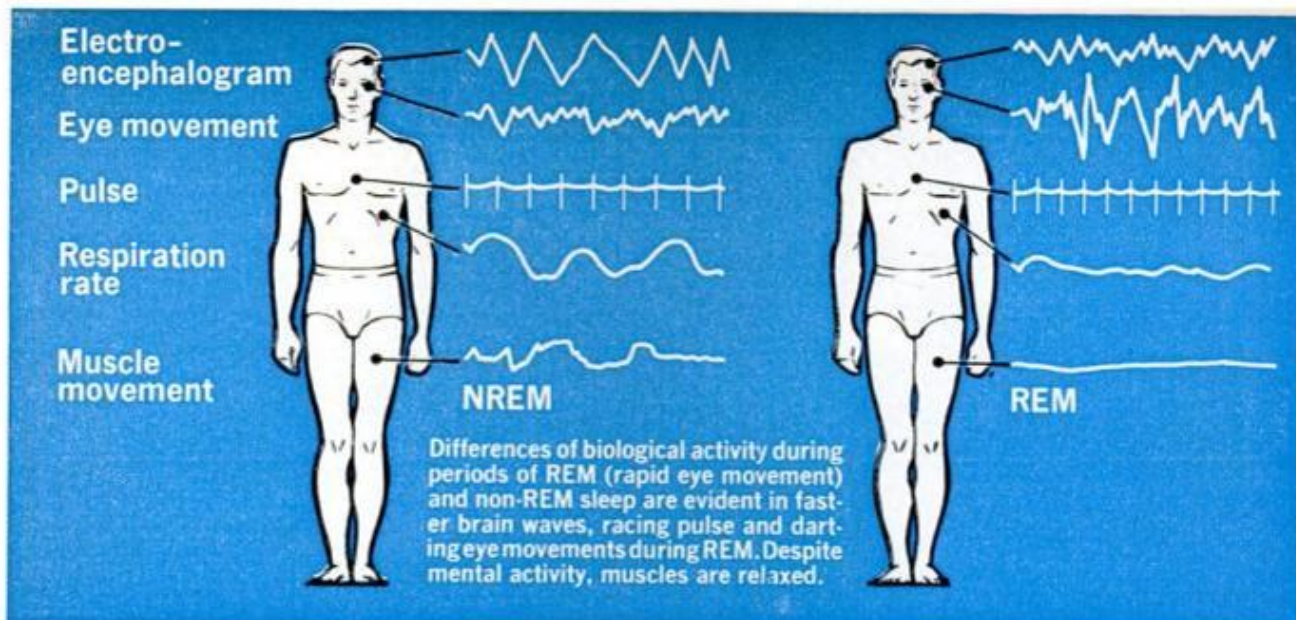
These possibilities, as any responsible researcher admits, are still a long way off. But present research is uncovering the basic knowledge needed to approach these goals.

Before leading me to the sleep room, Pessah had shown me the lab next door. It looked more like the control station on a rocket launch pad than a medical office. Amplifier racks, tube screens, dials and knobs reached from floor to ceiling. Strange devices hung from a wallboard. They were input transducers to check the sleeper's breathing rhythm, heart rate, temperature, blood pressure and flow volume, muscular tension, body movements, sweating, gastric contractions and even variations in the circumference of the penis.

"Relax," said Pessah. "We're only going to hook up your head."

My snooze was part of new efforts to penetrate more deeply into what still remains the most mysterious part of our existence—the dark third of our lives.

Men have puzzled and theorized about their nightly journey into oblivion and fantasy ever since their first nightmares about saber-toothed tigers. Yet only within the last decade or so—thanks to modern electronic equipment—has it been possible to get reliable



clues about what goes on in the sleeping mind and body.

The first big breakthrough in modern sleep research happened by accident. In April, 1952, a young graduate student at the University of Chicago named Eugene Aserinsky was taking the EEG (electroencephalogram, the technical name for a brain-wave recording) of a sleeping subject when one of the recording pens suddenly started jabbering and swinging wildly. His first thought was that the machine had gone haywire. When he checked it out, he found that the electronic ruckus came from an electrode placed near the eye of the sleeper. He placed another electrode near the other eye. Now the swings showed up in both channels. Evidently the machine was picking up action voltages generated by rapid movement of the eye muscles. He confirmed this by watching the eyeballs move under the lids.

To his surprise, Aserinsky found that every sleeper he tested had from four to seven periods of rapid eye movement (REM) each night, spending about a third of his total sleeping time in the REM state. What's more, the other recording channels, tracing the electric activity of various brain regions, showed much faster brain waves during the REM periods. Clearly, Aserinsky was on to something. The question was what.

One way to find out was to shake awake the sleepers right in the middle of their REMs. Many of them awoke in a state of great excitement, blurting out bizarre stories full of weird and sometimes violent happenings. Had they not been awakened at just that moment, they never would have known about these dreams. Everything during REM is forgotten. The dreams we remember occur in another phase of sleep. They are half-awake fantasies of a much milder sort. The fantastic dreams also provided an explanation for rapid eye gyrations. Presumably, the sleeper was looking at whatever he was dreaming.

Behind the calm—chaos

While the eyes dart about, the muscles of arms, legs and back go completely slack. At the onset of each REM period, the whole body visibly relaxes, presenting outwardly a perfect picture of restfulness. The surprise was all the greater when Aserinsky and his associates hooked the rest of their biological machinery to those seemingly peaceful sleepers. Behind the body's quiet facade, the instruments sensed frantic activity: racing pulse, wildly fluctuating blood pressure, profuse sweating and signs of sexual arousal. The body showed the usual signs of fright and anger: pale skin, cramped stomach and other visceral symptoms of alarm. In

short, the mental excitement of REM sleep was fully matched by physical symptoms. Aserinsky's astounding conclusion: Part of normal sleep is a condition of high turmoil.

Two phases of night's sleep

It now was clear that a night's sleep consists of two distinct phases:

(1) Ordinary or non-REM sleep. This looks like a proper resting state on lab instruments. As you gradually sink deeper into sleep, the brain waves slow down, pulse and breathing grow slower and the eyes are almost still. However, the muscles maintain some tension.

According to the EEG pattern it produces, non-REM sleep is classed in four stages from simple drowsiness to deep sleep. By running their machines all night, physiologists discovered that deep and light sleep alternate in cycles of about 90 minutes.

(2) REM. This agitated period occurs between each pair of non-REM cycles four to five times each night. Each REM period lasts from about 10 minutes to half an hour, depending on the individual. REM periods tend to get longer toward morning. Their function is still an open question, but some answers are on the way.

To solve the riddle of REM, Drs. Charles Fisher and William Dement at Mount Sinai Hospital in New York City decided to deprive their sleepers of REM sleep. Whenever a sleeper's EEG showed the onset of a REM period, he was awakened. After two to seven days, volunteer subjects were in a state of apparent panic. Although they had gotten a total of six hours of sleep each night, they felt tremendously agitated, were unable to concentrate and showed other symptoms of emotional disturbance. Nothing like that happened to the control group, who had been awakened the same number of times each night, but during non-REM periods.

My sleep stint at the lab was as part of such a control group in a similar ex-

periment. Pessah, watching my sleep chart on the recorder, spotted my non-REM cycles and woke me with a buzzer and by flashing bright lights into my face. To make sure I was thoroughly awake, he asked me a few key questions over the intercom like "How much is 7 times 6?" Not until I growled clearly and distinctly: "Forty-two, dammit!" would he let me go to sleep again.

The other group of subjects, who were deprived of their REM dreams for several days, were later allowed to sleep normally once more. It was then that a strange rebound effect showed up on their EEGs. The sleepers had an average of 60 percent longer REM periods. In a way, they were "sleeping on the double"—trying to make up for lost dreams.

Emotional safety valve

Apparently, people need to dream—perhaps as a way to work off the frustration of their instincts in civilized society, as Freud had suggested. These experiments seemed to jibe with the theory that dreams are our emotional safety valve. The function of REM dreams, said Dr. Fisher, is to let "each and every one go quietly insane every night of our lives."

When the emotional safety valve gets clogged by REM deprivation, the emotional pressure apparently builds up. According to theory, the hallucinations of REM dreaming then spill over into the waking state. Our sense of reality becomes distorted, leading us into unaccountable thoughts and actions.

Added observations bolstered this view. Alcoholics, for example, turned out to have shorter REM periods than other people. So had drug addicts and sufferers from depression and chronic fatigue. One explanation is that these people just weren't getting the right sort of sleep to cope with their conflicts and frustrations. Since they were unable to work off their emotional load in quiet little REM orgies, they ap-

(Please turn to page 214)



AUDI with front-wheel drive might be most advanced compact under \$3000 if sold in America

Good Cars You Can't Buy

The automobiles shown are from Europe, Britain and Australia. Some are from companies that send us other models. Some are outstanding; nothing's wrong with any of them. But they have one thing in common—you can't get them here

By TONY HOGG

IN CANADA the biggest selling imported car is the Vauxhall, but you can't buy it in the United States. In Australia the most popular car on the road is the Holden, but you can't buy it in America. In Germany the Auto Union company, jointly owned by Volkswagen and Mercedes-Benz, puts out a very advanced front-wheel-drive car called the Audi, and—you guessed it—you can't buy it here.

A significant feature of these three

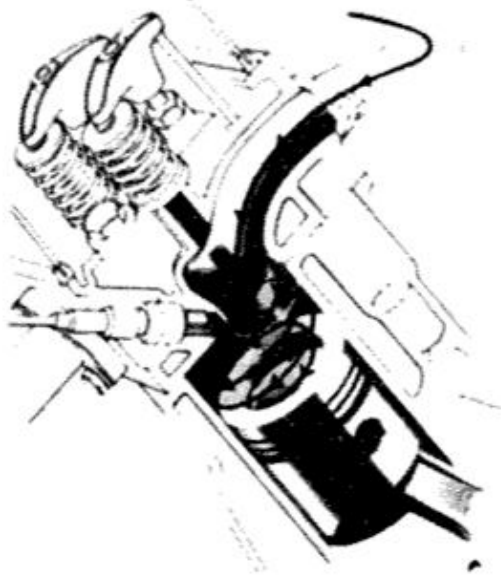
TRIUMPH 1300, same price as Cortina GT in Britain, has less power, but offers 4-w independent suspension

examples of cars you can't buy is that they are all well designed, well built and would be entirely suited to American conditions if sold here.

In fairness to the manufacturers, there's a lot more to selling a car in America than just appointing a few dealers and shipping some cars in. Many makers, dealers and unhappy customers have found this out the hard way. To market a car successfully requires a vast amount of capital. You

GERMAN TAUNUS 15M has V4 engine. Some say it resembles Cardinal, car Ford "almost" built in '62





AUDI gets very high compression ratio, 11.2:1, by casting combustion chamber in piston top, not in head

have to set up dealer sales and service, provide parts supplies, train mechanics and bring over factory representatives.

Vauxhall, a British company wholly owned by General Motors, builds a range of cars with engines from 70.7 cu. in. to 201 cu. in. The most popular model is the Viva, which would compete here with Volkswagen's familiar Beetle as far as price is concerned. The Viva is a stylish, sturdy little sedan built on a 95.8-in. wheelbase and powered by a 70.7-cu.-in. engine with an output of 56 hp. An optional engine of the same capacity but with an output of 69 hp is available in the fancier Viva SL, which also offers optional disc brakes in front, better interior trim. With these options the SL would likely

VAUXHALL VIVA, built by General Motors in Great Britain, shows American style appeal, offers snappy performance with 70.7-cu.-in. engine. But GM obviously figures one small import, German Opel Kadett, is enough

sell here for just over \$2000. The bigger Vauxhalls include the Victor 101 and VX 4/90, both with a 97-cu.-in. engine and a 100-inch wheelbase, and the Viscount, a 201-cu.-in. Six on a 107.5-inch wheelbase.

The Vauxhall was sold in this country during the late '50s through Pontiac dealers. Many buyers felt that their cars were not being backed by an adequate service and parts organization. GM stopped bringing Vauxhalls over in 1960, leaving the existing cars as "orphans" and their owners even more unhappy.

GM also owns the big Opel complex in Germany. Its policy is to sell the Vauxhall in Canada and the Opel in the United States. In this way GM does not have to have two dealer, parts and service organizations in the United States; neither does it have to compete against itself for the small-car market.

However, the only Opels you can buy in this country are the Beetle-size Kadett and the Rallye (a souped-up, sporty Kadett). In Europe, Opel offers the Rekord and Commodore, both on a 105-inch wheelbase, and the 112-inch Admiral and Diplomat. The latter, a luxury job designed to compete with middle-of-the-line Mercedes, is powered by Chevrolet's standard 283-cu.-in. V8, with Chevy's 326-cu.-incher as an option. Although the deluxe Opels offer a higher standard of interior fixtures and fittings than most Chevrolets, GM would still be competing





OPEL ADMIRAL with 170-cu.-in. six compares with Falcon in size, performance. Fancier Diplomat gets 124 mph out of 283-cu.-in. Chevy V8 with automatic transmission, more speed than any U.S. Chevy but Corvette

against itself if it brought them in, and prices would be in the Pontiac range.

Another car GM wants no part of in this country is the Holden. Designed specifically for the tough Australian country, which in terms of distance and climate is much the same as ours, the Holden is a rugged, nicely styled automobile powered by a 6-cylinder engine of either 161 or 186 cu. in. At 106 inches, the wheelbase is exactly the same as the Rambler American. With the 186-in. engine, the Holden is approximately the equal in performance of the American. Recently Holden began marketing a tough little car called the Torano. Basically it's a Vauxhall Viva beefed up structurally for tough Australian roads. It ought to be quite an automobile.

Volkswagen has always been cautious about introducing new models in America, and as a result has always

TOP BRITISH FORD, THE ZODIAC, has disc brakes all around—not even an option on American Fords



had to combat a certain amount of bootlegging. So far, Americans are denied the VW 1500 and 1600 notchback sedans. In my book these are more practical cars than the 1600 fastback, which is sold here.

Somehow foreign manufacturers all seem to labor under the delusion that fastbacks are what sell in America. Perhaps the reason that the notchback is not imported is because, while it's good looking, it looks entirely too conventional. VW knows only too well that it will lose its mystique once it becomes conventional—homely, yes, but conventional, definitely not.

Volkswagen also holds back on the 1600 Karmann Ghia, which is one of the sharpest looking small, sporty cars built today. The body of the KG has been completely restyled for the 1600 version, with some traces of Corvair about it, and it is 5.5 inches longer

HOLDEN, Australian "Chevrolet," has same wheelbase as Rambler American, 2 inches less than Corvair





RENAULT 16, bigger, more advanced than models sold here, has front drive, 4-wheel independent suspension

overall than the 1500 model we get here, although the wheelbase remains the same at 94.5 inches. The mechanical components are basically the same as in the 1600 fastback, which means an increase in power from 53 hp to 65 hp. Although 65 hp is not terribly impressive, the percentage increase in power is substantial. Acceleration is improved considerably, and the car is easier to drive because the improved pulling power at low and medium engine speeds assists hill climbing and eliminates a lot of shifting. The KG 1600 is available in England, where it sells for about 25 percent more than the 1500. It sells for about \$2250 at the factory, which means the price would be around \$2700 if it were sold here. But VW does very well in the United States with the older model and presumably doesn't want to kill it off. In fact the home office declined to give *PM's* German correspondent a photo of the 1600.

The Audi is something else. Introduced last year by Auto Union, now jointly owned by Volkswagen and Mercedes-Benz, the Audi combines the best engineering and quality standards of both companies. Its slanted 4-cylinder, 4-cycle engine (Auto Union's old DKW had a 3-cylinder, 2-cycle engine) is of very advanced design which gives 94 hp from only 103.3 cu. in. A

remarkably high compression ratio, 11.2:1, is achieved by casting the combustion chambers into the piston crowns, rather than in the cylinder heads as is traditional.

The power from the Audi engine is taken from the front of the crankshaft through the clutch to a transaxle, and then to the front wheels. Disc brakes are mounted inboard at the front on the differential, not on the wheels. VW, which builds Audis alongside Beetles in its modern new plant in Bavaria, announced about a year ago that it would sell Audis in America, but we haven't heard a word about it since. VW doesn't encourage Americans to buy one at the factory, but if you insist, the price is around \$2000.

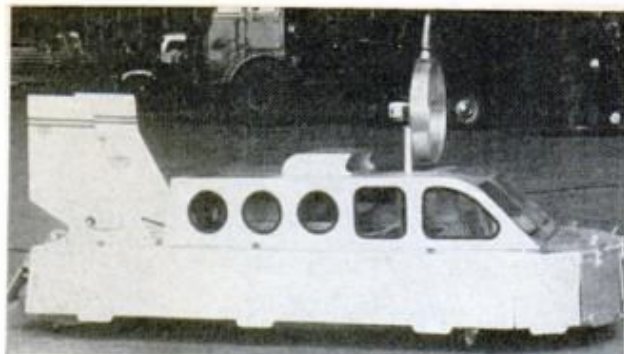
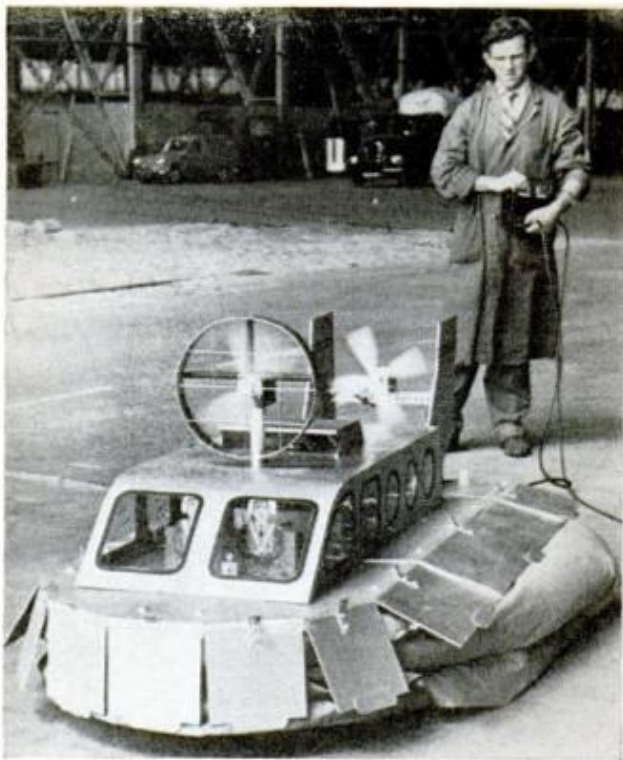
The Triumph 1300 is another front-wheel-drive job. But in the Triumph the power from the 79.2-cu.-in. engine



VW NOTCHBACK catches eye of Americans in Europe, but VW keeps it there, sends us fastback, squareback

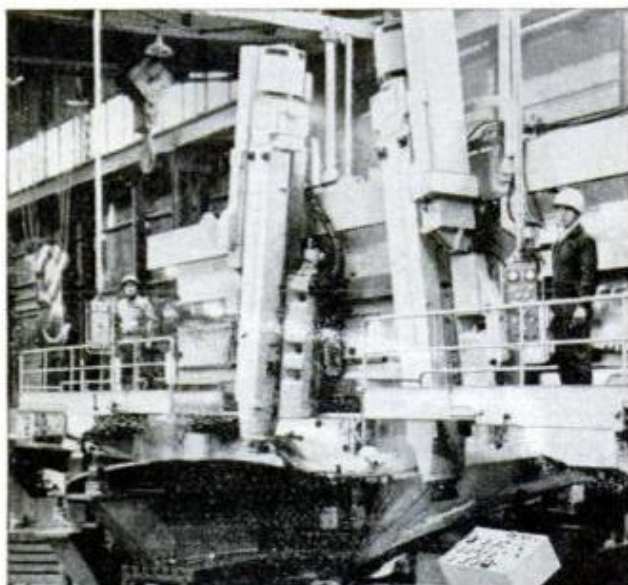
is taken from the rear of the crank to the clutch, and it then passes forward to a transaxle located underneath the engine which drives the front wheels. In contrast to the English Mini cars, whose front-drive engines are mounted transversely, the Triumph engine and transmission are separated so that the oil in one does not contaminate the oil in the other, and the correct grade of lubricant can be used in each. The Triumph is very well appointed indeed, which means that it would have to sell for around \$2700 in America. Triumph feels that the price is too much for the size and performance of the car. The Audi would be in the same price range as the Triumph, but it offers more car and more performance for the money.

(Please turn to page 211)



Low hemline for trucks

Able to shift from wheels to an air cushion, a proposed new truck, the Hoverlorry, has reached the working-model stage. The idea of a group of research workers at the Royal Aircraft Establishment, London, the truck would ordinarily be narrow enough to travel over roads on its wheels (upper right). With the push of a button, its hinged side flaps would move up as the air cushion forced out a rubber skirt (left). With the skirt fully expanded (lower right), the craft would be ready to travel on its air cushion.



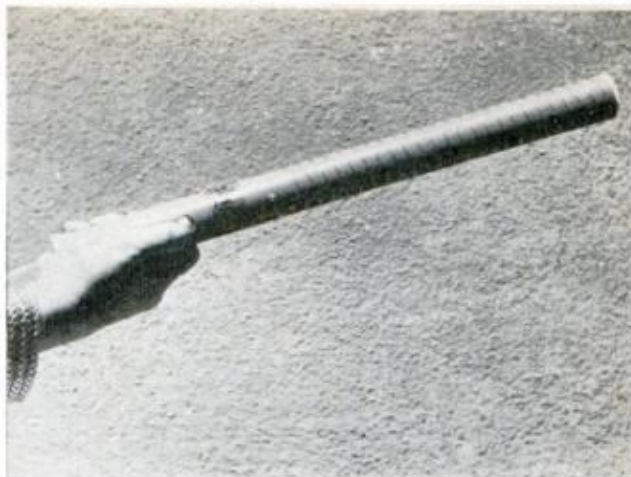
New shape in shapers

Giant propellers—up to 26 feet across—are being shaped by a computer-controlled machine in a Kobe Steel, Ltd., factory in Japan. The machine automatically processes the surfaces of propellers into designated shapes, receiving its instructions from a computer fed with numerical data.



But don't go near the water

A father, anxious to train his daughter to be a champion swimmer even though they don't live near a pool, developed a swimming machine that enables her to work out on dry land. Through systems of pulleys, she can now practice her stroke and kick—and, hopefully, develop championship form.



Stick with a kick

Even a lady can wield this new nightstick effectively because it takes only a light touch to discourage a would-be thief. That "light touch" yields a 12,000-volt jolt of electricity—not lethal, but enough to "throw anyone back," according to the German manufacturer. Power is supplied by four batteries and a transformer. A touch of a button sends current through copper wire that's wrapped around the outside of the stick.



Soviets have swing-wings, too

Appearing in a recent air show at Moscow's Domodedovo Airport was the single-engine Mikoyan variable-sweep fighter, with its wings in swept position (left) and in forward position.



Re-starts hearts

Operated like a hand pump, the Cara Cardiac Press brings a plunger to bear on a patient's chest at a rate of 50 to 60 strokes per minute to restore heartbeat after electrical shock or other accident has caused heart arrest.



Replica of Confederate sub

A full-scale replica of the Confederate submarine *Hunley* was recently built and placed in a branch of the Charleston (S.C.) Museum. The original 40-foot sub, a converted boiler, sank as it torpedoed a Federal warship in 1864.

Keep a grip—on yourself



PSYCHOLOGIST: This type of driver is lacking in self-confidence. He is apprehensive, indecisive, has poor self-control and is likely to be unstable.

DRIVING EXPERT: Total disaster! Anyone who drives with his hands in this position is inviting accidents. He can't control the car accurately.



PSYCHOLOGIST: A tense, obstinate sort of person, but also determined. This type of person is possessive, ungenerous and uncompromising—the kind who will defend his rights on or off the road.

DRIVING EXPERT: Very dangerous grip. First of all, it's a very tiring position to hold the hands and arms in, and it leads to a loss of concentration. Also, it hides the instrument panel.

The way you hold a steering wheel reveals a great deal about your personality as well as your driving skill

IT'S LIKE THE WAY you dress. Some people put on the left shoe first every morning, some the right. In driving, different people have different ways of gripping the steering wheel. Psychologists claim this tells something about the driver's character. To find out, the subject was discussed with a London psychologist and a hard-nosed road-safety expert, who was interested, not in the psychology of the grip, but in its practicality.



PSYCHOLOGIST: This grip indicates a definite, purposeful person, but one who is also a little pessimistic and suspicious. He knows where he's going, but he isn't sure about anyone else.

DRIVING EXPERT: The spokes of the steering wheel are for supporting the wheel, not for the driver's hands. Besides, the position is tiring on the arms and limits the turning power.



PSYCHOLOGIST: This indicates a sporty individual, full of vitality, alert, thinking ahead—a person who enjoys driving for driving's sake.

DRIVING EXPERT: Not good. The driver should always hold the steering wheel with both hands. While this type of driver is alert enough to cope with emergencies, he's also inclined to take chances.



PSYCHOLOGIST: An overconfident person, probably left-handed, too. He's not very punctual but, by and large, a good-natured sort.

DRIVING EXPERT: A lazy, sloppy driver. Car doors are made for getting in and out, not for leaning on. Always hold the steering wheel securely with both hands. Lazy drivers are dangerous.



PSYCHOLOGIST: This position shows the relaxed driver, the relaxed person in general. He's friendly, full of understanding.

DRIVING EXPERT: Another lazy driver, but not as bad as the one above. It's still dangerous, however, and could lead to accidents. It is not a good position and not recommended for safe driving.

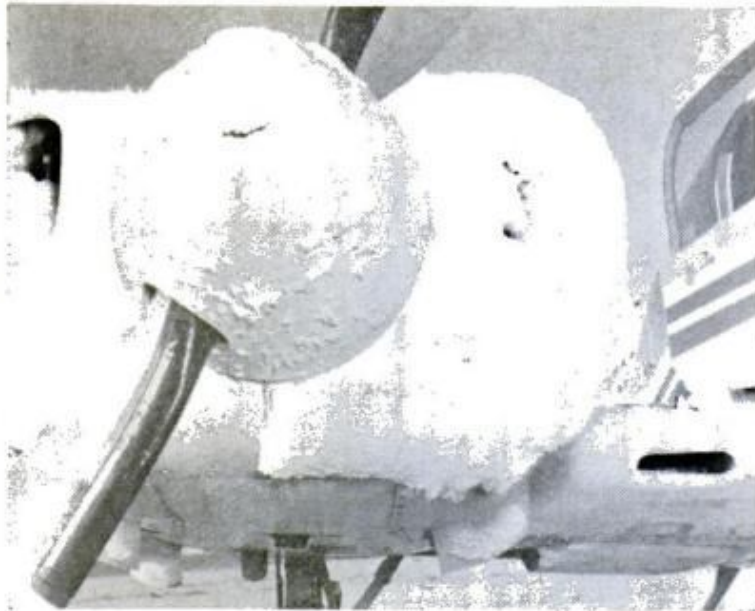
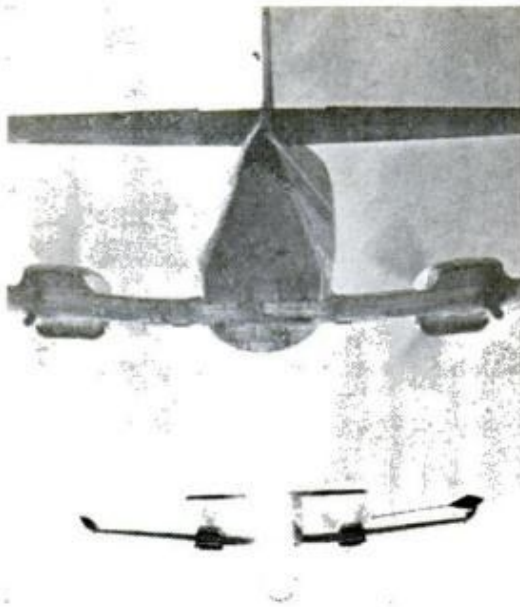
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PSYCHOLOGIST: This type of person is well disciplined, confident and controlled. Very sure of himself. Takes no chances, on or off the road.

DRIVING EXPERT: Just about right. The steering wheel is held lightly, but firmly, aiding control in either direction. This is the position of hands on the steering wheel that all drivers should copy.

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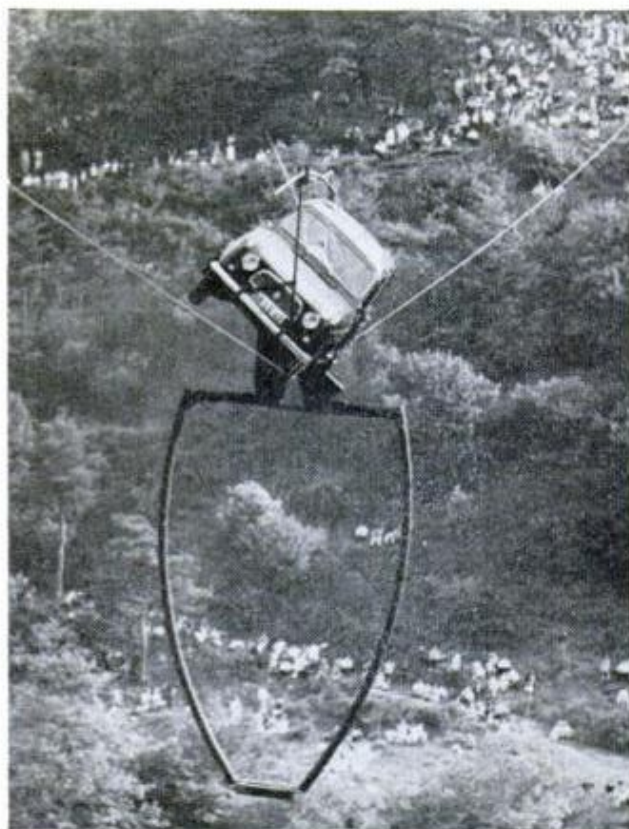
'Tanker' provides foul weather in fair skies

Cessna Aircraft Co. engineers can produce precipitation any time they need it to test deicing and rain-removal devices on airplanes. They have a specially equipped model 411 that carries 250 gallons of water—which it discharges through a 14-foot boom. Flying behind this "tanker," the plane undergoing the tests (left) gets drenched by an artificial rainstorm. When the outside temperature is 5° to 15° F., ice builds up on the test plane (right).



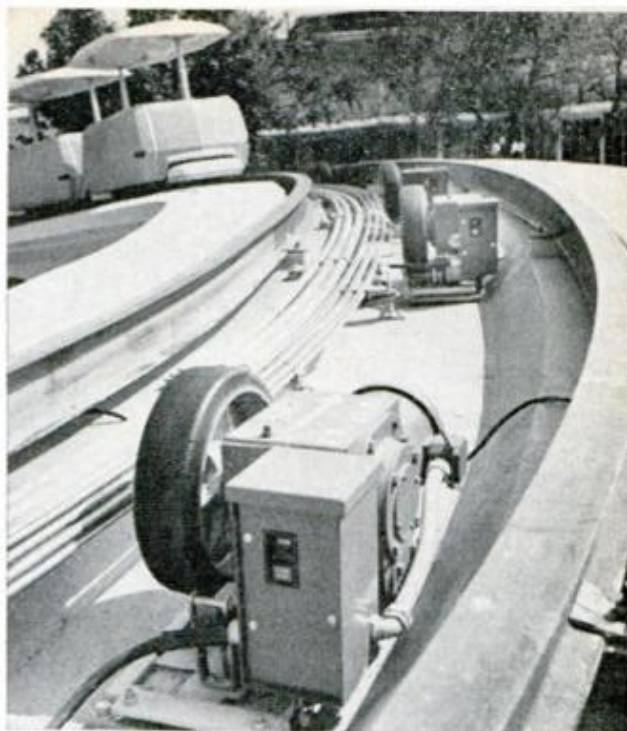
Takes two to Pogo

The "rocket belt"—formerly a one-man flying machine—now comes in a two-passenger model called the Pogo. It's shown here during a test at Niagara Falls airport. The maker, Textron's Bell Aerosystems Co., says that the new vehicle can be used for transportation either on the Earth or the moon.



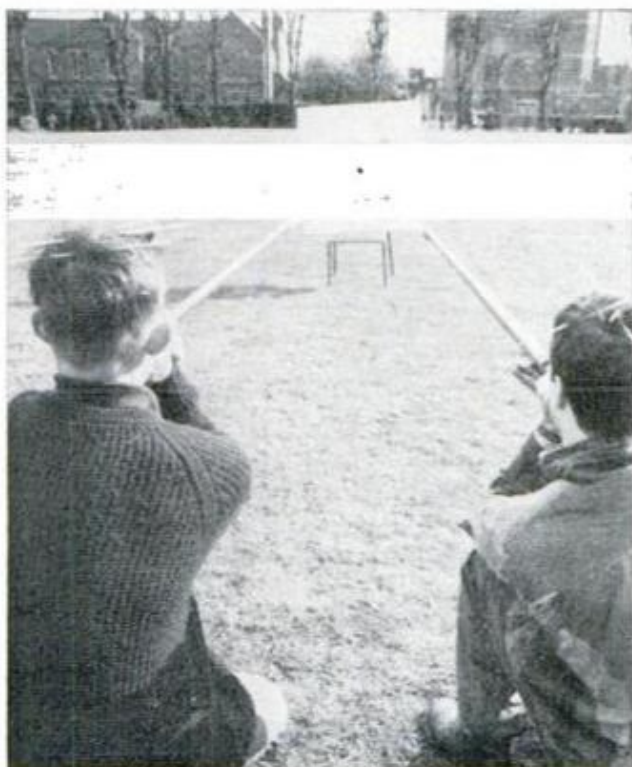
And the traffic's not heavy

If you're running out of interesting trips to take in the old bus, you might try a run across a single cable, as these two French daredevils are doing. Their Renault, balanced on two wheels, traveled a 1600-foot cable some 390 feet above a valley. Even though it's a short trip, it's reasonably exciting.



You hardly take a step on the PeopleMover

The new Goodyear PeopleMover can carry 4885 sightseers per hour on a three-quarter-mile trip through Disneyland's Tomorrowland. Passengers come up into the center of a revolving loading platform via conveyor belt. From the platform, they step into cars (left) which move out onto a "glideway," an elevated roadbed where 517 electric-motor-driven wheels (right) propel the cars up to 7 mph. The trip ends back at the revolving platform.



Next the Olympics?

Here's a way to achieve immortality: Become world blowgun champion. Don't know who he is? Neither do we—but he might be this British Army private or police cadet, shown practicing for the world event at Surrey, England.

NOVEMBER 1967



Biggest little town

Biggest miniature town in Europe is Dusseldorf's Minidomm, a 20-acre park containing some 2000 models of historical and modern German buildings built to 1/25th scale. In the foreground is Rothenburg's town hall.

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Baja and Back —on a Honda!

How rugged can a road test get?

By DOUG RICHMOND

THERE ARE about 950 miles of road between the Mexican cities of Tijuana, at the U.S. border, and La Paz, near the tip of Baja California. About 238 of those miles are nice, smooth, two-lane blacktop. But the remaining 712 miles are about as different from a paved road as one can get and still make it through with a wheeled vehicle. Those "roads" are two-rut nightmares with steep grades—up to 20 percent—sandy flats where taking it easy means getting stuck, large round rocks, small pointy rocks, bedrock and every combination thereof.

One of the very best motorcycle racers in the country, riding straight through on a lightweight machine, managed to ride the one-way distance in a bit over 49 hours—a record attempt that averaged less than 20 mph! I didn't ride straight through on the way down (preferring to sleep at night), but I spent about 50 hours on the narrow seat, which meant driving hard during those daylight hours. And then I turned around and came back!

My machine was a "street scrambler"—a peculiar breed of motorcycle. Basically, it's a street machine that the manufacturer has equipped with semi-knobby tires, high pipes, a skid or "bash" plate, and a few odds and ends for people who like to go boondocking now and again but who don't really do enough of it to warrant keeping a special bike for the purpose. This defines the 161-cc Honda Scrambler CL-160 that carried me through the dust of Baja California.



ROCK DODGING is futile on the typical two-rut Baja California road, I found. You've gotta hit some of them, and if you don't learn to ride 'em, you're out

By definition a street scrambler has to be sturdy: A broken-down bike three canyons from the nearest road is far from funny; many riders of dual-purpose cycles don't have the experience to know just when to take it easy, and novice riders have an alarming tendency to drop their bikes hard.

Unfortunately, many manufacturers have yet to realize just how tough these machines should be, so when I unloaded the little Honda CL-160 at the border at Tijuana I had definite misgivings as to whether the bike would stand the gaff. After all, a lot of advertising hay has been made about motorcycles and trucks even surviving the trip one way, and here I was proposing to test an unfamiliar bike.



BAJA CALIFORNIA isn't just a peninsula: To the cyclist it's one whose sticks-and-stones roads will break your bones (if they don't get your bike first)

My spare parts consisted of a set of extra control levers; clutch, throttle, and front-wheel brake cables; two sparkplugs; and a few chain repair links. Tools were those that came with the machine plus an adjustable wrench, cam-locking pliers and tire pump.

The bike itself had about 750 miles of breaking in and was fitted with a new Dunlop K-70 front and a Trials Universal rear tire as a good cactus-proof combination for this country. Another preparation took the form of a luggage carrier that started the trip but didn't finish (more about that later). Otherwise the points were set, the plugs gapped and all nuts and bolts tightened.

Considering engine displacement, the

CL-160 is a lightweight, but it actually weighs about 280 pounds ready to go, about the same as some bikes of more than twice the piston displacement. With luggage and rider, the little 161-cc engine would have to hoist more than 500 pounds over the hills.

On the road, I soon discovered that as long as I kept my speed above seven or eight mph, the little engine had no trouble at all with its big load. When the ruts were so bad that the speed dropped below this, or when on a hill, or when I had to stop to get off the road for a burro train, all that was necessary to keep headway was to wind up the engine, use the clutch for a torque converter, give a little push with the foot and away we'd go!

This trick wasn't used too often, but I was still surprised that the clutch never required adjustment and showed no signs whatsoever of slipping. In fact, it occasionally did just the opposite: When good and hot, it had a tendency to drag a bit.

On the extremely rough stretches, the forks bottomed now and again, making a horrendous "clank." But I'd been told by lads who race Hondas that

LOCAL 'SERVICE STATION' fueling the Honda CL-160 is a plastic detergent container. Bike with a less-than-effective filter system wouldn't get you far





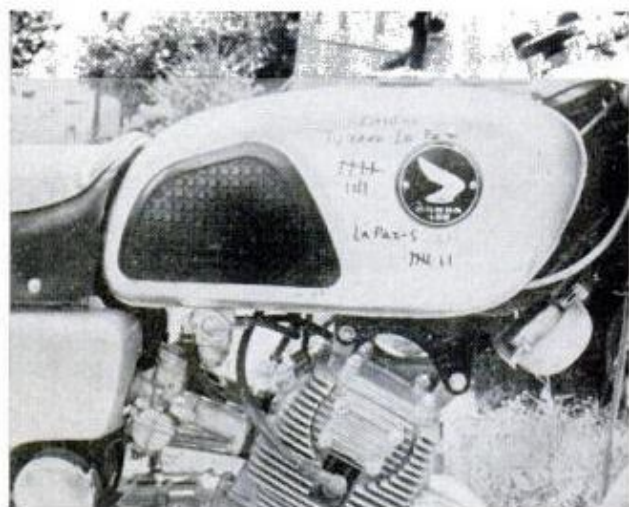
CUESTA DEL INFIERNILLO is Spanish for Hells Hill—a good place to stop frequently to check for loose nuts and fastenings, one of the preventive measures that kept the road to La Paz free of one downed cyclist

this is quite normal and might as well be ignored since the forks are just about indestructible. Nevertheless, the noise worried me for the first thousand miles or so.

The instruction book said that the adjustable rear suspension units were to be turned to the second or third position for use with heavy loads or on rough roads, so at the end of the main highway below Ensenada I dutifully wound 'em 'round.

Eighty-five miles of progressively worse road brought me to Rosario—the first of two towns with identical names—with never a sign of the suspension units bottoming; my back was just a bit sore from the stiff ride. Figuring the suspension units should be as husky as the forks, I set 'em back in the soft position before starting out the next morning. Sure enough, they bottomed occasionally, but showed no symptoms of damage or fatigue in all the hard going.

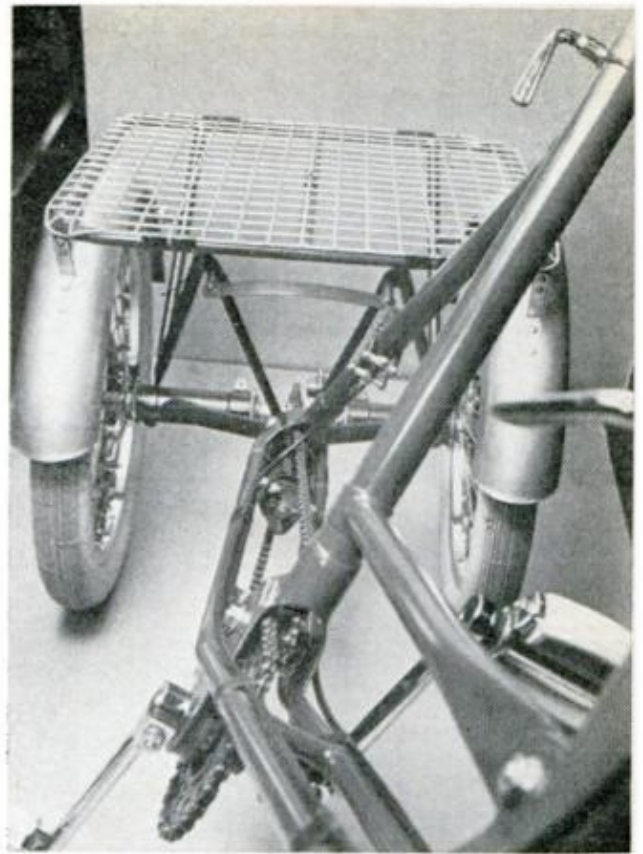
On the way south I overnighted in Muleje and awakened in the night to the sound of a tropical downpour. It didn't rain long, and in the morning I arose to clear skies and a sea of mud.



'AND I LIVED TO TELL ABOUT IT' is a well-worn story line and is also the story inscribed on the fuel tank, where I chalked up my impressive record of tumbles

Although I waited until almost 10:00 o'clock before pulling out for Comondu, the road still alternated with patches of sand, rock and mud. I'm not embarrassed to say that I fell off the bike in every piece of muddy road for 10 miles before I gave up and started riding "trails style" on the slick stretches. This is the technique of standing up on the rear pegs and balancing as you go, and it turned out to be a pretty good

(Please turn to page 226)



Double-jointed tricycle for grown-ups

A rotating joint just ahead of the rear wheels of a new English tricycle enables the rider to lean into a turn while the back wheels both stay on the ground. The three-wheeler comes equipped with pedals (right) or with a 49-cc. engine that drives it 30 mph. The manufacturer says that the wheel arrangement gives the cycle the stability of a tricycle with the maneuverability of a two-wheeler.



Roll out the carpet

In case of emergency, the supersonic airliner, Concorde, will be greeted with a foam carpet as it returns to Toulouse-Blagnac Airport from its test flights. A new truck can lay a 30-foot-wide strip of foam over a mile long in 10 minutes.

NOVEMBER 1967

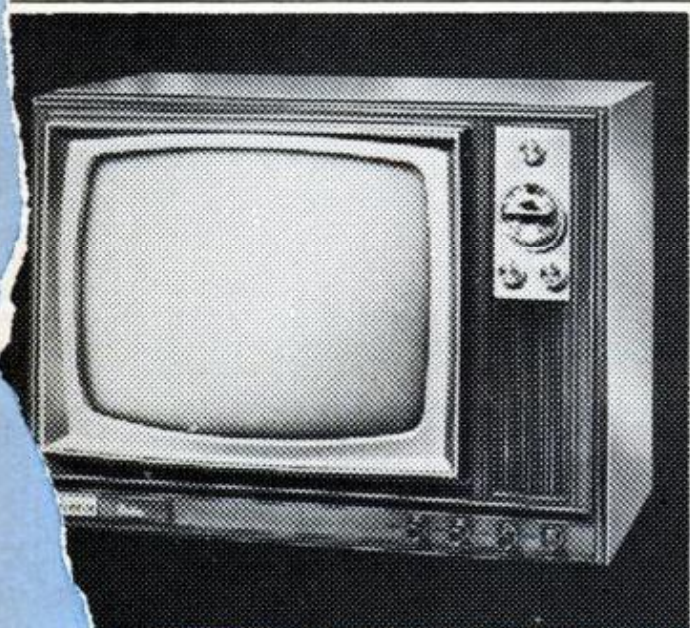


Dial M for money

Tellers in one London bank no longer have to count out bills by hand when they're cashing customers' checks. The teller simply dials the number of bills required, and the machine pops them out—and keeps track of how much went out and how much is left inside.

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Color for \$200?



EMERSON model 35P01 is a 15-inch (117 sq. in.) table model tagged at \$279.95. A deluxe version is priced at \$299.95. Both have one year warranty on all parts and picture tube



GENERAL ELECTRIC model M210HBN, at \$199.95, starts the 10-inch (60 sq. in.) Porta Color series. Top model in series has built-in clock and sleep switch; it's \$269.95

By **BILL HARTFORD**
Electronics Editor

YOU USED TO HEAR people say: "I'll wait until they perfect it." Now this is becoming a thing of the past. I haven't heard it lately at all—and for good reason: Most people are really turned on by the quality of color they see today and tuned in to the fact that color technology has come a long way since the days of the smeared, kaleidoscopic screen.

Still, *price* has been the remaining obstacle to color TV sales. Now this last big barrier is beginning to give

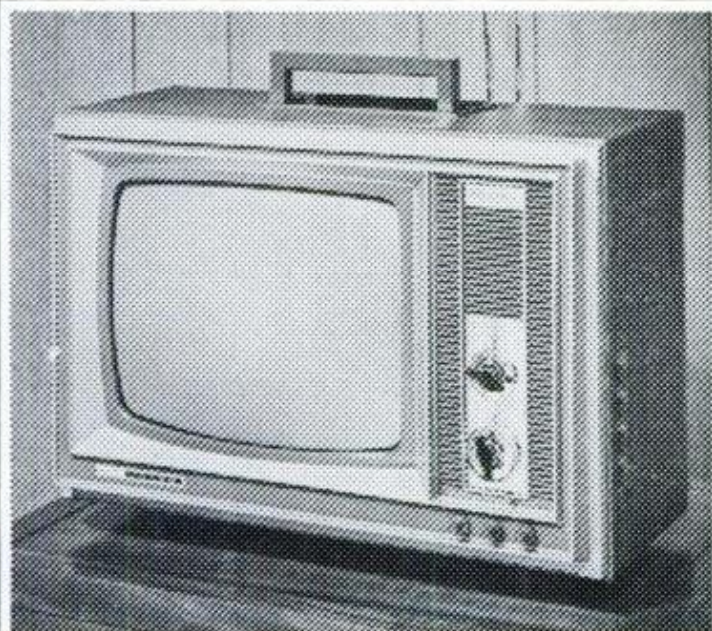
Call on Senate T

way, too. From all indications, 1968 promises to be a landmark year for color TV—the year of the price cut. Already, there's one set—GE's 10-in. Porta Color—priced at \$200, and the last few months have seen a rash of price slashes in larger screen sizes.

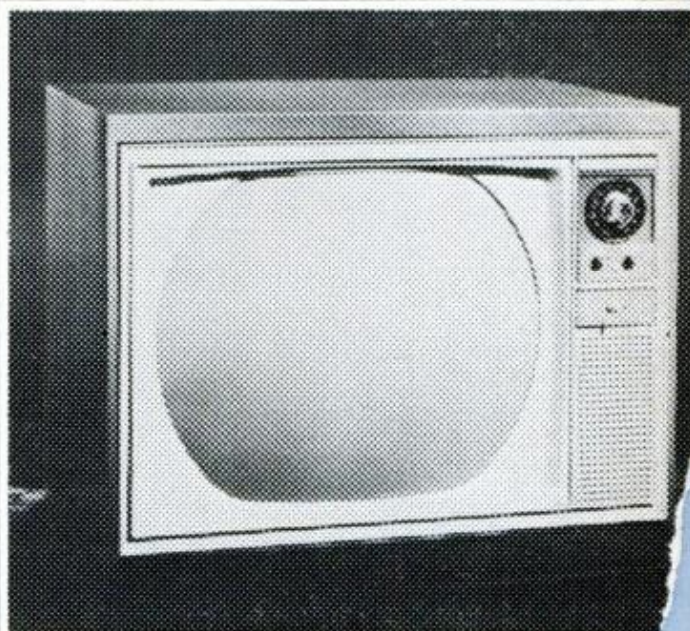
The price cuts in many cases are double cuts since a lot of the \$20 to \$30 drops on 18 and 20-in. sets were lopped off prices established for 1968 that were already lower than those for comparable 1967 models to begin with. Exactly

POPULAR MECHANICS

**Almost a dozen models,
costing between \$200 and \$300,
in screen sizes from 10 to 20 inches,
put color in anyone's ball park
—and price isn't the only news in '68**



SEARS 15-inch (117 sq. in.) portable is priced at \$289.95. It weighs 57 pounds. Another set, an 18-inch (170 sq. in.) table model with legs included also costs \$289.95



PHILCO-FORD model 5239GY has 20-inch round tube (267 sq. in.) and a price tag of \$299.95. Price of this table model is lowest for a color TV in the company's history

QUOTES BY PHILCO-FORD INITIATED

WASHINGTON

where the downward trend will level off is not yet known for sure. A few manufacturers have hinted that they can't afford the new pared-to-the-bone prices and may have to make adjustments. In any case, such adjustments, if any, are expected to be small and are not likely to change the fact that prices for 1968 will be the lowest in the history of color TV.

Expanded production facilities have finally alleviated a several-year shortage of color picture tubes and other

components, increasing the supply and enabling you to almost call your own shots in the showroom. Not only are retail prices that the manufacturer suggests to the dealer down, but in some case they're "open." This lets the dealer set them himself to meet competition.

So, even if you've decided on a TV with a firm suggested price, look around. You may get it at the same price in the next town with a toaster thrown in. This goes for almost any set on the market. Even kits are down in price. You can build Heath's 18-in.

color kit for \$30 less than last year.

\$200 to \$300: Basic color in both big and little screens. There's no arguing that the \$200 price range is the domain of the smaller screen, but not exclusively. Philco-Ford has a 20-in., 267-sq.-in. picture priced only pennies over a buck a square inch. Models using their 267-sq.-in. round tube start at \$300 and are open at the high end.

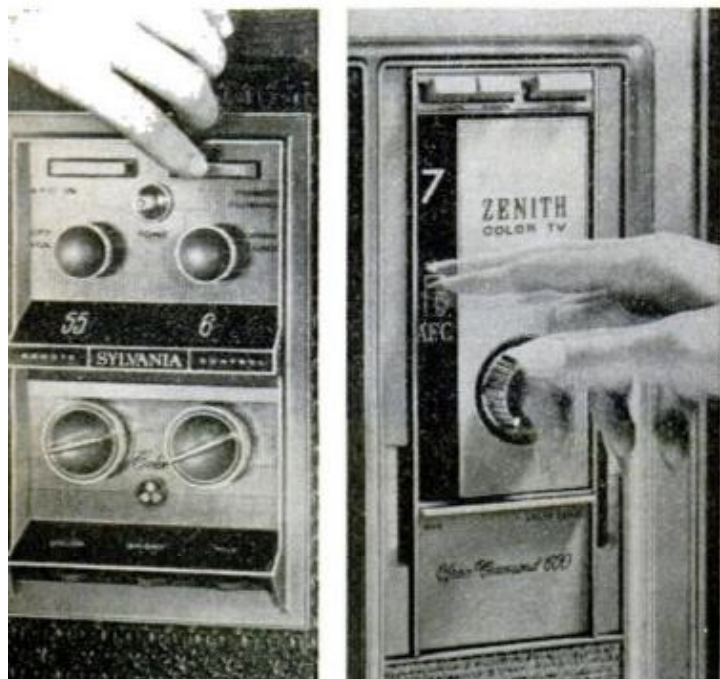
Several 18-in. rectangular screen models also log in under \$300, specifically those from Sears, Delmonico and Olympic. A couple of 15-inchers also beat the \$300 barrier. Smaller yet is GE's 60-sq.-in. Porta Color series, which starts at \$199.95 for the basic portable without carrying handle and built-in antenna. At \$230, the step-up model with antenna, handle and deluxe cabinet is priced less than last year. The new Porta Colors are priced at \$250 and (for the clock-timer model) \$270.

Smallest of the small color sets is Sony's tiny, new 7-in. portable. This transistorized set—recently announced—has not yet arrived at your local electronics emporium. But you can expect to see the "Microcolor" portable in display cases by the spring of 1968. It'll

weigh 18 pounds and will be the first set available with a chromatron picture tube (characterized by a minimum of image washout in strong light). The set is expected to be priced "around \$350." Maybe it'll be closer to \$300.

All of the sets discussed so far, as with most in the 1968 lineup, are what you may call "manual transmission" models. Like driving a car with manual shift, these sets require a little coordination for fine-tuning the best color picture. Most of these sets have "memory" fine tuning—which means the tuning stays put once you've adjusted it—but you still have to do the adjusting by eye to begin with, just as with your conventional black-and-white set. There's nothing difficult about it—it's just that you don't get the help of a tuning indicator.

Tuning indicators tell you when you're perfectly fine-tuned without your ever having to look at the screen. They are becoming increasingly popular, but are a more expensive feature. The best thing of all is automatic frequency control, known as AFC, which is appearing on many higher priced big-screen sets. With AFC, you don't fine-



PUSHBUTTON SIMPLICITY: Sylvania panel has a bar at top for power channel switching, another for AFC fine tuning. More Zenith sets have AFC this year



TOTAL REMOTE CONTROL: Proliferation of easy chair controls includes Magnavox's. It has on/off, 82-channel tuning, volume, color, and auto shutoff

tune at all. An electronic circuit does your tuning automatically—and keeps it. All you do is switch channels.

\$300 to \$450: Bigger screens and more features. The first color TV that a family buys is often the top 23-in. screen size, which is destined for the living room. Smaller-screen color is usually a second TV for a bedroom or den. But in between there's the lively land of intermediate screen sizes—the 18, 20 and 22-inchers, most of which are available with versatility built in: The same chassis comes in either tabletop or console models. Some sets are actually both—being convertible with the use of removable legs. Others—essentially tabletop models—come with roll-about stands.

Some models are available with fine-tuning aids. Andrea and Philco-Ford's tuning aid, for example, is an electron-tube tuning eye that indicates optimum fine tuning when you adjust it to minimize the size of the shadow on the tube face. Setchell Carlson and Motor-

ola's indicator light goes out when you achieve perfect tuning. (Some sets have lights that do not assist in tuning; they only indicate when a color signal is being received.) On GE and Emerson models, you adjust fine tuning until the meter gives a maximum reading.

You'll find more ultrasonic remote controls on more models this year and in most cases that means *fully* remote—you can control from your easy chair every function for which there's a control on your set. Power tuning is also featured on more models. Two pushbuttons—one to increase channel number and one to decrease it—eliminate old wrist-action channel selection. Pushbuttons and simplified tuning dials are also making UHF tuning easier.

More manufacturers are featuring a third color control or switch that allows you to "tint" black-and-white broadcasts. The effect is to give black-and-white pictures the little pick-me-up they need when you're used to lots of color viewing. Instant sound can be

FEATURE-PACKED CONTROL PANEL is on Motorola's new solid-state chassis. Slide controls (1) for volume and contrast and color hue, brightness and intensity are numerically marked so they can be memory set. Indicator light (2) glows when color picture is not tuned properly. It goes out when fine tuning is set for best picture. Pushbuttons and radio-type dial (3) simplify UHF channel selection



NEW FINE-TUNING INDICATOR: Touch of switch on Westinghouse set puts bar on screen. If two bars appear, you're mistuned. Adjust until two merge into one, then touch switch again to remove bar



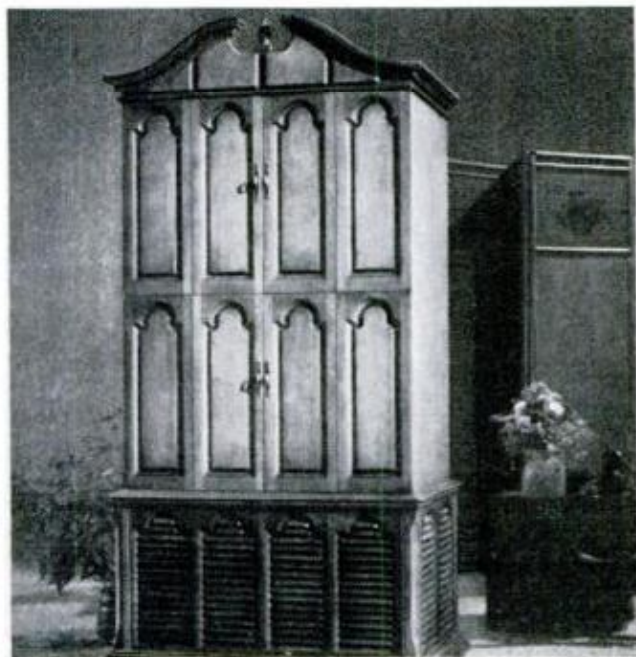
POPULAR MECHANICS BUYER'S GUIDE TO 1968 COLOR TVs

Manufacturer	Screen Sizes		Color Fine-Tuning Aids Available (1)		Mfr.'s suggested prices start at:
	Diag. (in.)	Area (sq. in.)	Visual Tuning Indicator	Automatic Frequency Control	
ADMIRAL	18	180	No	No	\$ 349.95
	20	227	No	No	399.95
	23	295	No	Yes	449.95
AIRLINE (MONTGOMERY WARD)	18	171	No	No	309.95
	23	295	No	No	399.95
ANDREA	23	295	Tuning eye	No	725.00 (2)
	23	295	Tuning eye	No	1025.00
ARVIN	18	171	No	No	389.95
CLAIRTONE	23	295	No	Yes	549.00
DELMONICO/NIVICO	18	176	No	No	299.95
	20	265	No	No	599.95 (3)
	23	295	No	No	599.95 (3)
EMERSON/DUMONT	15	117	No	No	279.95
	18	171	No	No	339.95
	20	227	No	No	379.95
	22	268	No	No	Open
	23	295	Meter	Yes	429.95
GENERAL ELECTRIC	10	60	No	No	199.95
	18	180	Meter	No	Open
	20	226	Meter	No	Open
	23	295	Meter	No	Open
	23	295	Meter	No	Open
HEATH	18	180	No	No	349.95 (4)
	23	295	No	No	479.95 (4)
HITACHI	18	171	No	No	349.95
HOFFMAN	18	180	No	No	449.95
	23	295	No	No	549.95
	23	295	No	No	549.95
MAGNAVOX	18	176	No	Yes	339.50
	20	226	No	No	449.95
	20	267	No	Yes	399.90
	22	270	No	Yes	549.50
	23	295	No	Yes	469.50
MOTOROLA	20	226	Light	No	399.95
	22	274	Light	No	699.95 (5)
	23	295	Light	No	449.95
	23	295	Light	No	599.95 (6)
OLYMPIC	18	180	No	No	299.95
	22	268	No	No	349.95
	23	295	No	No	Open
PACKARD BELL	18	180	No	No	369.95
	23	295	No	No	499.95
PANASONIC	14	113	No	No	379.95
PHILCO-FORD	18	172	No	No	399.95
	18	180	Tuning eye	No	379.95
	20	227	Tuning eye	No	479.95
	20	267	Tuning eye	No	299.95
PILOT	23	295	Tuning eye	No	499.95
	18	171	No	No	349.95
	23	295	No	No	750.00
RCA	14	102	No	No	329.95
	18	180	No	No	369.95
	20	227	No	No	399.95
	23	295	No	Yes	469.95
SEARS/SILVERTONE (SEARS ROEBUCK)	15	117	No	No	289.95
	18	170	No	No	289.95
	23	295	No	No	389.95
SETCHELL-CARLSON	18	180	Light	No	499.95
	22	270	Light	No	659.00
	23	295	No	Yes	689.00
SHARP	18	171	No	No	370.00
SONY	7		Expected Availability Spring 1968		
SYLVANIA	18	180	No	No	329.95
	20	227	No	No	399.95
	23	295	No	Yes	449.95
SYMPHONIC	18	176	No	No	399.95
TOSHIBA	15	117	No	No	329.50
WESTINGHOUSE	18	180	No	No	399.95
	22	270	No	No	449.95
	23	295	On-screen bar	No	459.95
ZENITH	18	180	No	No	369.95
	20	227	No	No	399.95
	23	295	No	Yes	469.95

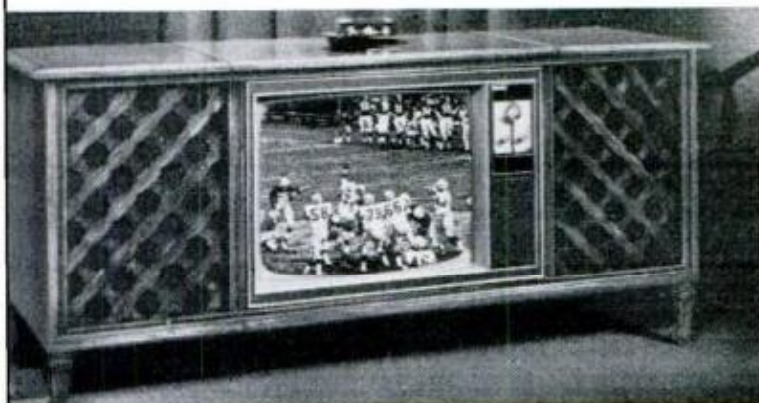
(1) Where indicated, not necessarily available on all models in specified screen size; (2) Chassis only (for custom installation); (3) Includes AM/FM stereo, phono and built-in bar; (4) Chassis in kit form with variety of cabinets available; (5) Includes AM/FM stereo and phono; (6) All solid-state except picture tube & rectifier.



SPACE-AGE "THEATRE IN THE ROUND" is a 23-in. color TV, AM/FM stereo and phono unit from Andrea. It swivels 360°, has a 5-year guarantee, is \$1995



HIGH COLONIAL HUTCH from RCA is a leading example of many fine furniture offerings in '68. HJ-873 is \$1600, has 23-in. color TV, AM/FM stereo and phono



SPANISH CONVENTIONAL CONSOLE is Philco-Ford's 6944SP Home Theatre. The \$900 fine furniture unit houses 23-in. color TV, AM/FM stereo and phono

had on many sets using transistors or integrated circuits in their audio sections, and warm-up time for the picture is being cut down to seconds by such techniques as feeding a trickle current to the tubes when the set's off.

\$450 to \$600: Biggest screens and biggest features. Sets with the 23-in., 295-sq.-in. rectangular tube are the giants of color viewing and their chassis are the ones lavished with the most features. Some are tabletop types, but most are consoles with everything from pop-out panels to tambour doors.

At the bottom of the price bracket are the 23-in. "standard shift" models of most manufacturers (as well as feature-loaded smaller screen models, a good example of which is an 18-in. model from Magnavox with power tuning, remote control and "Automatic Color" fine tuning for \$449.50).

But when your budget goes over \$500, look for the features mentioned as well as a tuning indicator or AFC. AFC may go by different names, but make sure that whatever it's called it means that fine tuning is accomplished with the flick of a switch.

A new tuning indicator this year is the Westinghouse on-screen tuning bar. Unlike other indicator types, the on-screen bar allows you to observe the picture as you tune.

Motorola has the first solid-state color chassis on the market. The solid-state components, which provide both sound and picture in a few seconds, are mounted on circuit boards that comprise 10 plug-in modules for easy servicing of the front-removable chassis (page 112, Oct. '67 PM). The solid-state models start at \$600, a good \$100 over Motorola's comparable tube sets, but increased reliability and less servicing should pay the difference in the long run.

\$600 and up: A lot of electronics in woodworking wonders. It's a long jump from \$200 color to the cost of top-line consoles and the increasingly popular entertainment centers that offer more

(Please turn to page 256)



Gordon Johncock Tests AMC's JAVELIN

I'M TOLD that when I first saw the car, I said, "Oh, that's nice."

It was. Parked in the experimental garage at American Motors' Burlington, Wis., proving grounds, the Javelin had the kind of low, racy look I like in a car. And now that I've driven it, I can add a plus for performance.

I found the Javelin—particularly the version I tested—a nice, all-'round blend of features I imagine will appeal to a lot of car buyers. We'll hit the details later on, but basically this new one from

AMC stacks up as a roomy, comfortable, peppy and handsome example of a so-called "pony car," the type of automobile that's showing up more and more on U.S. highways.

The car's good looks aside, however, it was out on the proving grounds that the Javelin really surprised me.

I've always had the idea AMC made nice "Mom and Dad" cars, period. It never crossed my mind that the company might be interested in racing, even though a six-cylinder Rambler

GORDON JOHNCOCK, a native of Hastings, Mich., has charged to the forefront of USAC championship car racing over the past few years. He finished third in championship point standings last year, ranks fourth so far this year. A graduate of both stock car and modified racing ranks,

Johncock finished fifth in his first Indianapolis "500" in 1965, fourth in 1966. At Indy this year he qualified at 166.55 mph, then spun out late in the race to finish 12th overall. Early this past summer he won the 150-mile Rex Mays Classic at the Wisconsin State Fair Grounds.



I LOOK LIKE a guy with my first car, don't I? In a way, this Javelin recreated a lot of my "first car" fun
SPORTY LINES of Javelin are emphasized by wide "rally" stripe along top of fenders, doors in SST version



engine showed up at Indianapolis this year. When I learned AMC is serious about placing the Javelin in competition, I found myself grinning from ear to ear; I'm all in favor of racing, and the more companies that are in it, the better.

But before anyone charges off to the racing wars with the Javelin, they're going to have to make a few changes.

The car I tested was an SST equipped with AMC's "Go" package. This includes a heavy-duty sway bar, heavy-duty shocks and springs, wide-rim wheels, wide-tread tires, dual exhausts and power disc brakes up front.

The car was powered by a 343-cu.-in., 4-bbl. V8 that puts out 280 hp at 4800 rpm. This is more than enough for average highway use, but not enough for racing. I understand the company has a new 300-plus-hp, 390-cu.-in. engine in the works. This new engine should make the car much more competitive in the various sedan racing events in which it will be entered.

Another thing AMC will have to do is beef up the suspension. Don't get me wrong; the car as is offers good handling and control for average use. But under the stress of racing, a car set up the way my test car was wouldn't make

it. There's just too much body roll.

So let's forget about racing and talk about the Javelin as an out-and-out passenger car.

The first thing I noticed was a pronounced understeer. This makes sense to me. Understeer makes a car easy—or easier, anyway, to control in tight cornering. (The Javelin is a bit light in the rear end, and if this was coupled with *oversteer*, you'd stand every good chance of being all over the lot. As it is, the car doesn't wobble out of a high-speed corner.) It makes the Javelin stable and forgiving, meaning the car tends to straighten itself out if given half a chance. I pushed the car through some tight bends, and while I could feel the tires roll out, I never once felt the rear end was going to break loose.

I also took the car over some pretty rough going. Even on gravel roads, turns and straights, tromping on it and backing off, the Javelin stayed on line and didn't wander from side to side. It gave me a comfortable ride, too.

I found the Javelin's four-speed gearbox to be smooth and easy. Flipping through the gate gave me no trouble.

On the high-speed test track, I got the Javelin up to about 95 mph without

(Please turn to page 218)

ON UNDULATING SURFACE, Javelin didn't "bottom out" despite brisk clip. However, hood latch popped



'Tiger Sharks' Strike In the Vietnam Swamps

The big awkward-looking air-cushion vehicles surprised the Vietcong (and the U.S. Navy) by riding over any terrain at 70 mph, knocking over trees and capsizing enemy sampans.

By Wallace Clouse

THREE ACVs sweep across marshlands, searching out Vietcong terrorists in previously privileged sanctuaries

ON THE WAY to the Plain of Reeds," Mike Vincent said, "the last ACV in the column radioed they thought they had hit a land mine. We didn't stop—we were moving through VC territory.

"Later, we took a look. All we found were some holes in the craft's skin, aft. Nobody was hurt, and there was no structural damage.

"We're not sure it was a land mine, but it takes more than that to stop a skimmer at 60 knots."

That's right. Sixty knots (about 70 mph) across flooded paddies, mud flats mangrove swamps, saw-grass hummocks. ACVs (air-cushion vehicles) can go where even helicopters can't

land. You're down on the ground, churning up spray, carrying 10 or 15 Green Berets and Vietnamese irregulars on the sloping deck. You can plop down anywhere—on hard ground, muck, or water—search sampans and grab prisoners hiding in the reeds—then lift up and streak away.

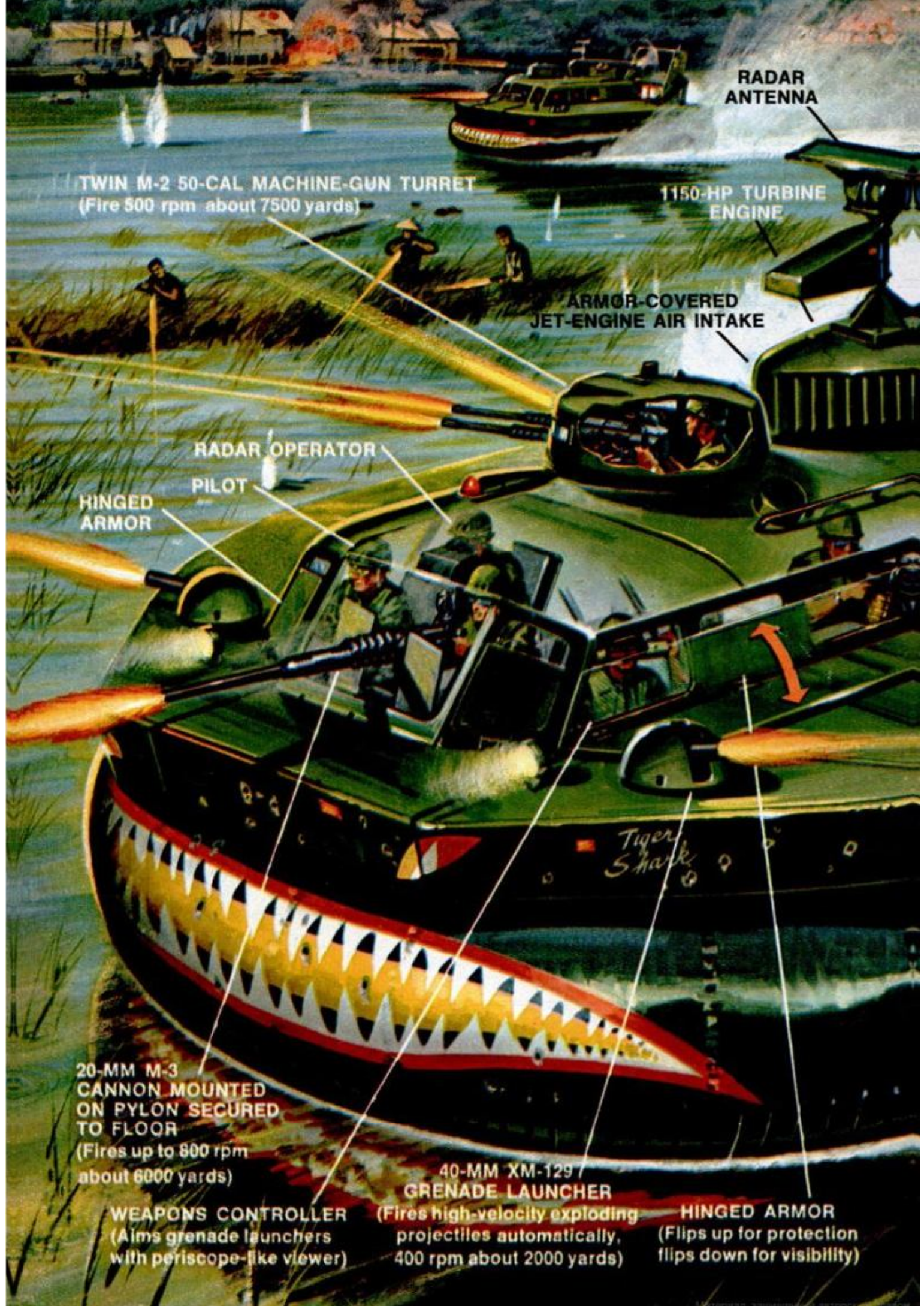
That's what guys who were there say about the U.S. Navy's odd inland mission to test three Bell SK-5 ACVs, armed with machine guns, in action in Vietnam. Lt. Mike Vincent was executive officer of PACV (Patrol Air Cushion Vehicle) Div. 107. Now a civilian, he works for Bell Aerosystems, builder of the skimmers.

Will hovercraft (as they're also

SURPRISED VC (below) surrender. They had never met anything like ACVs which chased them into swamp

ARTIST'S CONCEPT of newest ACVs (next two pages) in full color by Don Evans and Howard Schafer





RADAR ANTENNA

TWIN M-2 50-CAL MACHINE-GUN TURRET
(Fire 500 rpm about 7500 yards)

1150-HP TURBINE ENGINE

ARMOR-COVERED JET-ENGINE AIR INTAKE

RADAR OPERATOR

PILOT

HINGED ARMOR

Tiger Shark

20-MM M-3 CANNON MOUNTED ON PYLON SECURED TO FLOOR
(Fires up to 800 rpm about 6000 yards)

40-MM XM-129 GRENADE LAUNCHER
(Fires high-velocity exploding projectiles automatically, 400 rpm about 2000 yards)

WEAPONS CONTROLLER
(Aims grenade launchers with periscope-like viewer)

HINGED ARMOR
(Flips up for protection flips down for visibility)

5.56-MM XM-134 MINIGUN
(One on each side.
Fires 4000 rpm about 1650 yards)

TAIL ASSEMBLY

MOVABLE RUDDERS
(Control vehicle by directing
blast from propeller)

**DUAL-DRIVE
TRANSMISSION**

**3-BLADED 9-FT
PUSHER PROPELLER**

**7-FT CENTRIFUGAL
LIFT FAN**

BUOYANCY TANKS

STORAGE AREA

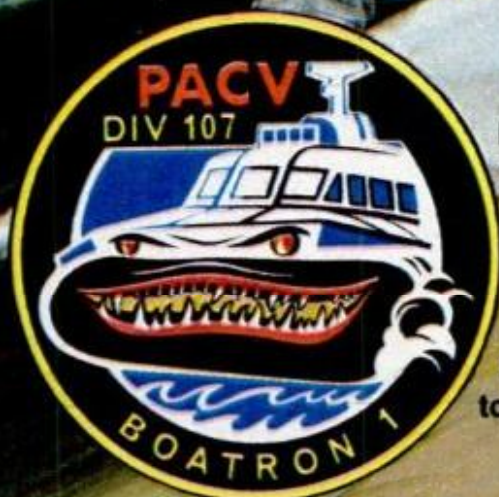
PUFF PORTS

**FLEXIBLE
RUBBER SKIRT**

PLENUM CHAMBER
(Arrows show direction
of air flow)

PUFF PORTS
(For yaw control)

FINGER SKIRTS
(Control air direction
under vehicle)



Floating fortress may look like this when it returns to combat in Vietnam. Planned improvements, shown in this PM version, include increased cabin size for larger crew, special armor plating for crew protection, larger engine for greater speed (up to 60 knots) and payload, finger skirts and puff ports for better control and, especially, devastating firepower to pursue and defeat the Vietcong.

Shoulder patch of first Navy ACV unit, Boatron 1, PACV (Patrol Air Cushion Vehicle.)

known) prove to be the weapons that can sweep the guerrillas out of the waterlogged South Vietnam delta?

"I think the feeling among those who participated in the evaluation is that as long as the engine keeps running there isn't anything you can't do with the craft," Mike told *PM*.

The big, awkward-looking pancakes surprised a lot of people by turning out to be rugged fighting machines. The Vietcong were shocked when the skimmers came crashing through the reeds, destroying their supplies by running over their hidden sampans and capsizing them. The Navy crews were delighted when they knocked over 20-foot trees. Maintenance mechanics were surprised when they came upon field repairs that crewmen had made under combat conditions such as a flattened beer can used as a shim to fix the steering gear.

The three PACVs—called "Pak-Vs" by their crewmen—were originally assembled in England by the Saunders-Roe Div. of Westland Aircraft. They were modified and "Americanized" (fitted with standard U.S. compo-

nents) by Bell, which has the U.S. license to manufacture them.

They were armed with twin .50-cal. machine guns mounted in a turret in the cabin roof, plus two 7.62-mm. machine guns in helicopter-type mounts, firing from the side windows of the cabin. High-resolution radar is standard on the SK-5s. This enabled the ACVs to run without lights at night.

Thirty-nine feet long and 24 feet across the beam, each SK-5 is powered by a single 1150-hp General Electric gas turbine, burning kerosene jet fuel. The engine drives both a nine-foot-diameter pusher propeller and a seven-foot lift fan. The fan forces air downward into a plenum chamber and then through slots around the periphery of the hull to create and trap a bubble of compressed air under the craft's flat bottom. That's what an air-cushion vehicle rides on.

In the SK-5, the air slots are extended by flexible rubber "skirts" that run all around the craft. The increased height of the air cushion raises the SK-5 about four feet off the ground, plus a

(Please turn to page 230)

AIR-CUSHION VEHICLES work closely with helicopters, which spot ground targets for them to investigate



JOBS



WALKIE-TALKIE at the ready, Capt. Grover Sanchagrin directs his tugs as they nurse another ocean liner through New York Harbor

The Man

MORAN TUG nudges luxury liner *Queen Elizabeth* into berth. Next job might involve loaded tanker or a trip to Vietnam



CAPTAIN SANSCHAGRIN, during lull in harbor activity, doffs his coat and relaxes in the wheelhouse of one of tugboats in Moran fleet



from MORAN

Tugboat Annie was a great work of fiction. Today's harbor pilot wears a business suit, uses a walkie-talkie and earns up to \$25,000

By CREIGHTON PEET

Photos by James Pickerell

WHEN CAPT. SANSCHAGRIN barely touches the controls at the side of the *Patricia Moran's* wheel, two giant diesels, which fill up a good half of the space below decks, increase their humming to a roar, and his 108-foot tug leaps forward leaving a whirlpool trail of foaming white water in its wake.

From the 25th floor corner window of the Moran Towing and Transportation Co.'s operations room at the tip of Manhattan, the *Patricia Moran* and her sister tugs—the *Eugenia*, *Barbara*, *Kerry* and others look like wind-up toys churning back and forth over the flat surface of New York Harbor. But

to Grover Sanschagrini, on the *Patricia's* tiny bridge, his tug is a piece of waterborne muscle, capable of tremendous power one minute and of giving a ship a feather-light nudge the next.

Early one morning recently when he sighted the 81,237-ton, 1019-foot *Queen Mary* coming in from the sea out of the mists beyond the Verrazano-Narrows Bridge, he waited till she was abreast of the Battery and then approached her amidships, where her hull is a massive black, flat steel wall. Running parallel with the big ship still under her own power, Sanschagrini gradually slid close enough to touch



WHITE SHIRT, TIE and homburg typify today's tugboat captain, here on deck of New York-bound liner

her hull with a barely perceptible bump, and adjusted his controls so that both the tug and the liner were running at precisely the same speed.

Turning over the operation of the *Patricia* to mate Harry Hennessey, Sanschagrín prepared to jump aboard the liner. In some cases he can step directly from his deck into a side port—a door opened in the bigger ship down near the waterline. But the *Queen Mary's* side port is so high that on this occasion he had to use one of the 24-foot wooden ladders he keeps lashed to the tug. With his ladder on the tug's deck and just reaching the side port, he climbed up while the water boiled and foamed between the two hulls below him. Reaching from the *Queen Mary* with outstretched arms were two sailors to pull him aboard.

Sanschagrín, who performs this "act" two, three or four times every working day, confesses that in rough weather, when the tug is heaving and pitching and a high wind is pulling at him, this bit makes him nervous despite his 27 years on the job.

Grover Sanschagrín is a docking pilot, a specialist in moving big ships into and out of their berths. As he steps aboard the *Queen Mary*, the *Rotterdam*, the *Michaelangelo*, or the *United States*, he fools you. There's no Tugboat Annie here. He's dressed in a faintly striped shirt, conservative tie,



TUGBOAT CREW, besides Sanschagrín (right), includes helmsman (left), engineer, deckhand and cook

business suit and, in winter, wears a civilian overcoat and homburg and carries his walkie-talkie in a neat leather case slung over his shoulder.

In a few minutes the *Queen Mary* was ready to move into her berth, and after greeting the ship's captain, Sanschagrín took charge of navigation—although he never actually touched the wheel. Through his walkie-talkie he directed the *Patricia* and the five other Moran tugs involved in the operation, speaking frequently to his mate, Hennessey. Turning from time to time to the liner's captain, he "suggested" steering maneuvers for the helmsman, as the big ship's propellers were still turning slowly. A ship's captain is always in full charge of his ship, something Sanschagrín never forgets.

TUGBOAT FOOD is excellent. Crew is on duty 48 straight hours and sleeps and eats right on board





OIL TANKERS monopolize much of tugboats' time as they're moved from place to place to fuel liners

Captains from some parts of the world can be very sensitive about their dignity and importance.

By now the *Patricia's* powerful diesels, each of which produce 1750 horsepower to drive her twin screws, came roaring into action as she and the other tugs nosed hard against the ship's dead weight, pushing her sideways to her pier. Soon shore lines were thrown

TEN-ROOM HOME was built by Sanschagrin in spare time. Now it's worth twice what it cost to build



down by the ship's sailors, heavy Dacron hawsers were being secured and gangplanks installed.

Sanschagrin relaxed, shook hands with the captain, and joined the passengers going ashore. This job was done, but his day had only started.

As soon as Sanschagrin was back on the bridge of his tug, Hennessey learned via radiophone that as usual, operations had another job for the *Patricia*. The *American Ranger*, a fast new automated freighter, sister to the *American Racer* (See *The Ship You Drive with One Finger*, PM, Aug., 1966, page 92) was due in another half hour. "Just about time for breakfast," said Sanschagrin. Leaving Hennessey at the wheel, everybody else went below to the galley where Emerito Cabales, the Philippine cook, provided big plates of ham and eggs. Tugboat food is traditionally good, but that on the *Patricia* is exceptional. Cabales is one of the tug's crew of five, the others in addition to Sanschagrin

(Please turn to page 204)

LARGE WORKSHOP in split-level home occupies much of harbor pilot's two full days of off-duty time



Huge new sports center:

How the Garden grew



Text and Drawings
By HENRY COMSTOCK

New York's Madison Square Garden is a "layer cake" of action and exhibitions

ROUNDHOUSES used to hide behind railroad depots. Now one sits, like a caramel-and-nut-frosted cake, on the site of New York City's razed Pennsylvania Station. It's a seven-layered setting for sports gourmets—the new Madison Square Garden.

Money is the No. 1 ingredient. The circular "Center," along with a connected office building and five acres of greenery, has set the Madison Square Garden Corp. back \$116 million. That's only \$25 million less than the railroad paid, in 1910, for its splendid terminal, 13 miles of approaching real estate, and all of the hard-rock drilling under Manhattan Island and the Hudson and East Rivers.

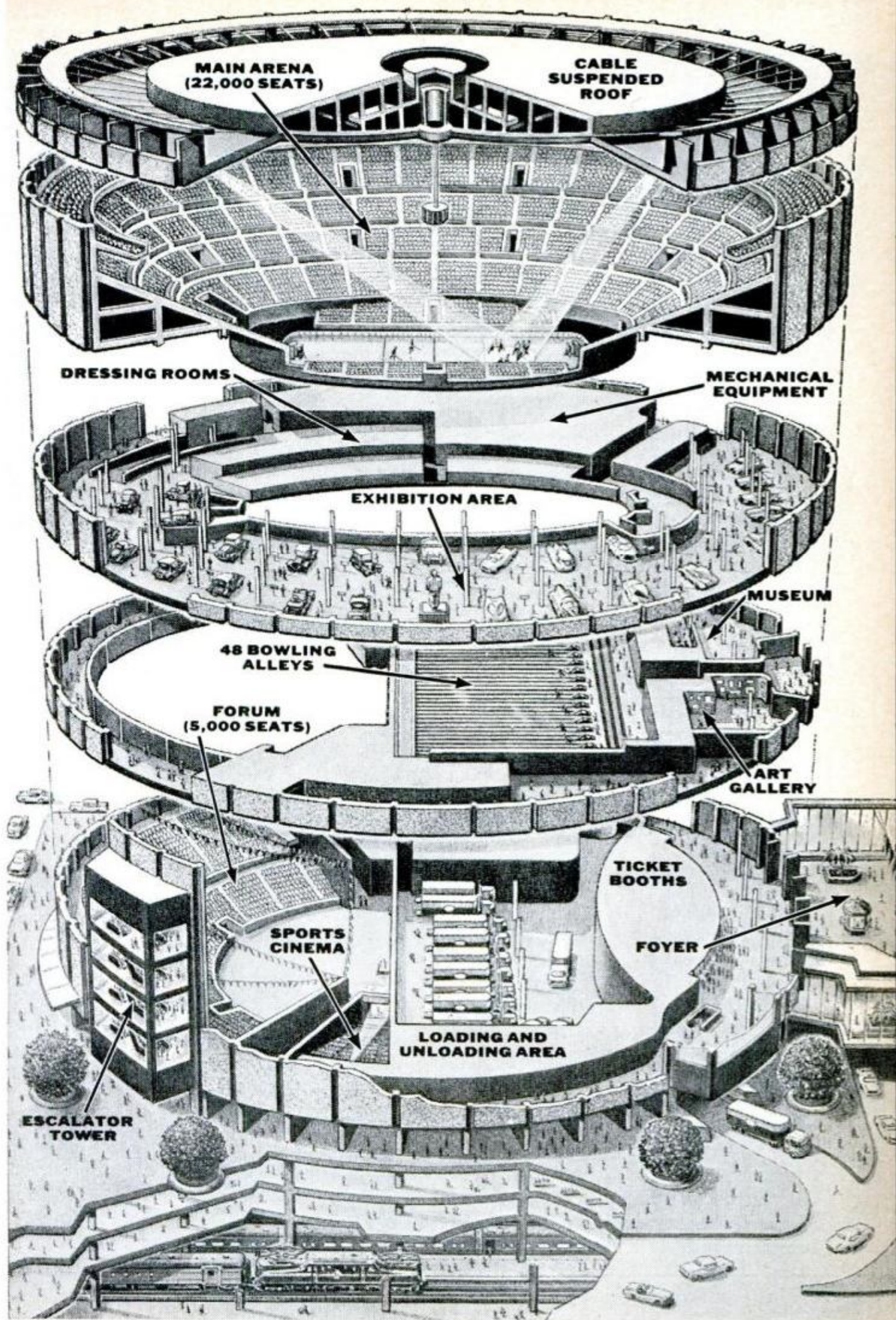
There's the second ingredient: *Accessibility*. With 650 daily trains and

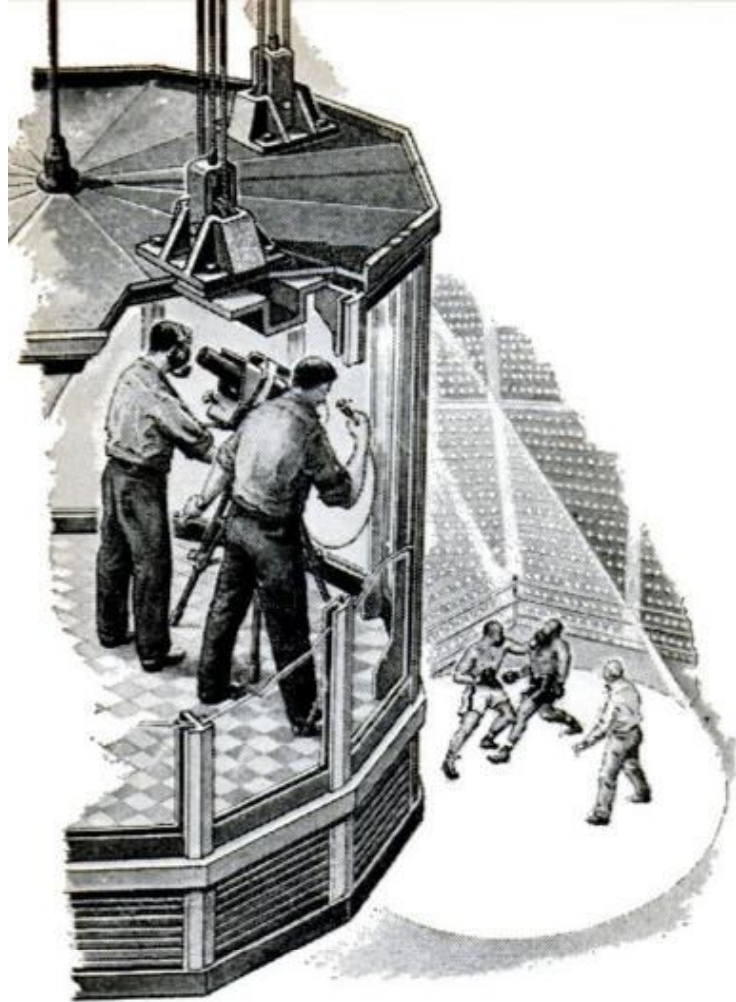
three interconnected subways underfoot, the Center is as easy to reach as a can of beer in the refrigerator. Leg-lazy sports fans don't even have to trudge up ramps to the amphitheater; a collective mile of escalators can fill or empty the entire building in 22 minutes.

You ride the most spectacular electric stairs in four glass towers flanking the 150-foot-high structure. Looking down, you see patrons who prefer a Versailles Garden approach pulling up to recessed curbs which accommodate 2000 automobiles an hour. Equally easy access is offered oversize visitors ranging from elephants to tractor-trailers. A two-lane ramp with governing signal lights

\$116-MILLION LAYER CAKE for sports gourmets, New York City's fourth Madison Square Garden rises 13 stories above site of razed Pennsylvania Station. Easily accessible by train, subway or surface transportation, Garden has something for everyone, whether his interests are athletic, cultural or political







TV CAMERAS peer down on sports events from roof, augmented by mikes to pick up crowd noises

spirals them three stories high to the main arena and exposition rotunda. Another ramp drops to a truck-dock area with 21 bays. Thus surface traffic is no more disrupted than the railroad was when the Center's 300 supporting columns were bedded between the multiple tracks without delaying a single train.

Ingredient No. 3 is *versatility*. Previous "Gardens" (this is the fourth) have played host to sports classics, the circus, cultural happenings, and patriotic, religious and political rallies. The new Center's main arena will do that, too, with a 40-man crew setting the stage for the vastly varied billings. By the way, if you ever wondered what happened to the Portuguese economy when soda-pop corks went out, it's good to know that a two-inch layer of the insulative stuff lies under the refrigeration system built into the floor. No seven-hour ice-making job will melt beneath the New York *Rangers* hockey team.

But versatility gets a new lift in the

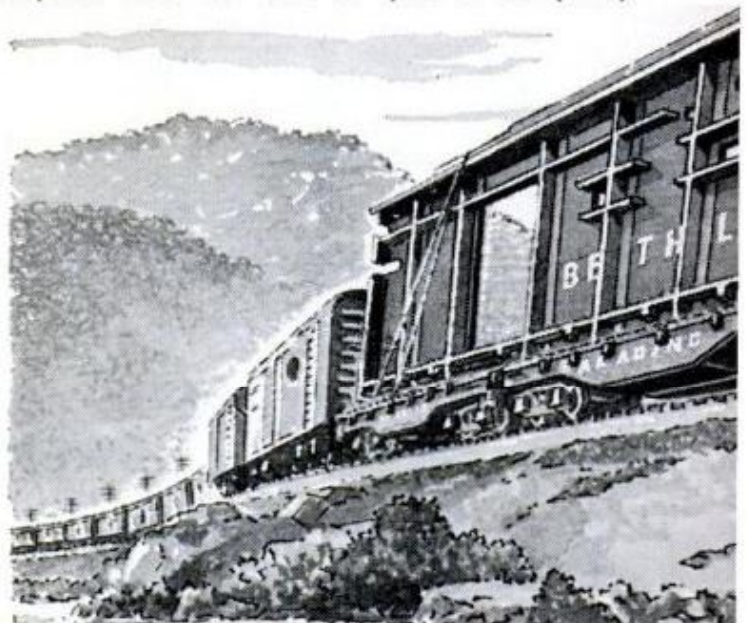
fun palace. Architect Charles Luckman has placed the inverted concrete cone supporting most of the 22,000 spectator seats high above ground. The doughnut-shaped area immediately below offers, in addition to storage space and dressing rooms, an exposition rotunda as large as two football fields.

That still leaves cubage on lower floors for a huge bowling center, a forum for major sales and stockholder meetings, a sports theater, an *MSG Hall of Fame*, and an art gallery featuring paintings and photos of great moments in the Garden. With three restaurants thrown in, the temptation to "do the town" should not thin the ranks of the faithful at conventions.

This leads to ingredient No. 4: *Comfort*. It begins with no tedious queuing in the lobby; there are 25 ticket windows. The cardboards tell which escalator is nearest your seat. If you've brought along your wife and children, you won't lose them in a crowded corridor; the galleries girdling the arena are 18 feet wide. Neither will your neighbors in Row Z be forced to give you a standing ovation as you squeeze by. Seat spacing is three feet.

Naturally the air is climatized. But it's also decontaminated. Those ions, or space charges which, in the past, have caused tobacco and locker-room odors to offend the nostrils and cling to

LARGEST GIRDER ever bedded in New York building, required three flat cars for part of its journey



clothing are electronically weeded out of the atmosphere.

Visibility is not obstructed by columns. The 1750-ton roof rests on a web of 48 zinc-plated steel cables. Each is three inches thick and over 190 feet long. As a further gesture to good viewing, 20 overhead spotlights follow the action, pouring 150 foot candles on the arena floor, and 600 on platform events.

Communications is ingredient No. 5. Closed-circuit TV links the arena with the sports theater and forum. In the latter there's a microphone jack within 25 feet of every seat to facilitate audience participation. Upstairs, batteries of loudspeakers glide on tracks in the huge ceiling, bringing "presence" to shifting events below. As a final fillip, a capsule large enough to house a video crew and 25 more P.A. speakers can be lowered from the center of the cable web to within 40 feet of, let us say, a boxing bout.

No. 6: *Beauty*. There are those who mourn the passing of the grand old

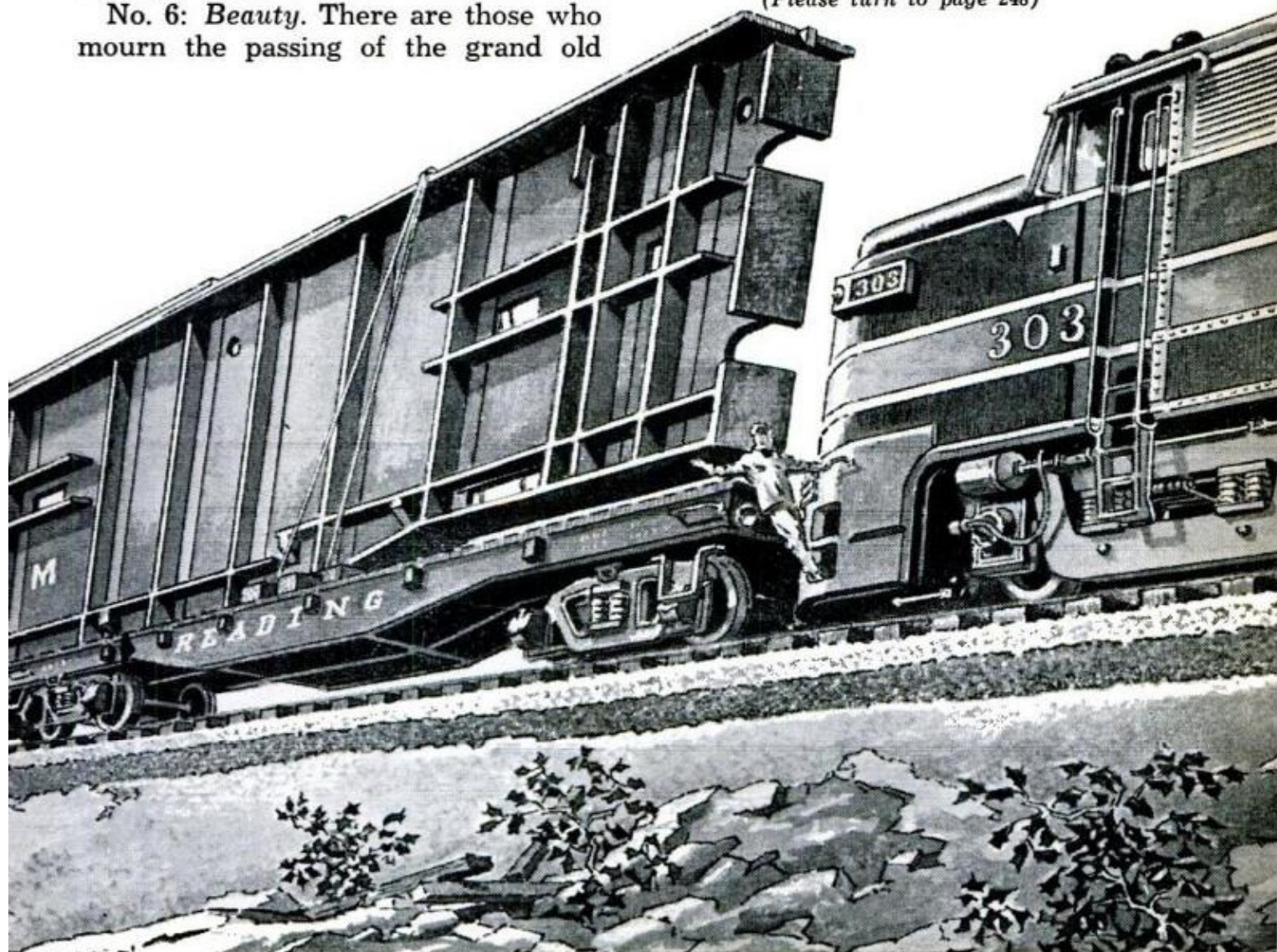
1870



ORIGINAL GARDEN was converted by Phineas Bar- num from railroad freight shed at another location

Pennsylvania Station. But with its tastefully landscaped setting, the Center makes an eye-filling contribution to New York City. There's nothing dead- pan about the windowless walls that encase the 14,000 tons of structural.

(Please turn to page 248)



Stalling: How to find and fix the trouble

By Mort Schultz

Keep choke
plate and
linkage clean
to prevent
binding

WHY DOES A CAR STALL more often in winter than in summer? It doesn't! But it sure seems to. When my car stalls in warm weather, I put up with the slight inconvenience, not giving it much thought because seldom does it refuse to re-start. But in winter it can be a cold proposition, especially with the battery already weakened by the cold.

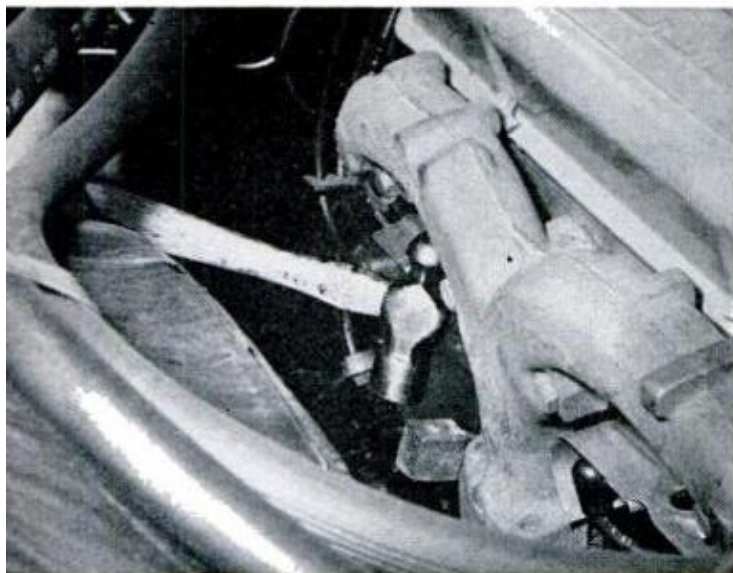
Stalls occur in several distinctive ways, but only one cause — carburetor icing — can be blamed on winter, and not always, at that. Carburetor freeze up can occur when the temperature is as high as 50°, too. Another cause of stalling — vapor lock



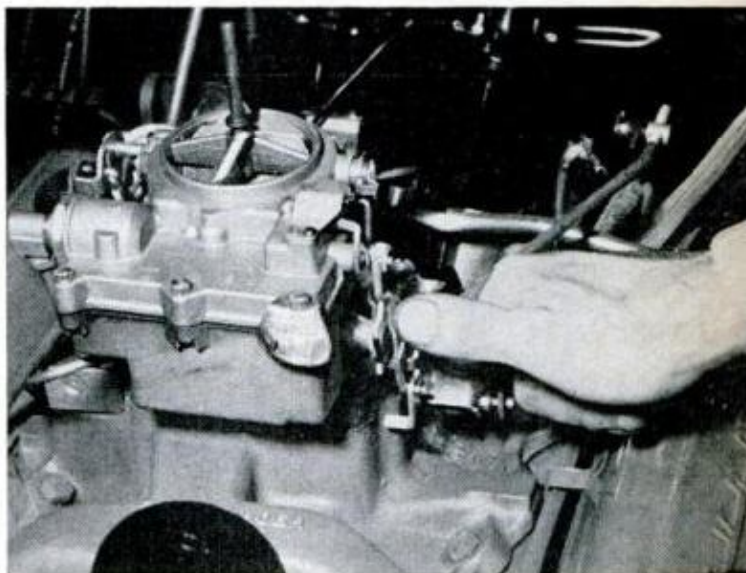
FAST IDLE ADJUSTMENT ensures that enough fuel reaches cylinders of a cold engine to prevent stalling. Screw, which rests on cam, is turned to adjust



MANIFOLD HEAT-CONTROL VALVE that is stuck open prevents engine from coming up to temperature quickly. Apply lubricant if it doesn't move freely



TAPPING THE COUNTERWEIGHT of the manifold heat-control valve lightly with a hammer after lubricating should free the valve so it operates properly



CARBURETOR ICE can be broken away by carefully operating the throttle plates. To prevent recurrence add de-icer to your fuel in proper ratio

—only happens when the weather is hot.

Essentially, there are four circumstances under which your car can stall. Each condition points to possible causes that are thumbnailed in the stalling chart on page 147, but bear discussing in detail.

**Engine stalls when cold
—okay when hot**

Sticky choke plate. Most often it is nothing more than dirt that keeps the plate of an automatic choke from closing. A cold engine is thereby prevented from getting the rich fuel mixture it needs to keep running. Occasionally, though, plate sticking is caused by a mechanical defect.

Remove the carburetor air cleaner. Tap the accelerator pedal once if the choke plate is fully or partially open. The plate should automatically close over the carburetor air horn. If it doesn't, use choke cleaner to clean the area around the plate and the linkage.

If cleaning fails to free the valve, the choke should be disassembled and checked for a mechanical defect such as a binding piston or a worn choke-plate shaft.

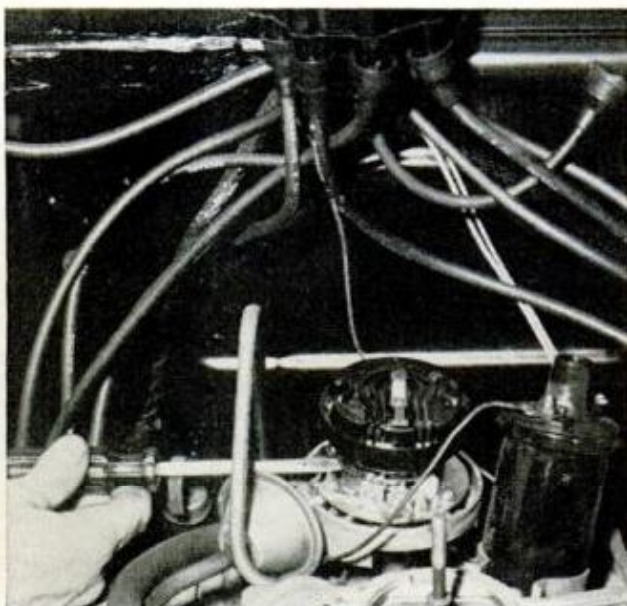
Incorrect fast-idle adjustment. An engine needs a higher-than-normal rpm to support operation when its temperature is below normal. A fast idle that isn't fast enough can't feed the fuel needed by the



FUEL-AIR RATIO or "richness" mixture is adjusted at idling speed when engine is hot to cure stalling problem. Richness is adjusted for specified idle rpm



VAPOR LOCK, a sure cause of stalling, can be permanently remedied by wrapping fuel lines with a plastic foam or similar type of insulating material



A GROUNDED PRIMARY LEAD in your ignition system can cause engine to stall under load. Inspect it and trace back from inside of distributor to coil

engine until it heats up.

The fast-idle adjustment for each type of carburetor is done somewhat differently. With a single-barrel carburetor, though, the adjustment is generally made by bending the choke rod to obtain a specified clearance between the lower edge of the choke plate and the air-horn wall.

With two and four-barrel carburetors the adjustment is usually made by turning the fast-idle screw against the high step of the fast-idle cam until a specified wire gauge fits between the throttle valve and bore. Then, a final, fine-tune adjustment is made with a tachometer.

Stuck manifold heat-control valve. If the manifold heat-control valve is stuck open, the time needed to bring an engine up to normal operating temperature is prolonged. This added time of operating under a rich fuel-mixture condition contributes to stalling.

Check valve operation by grasping the counterweight you'll find beneath the manifold. If it doesn't move freely, squirt some heat-valve lubricant around the shaft and tap the counterweight lightly with a hammer. If the valve refuses to free itself, it should be removed and replaced.

**Engine stalls during warm-up
—okay when hot or cold**

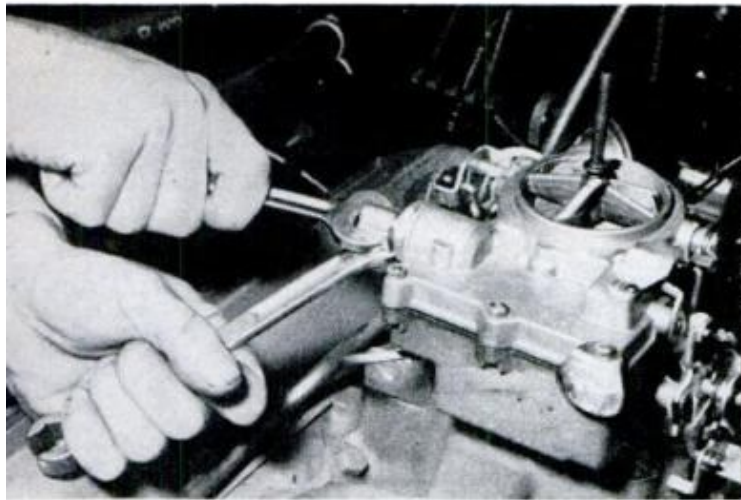
Carburetor icing. This problem can occur when air temperature ranges from 30° to 50°F. and when relative humidity is above 65 percent. Moisture from in-rushing air collects between the throttle plate and throttle bore, freezes in this relatively small space and cuts off the air supply to the engine.

You can break the ice jam by operating the throttle plate manually, which will then allow the engine to start. However, this won't prevent ice from forming again. If carburetor icing continues to plague you, use an anti-icing additive, which you can buy at any service station or auto-supply store.

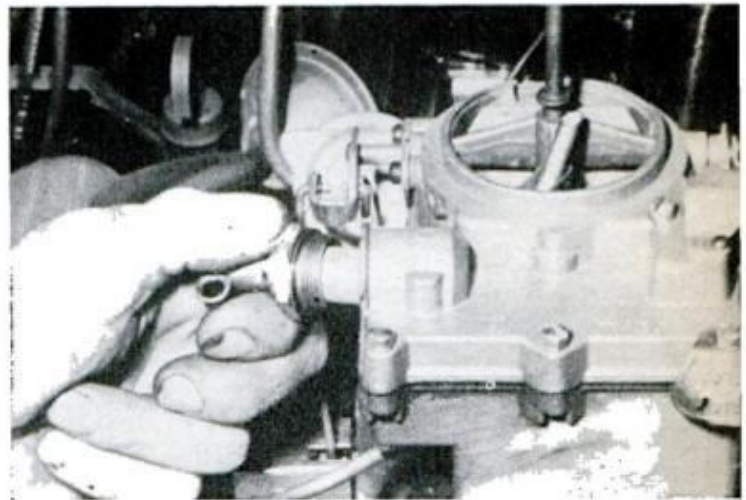
Stuck manifold heat-control valve. Follow the same procedure that we covered above under the heading of "Engine stalls when cold—not when hot."

**Engine stalls when hot
—okay when cold**

Improper idle speed. This condition



FUEL FILTER SCREEN is found in various places along the fuel line. In this case, it is accessible by removing the fuel-line fittings at carburetor



CYLINDRICALLY SHAPED FUEL FILTER SCREEN can be removed from its housing and inspected. If it's not 100-percent clean, it should be replaced

causes stalling when the engine is idling or running at slower speed. Each make and model carburetor is designed to idle within a specified rpm range. You will need this specification for your car and also a tachometer to check and adjust the idle mixture. A single-barrel carburetor has one idle-mixture screw—two and four-barrel carbs have two.

Vapor lock. This is usually a hot-weather cause of stalling. The carburetor is designed to meter liquid fuel only. When high engine temperature and high outside temperature combine, air bubbles

(vapor) form in the carburetor passages and the flow of fuel is interrupted—especially at idle speed when metering is done through smaller passages.

In an emergency, a vapor-locked fuel system can be temporarily relieved by pouring cold water over the fuel pump and fuel-supply lines. There are two methods you can try to get rid of the problem permanently.

One is to insulate the fuel pump, fuel pump inlet and outlet lines, and the carburetor by shielding them or wrapping them with insulation to reduce the effect of engine heat. Another method is to provide greater ventilation, such as by replacing your present fan with one that has more blades.

Sticking choke butterfly plate. A choke plate stuck in the closed or partially closed position because of dirt or a mechanical failure will cause stalling when the engine is warm. The procedure for getting rid of the problem is the same as that described previously.

Flooding. This problem is usually caused by a number of interrelated malfunctions that are generally confined to the fuel system. When too much fuel accumulates, it won't ignite. It is gasoline vapor, or a gaseous mixture of fuel and air, that ignites easily.

Flooding is most often caused when the carburetor float level is too high, which is the result of a leaking carburetor needle valve or float, excessive fuel pump pressure, or a bad fuel-pump discharge valve.

Defective fuel pump. A fuel pump that
(Please turn to page 244)

QUICK GUIDE TO STALLING

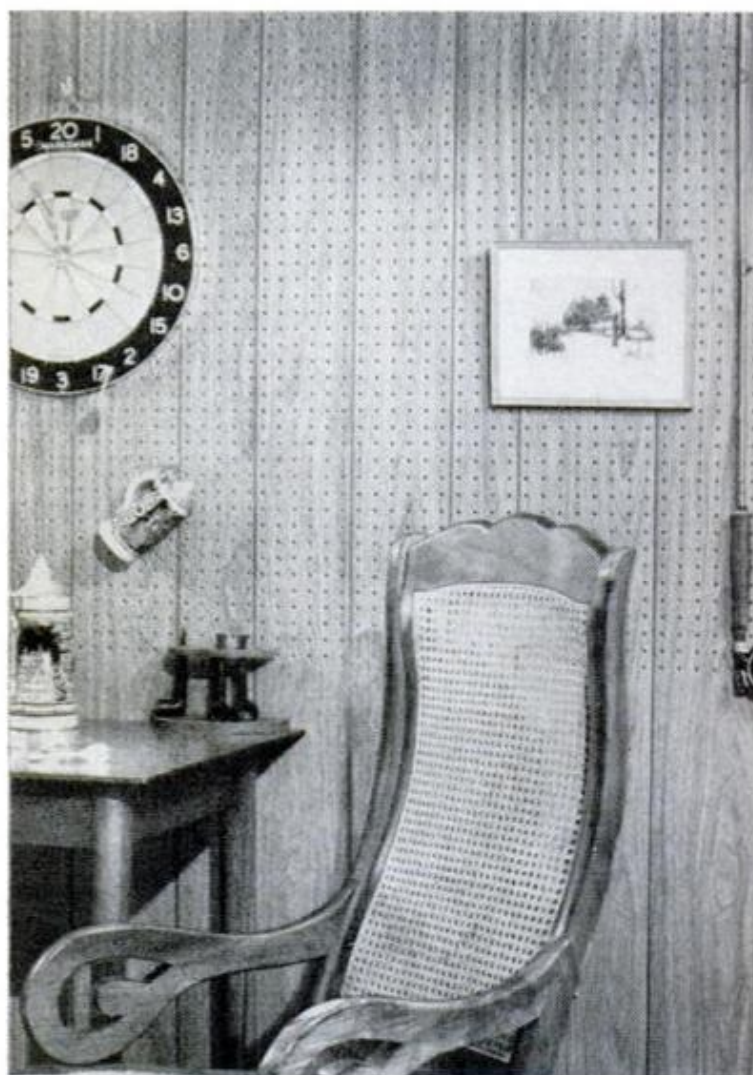
Condition	Causes
Engine stalls when cold—not when hot	<ul style="list-style-type: none"> • Sticking choke butterfly plate • Improper fast-idle adjustment • Manifold heat control valve stuck open
Engine stalls during warm-up—not when hot or cold	<ul style="list-style-type: none"> • Carburetor icing • Manifold heat control valve stuck open
Engine stalls when hot—not when cold	<ul style="list-style-type: none"> • Improper idle speed • Vapor lock • Sticking choke butterfly plate • Carburetor flooding • Defective fuel pump
Engine stalls upon accelerating from stop	<ul style="list-style-type: none"> • Fouled or improperly gapped sparkplugs • Defective vacuum advance • Distributor primary internally grounded • Clogged fuel filter • Carburetor accelerator pump defective or float level too low • Breakdown inside engine

EXCITING NEW PRODUCTS

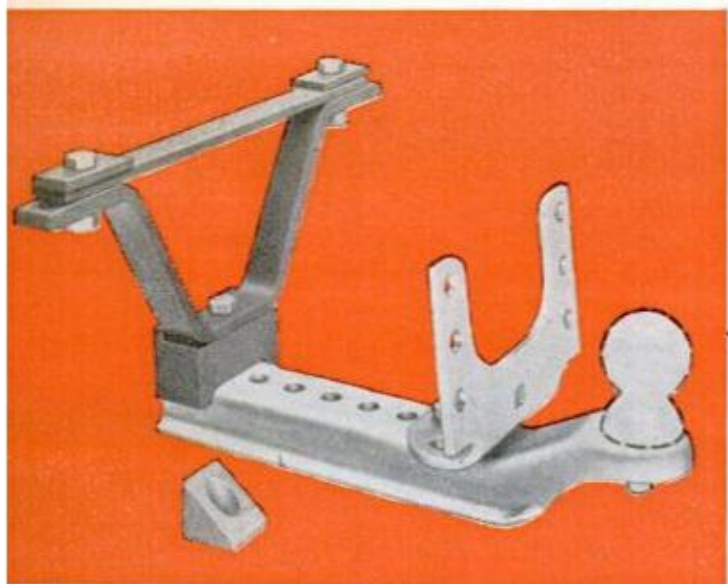
By CAROL SCHULTZ



▲ **A BUILT-IN COFFEE MAKER** connects directly to kitchen water lines and measures only 12 inches wide, 8 inches deep and 4 inches high. One to ten cups of coffee are brewed, as piping-hot water is sprayed over ground coffee and passes through a no-taste filter into a pyrex decanter. \$149.50. Brewmatic, 3828 S. Main St., Los Angeles, California.

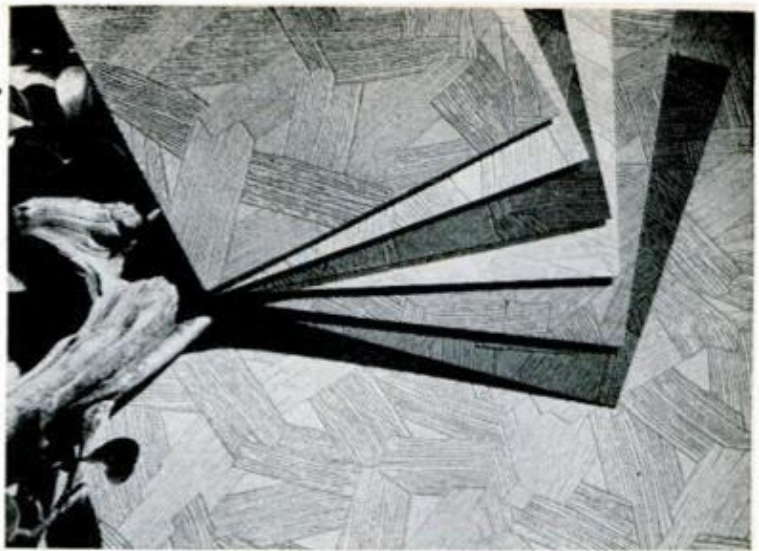


▲ **PERFORATED HARDBOARD PANELING** has been designed for areas where wall hangings are frequently changed. Stor-Mor panels are perforated 1 inch o.c. from wainscot height to the top of the panel. Panels come in three styles: Hearthside, Homespun and Utility. Hearthside, above, is available in butternut, walnut or whitewood and is ideal for dens. A 4x8-foot panel costs about \$11.50. By U. S. Plywood Corp.



◀ **TRAILER HITCH** will fit almost all the popular models of the major auto manufacturers produced in the last two or three years. The hitch, called the "PresTow," is for gross loads up to 2000 pounds. It's easily installed, and has a stamped-steel channel-shaped drawbar. Sells for \$12.95. Made by Big Boy Products Div., the Dalton Foundries, Inc., Warsaw, Ind.

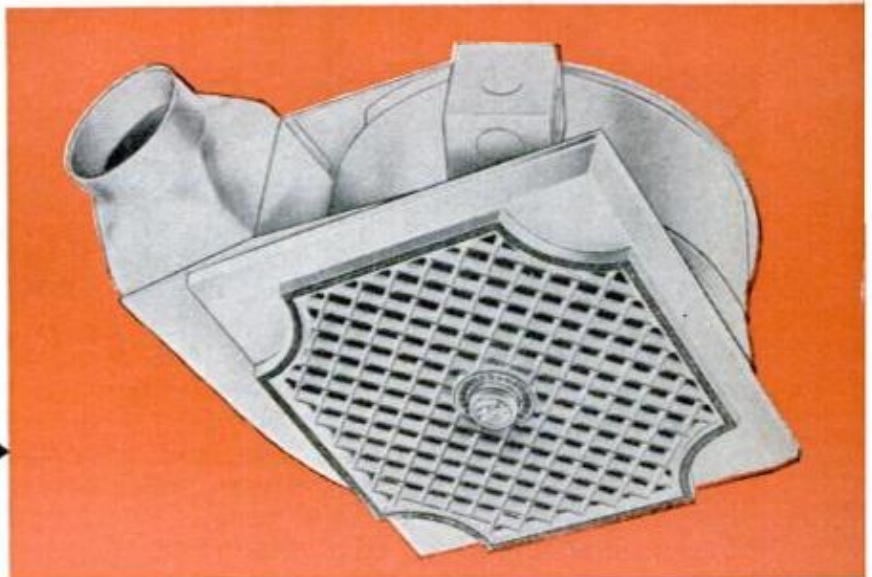
VINYL ASBESTOS TILE is now made in a unique combination of a smooth and textured surface. "Tanglewood" with its alternate textures has a seamless, three-dimensional appearance. A striking feature of the new flooring is the ease with which its greaseproof surface is maintained. Only an occasional washing and waxing is required. Available in green, white, red, beige, brown and light brown. About 50 cents per square foot installed. Kentile Floors, Inc.



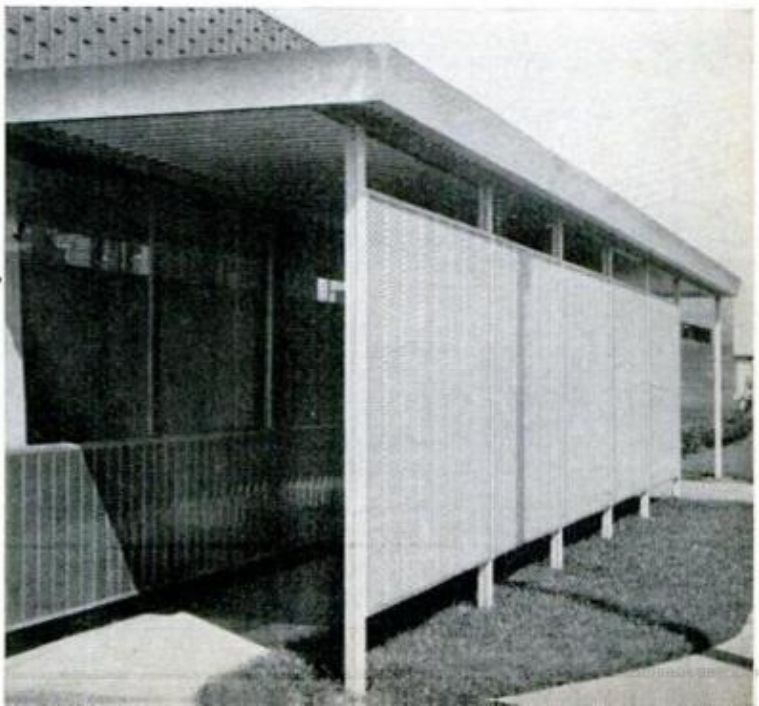
PORTABLE AIR PURIFIER utilizes magnetic attraction to trap more than 90 percent of the air contaminants pulled through its triple filtering system. The purifier rids a room of smoke in 15 seconds, and runs all day for less than the cost of a 40-watt bulb. The unit is 14 inches wide, 14¾ inches high and retails for \$89.95. Made by Nautilus Industries, Inc., Freeland, Pa.

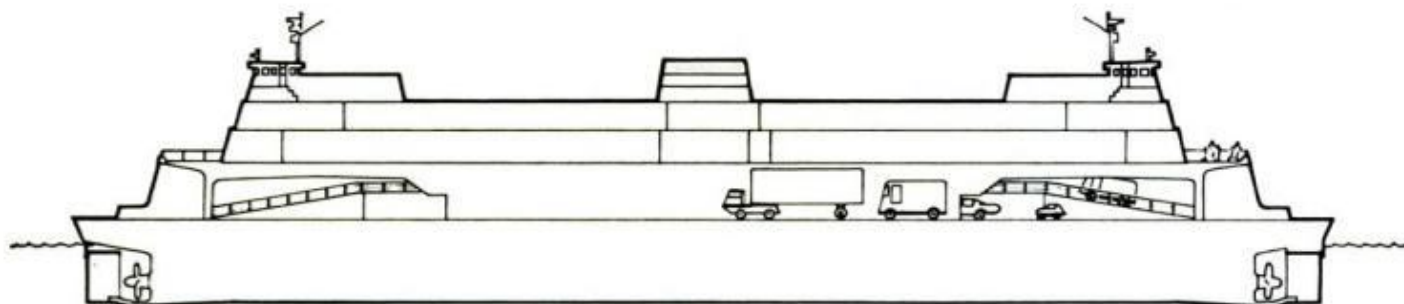
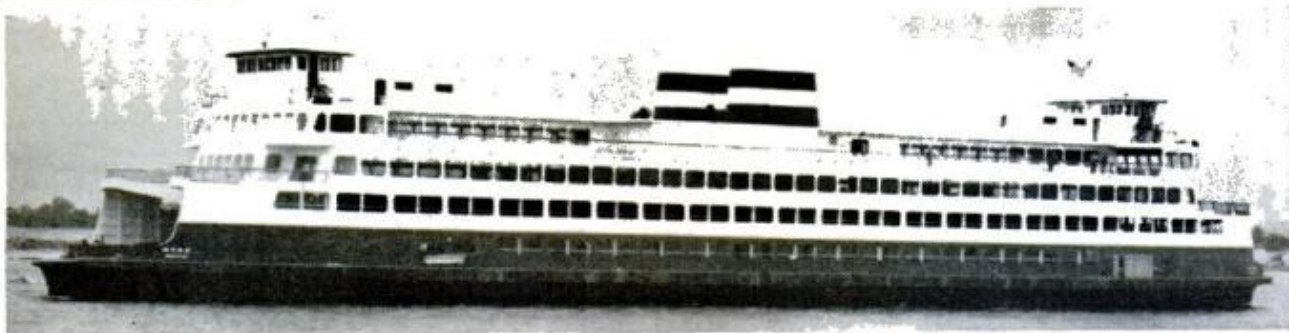


VENTILATING FAN features an elegant white molded polystyrene grille, highlighted with antique gold. Sculptured design follows traditional and provincial lines so popular in today's decor. These fans are ideal in kitchens and dens, as well as bathrooms and powder rooms. Available in a range of sizes, offering solutions to most ventilating problems. Wall or ceiling model about \$21.50 (shown): By LeighProducts, Inc. Coopersville, Mich.



DECOR-WALL PANELS are a new building facing material, also ideal for carports, wind screens and any other use where a degree of privacy is necessary without restricting ventilation. Panels are made of aluminum and are manufactured in 16 "hi-bake" enamel colors. They are available in the following configurations: vented, concave, flat convex, screen and extruded profiles. Made by Navaco Div. Howmet Corp., 601 Hall St., Dallas, Tex.





New ferries speed crossing of Puget Sound

The M.V. *Hyak*, which went into regular ferry service this summer between Seattle and Bremerton, is the first of four new 382-foot "superferries" to start operating on Puget Sound this year. The four new vessels were built by National Steel & Shipbuilding Co., San Diego, for the Washington State Ferry System, which operates 20 vessels. The *Hyak* can carry 2067 passengers and 160 vehicles at a speed of 20 knots. The speed and efficiency of the double-ended superferry have cut the Seattle-to-Bremerton trip time from 65 to 45 minutes. After parking their vehicles on the two car decks (see drawing), passengers may lounge or dine on the two upper decks. Bottom photos show one of two bridges (left) and dining area.



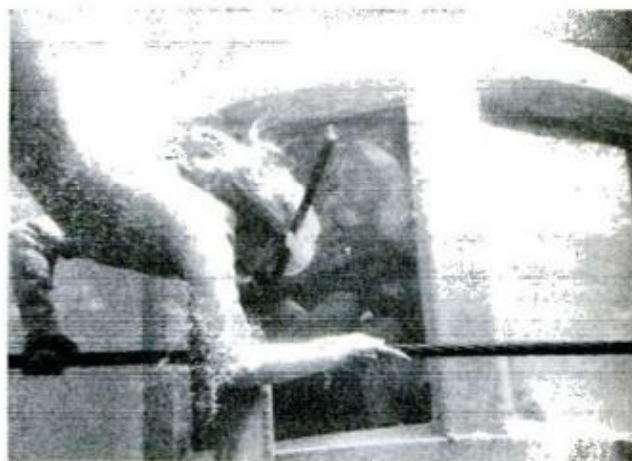
London rail passengers take their cars along

Motorail service from London lets travelers and their cars ride on the same train. As autos are loaded on "Cartic" cars (left), passengers relax (right) until they board sleepers.



Underwater cable cars

Undersea cable cars that descend some 33 feet into the Mediterranean are being tested near Marseille, France. Each cabin of the Telescaphe system can hold six passengers and remain submerged for 30 minutes. A bell-shaped housing is lowered over the riders (above), and then the cable car is launched from a platform (upper right) for the trip. Large windows in the housing let the passengers view sea life—or vice versa (lower right).



Bug stopper

This new bush hat has been designed for U.S. troops in hot climates. The hat, secured by a lanyard under the wearer's chin, has a detachable bug netting for his protection.

NOVEMBER 1967



No strings attached

An experimental lineless telephone by Bell connects via radio with a fixed station on a telephone line. It provides two-way conversation as well as dialing and ringing.

Build a sail-powered WINTER SKATER: SUMMER SCOOTER

Illustration by Howard Schafer
Technical Art by Don Evans

DESIGNED FOR ENJOYMENT 12 months of the year, this trim little yacht will scoot around playgrounds and parking lots when fitted with wheels, or it can be quickly equipped with runners to skim along icy lakes and ponds. Either way, it's sure to thrill the young at heart. The main sections are made of 1-in. white pine, while the other wooden components are formed from either 2 x 4 stock or scraps of hardwood. When boring the 2 x 4 mast step, be certain to cant the hole about 4° aft to increase the bracing effect of the shrouds. These are secured to the cross member through tension springs, while a single turnbuckle tightens the forestay. Don't try to do without the springs as they equalize any "give" in the cross member. The sail is made of cotton or a similar material, with hems wide enough to receive the mast and boom. Attach pulleys to the boom as shown in the illustration below and thread durable sash cord through the pulleys to a cleat on the deck. To switch from ice running to sidewalk sailing, just withdraw the ½-in. machine bolts that serve as axles and remove the runner assemblies. Insert the stock ball-bearing wheels, replace the axle bolts and you're ready to go. And GO you will! — Hi Sibley



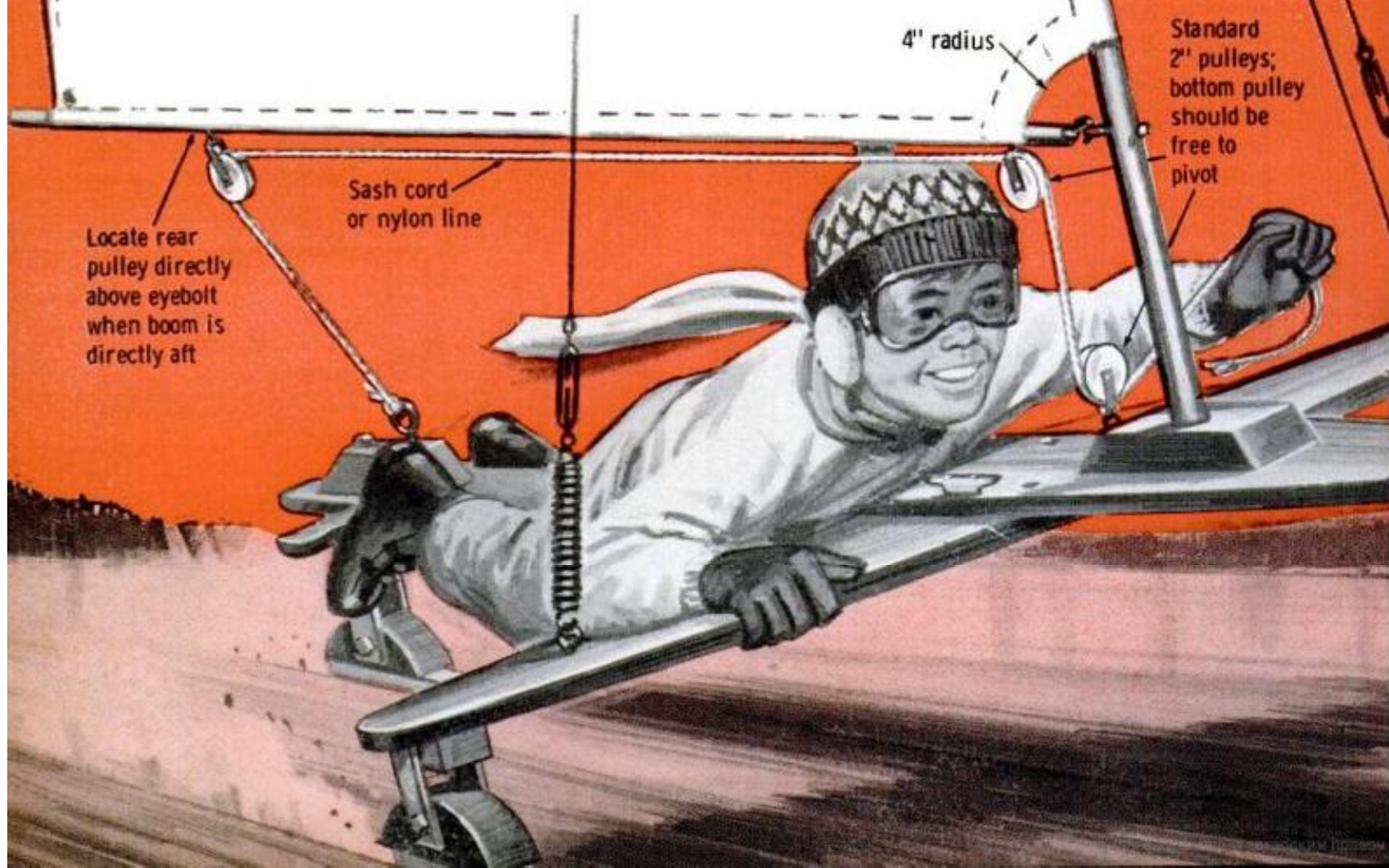
Loop rigging
over 3/8" dowels

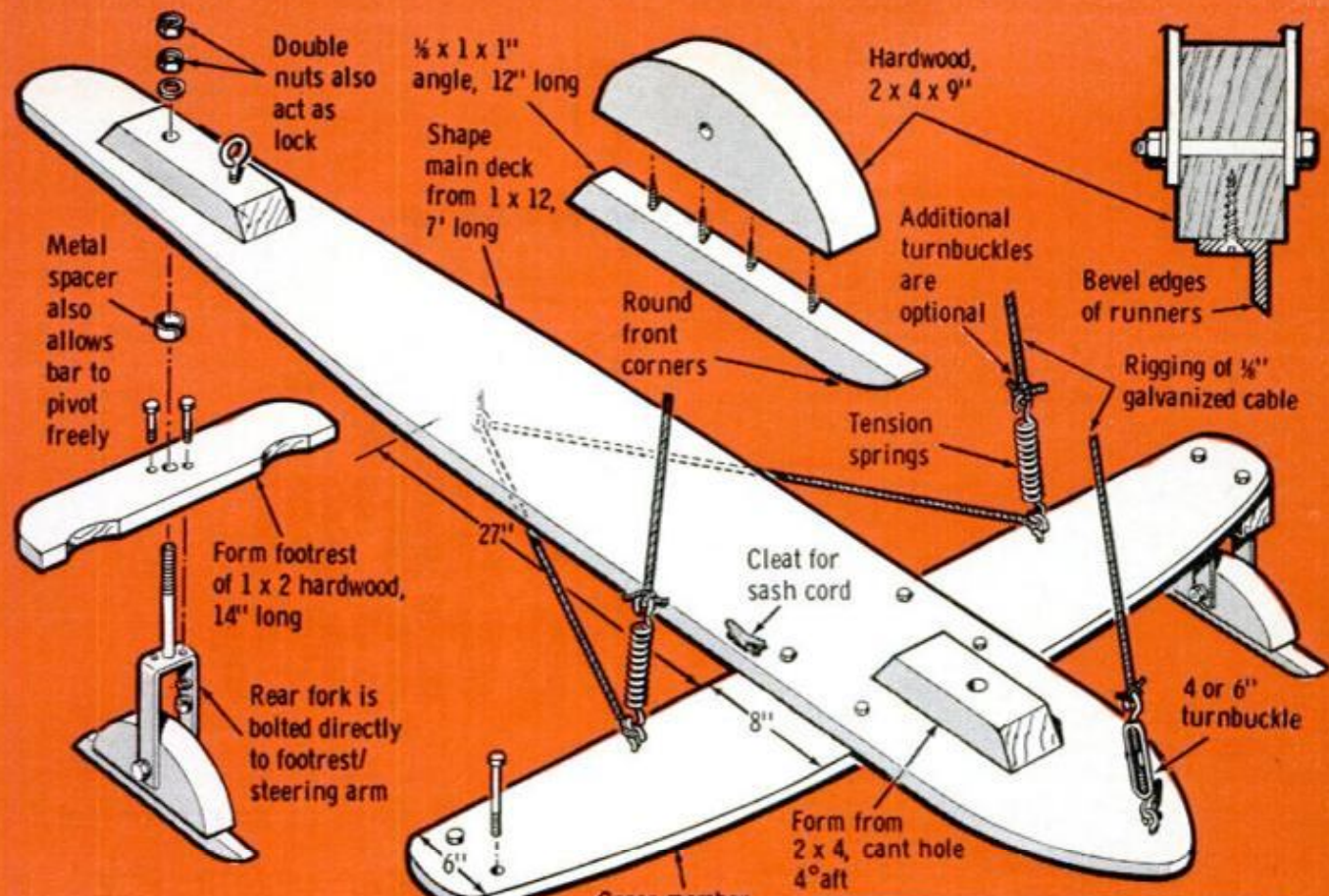
4" radius

Standard
2" pulleys;
bottom pulley
should be
free to
pivot

Locate rear
pulley directly
above eyebolt
when boom is
directly aft

Sash cord
or nylon line





Mast is 1" pole
 9' long.
 Boom is 62" long

Round off
 point and
 bend back

Approx. 16" above
 deck level

Fit cotton sail
 with grommets
 and gussets in
 corners

Maple
 battens
 sewn in
 sail

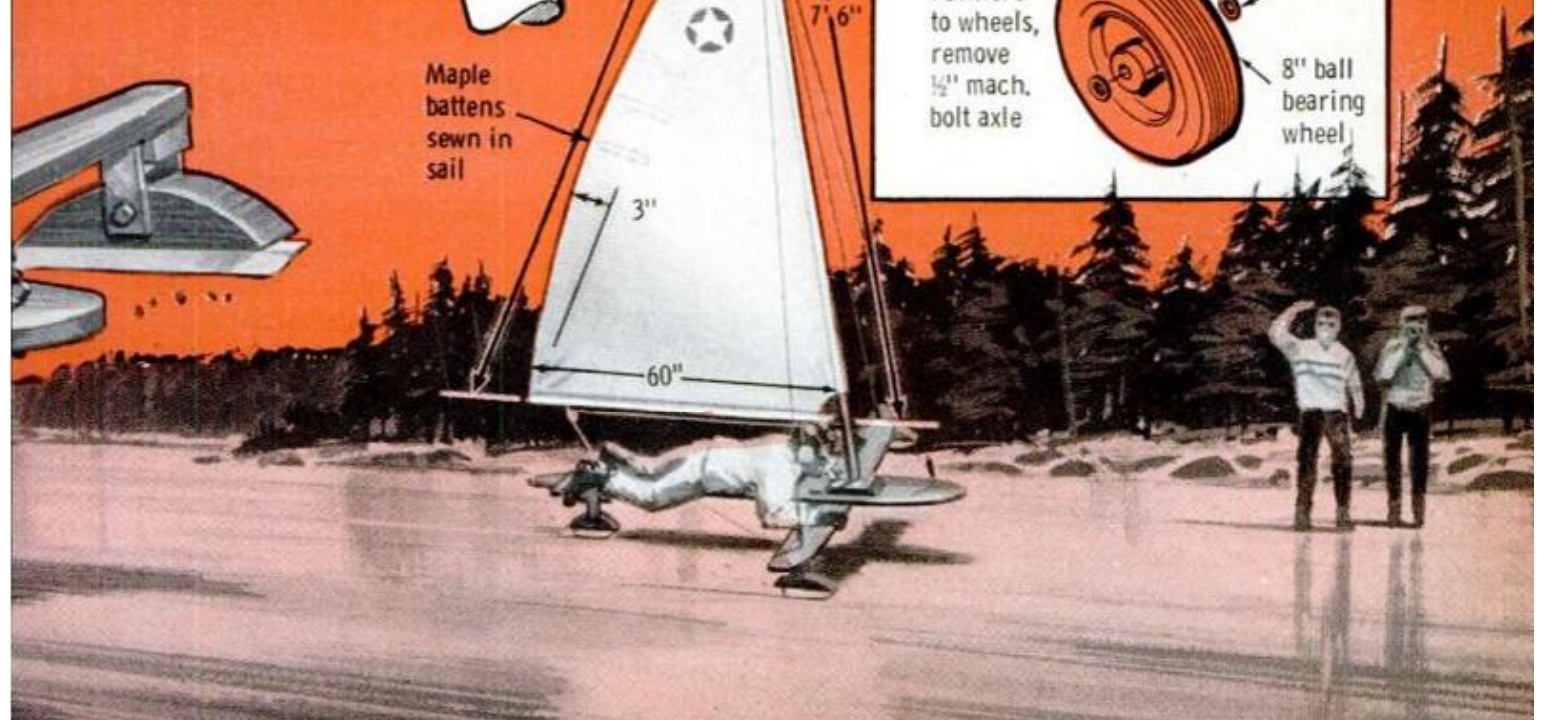
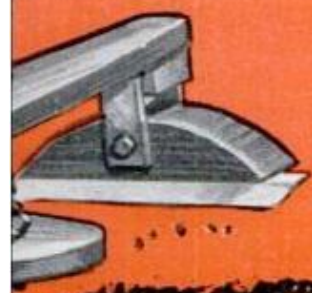
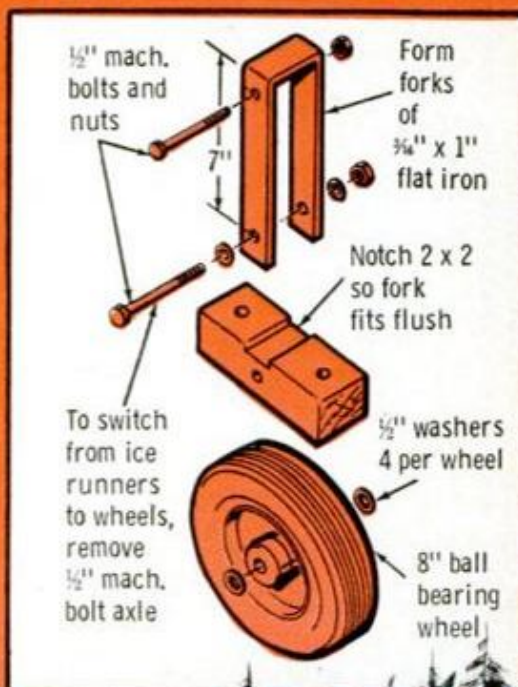
7' 3"

7' 6"

3"

60"

Cross member
 of 1 x 8,
 5' long



The ABCs of Smog- Control Devices

The alphabet soup of smog-control systems from CAP to NOR, PCV and VVR is a mixture of different approaches to the problem of air pollution. But they all do the job they're designed to. Here's how

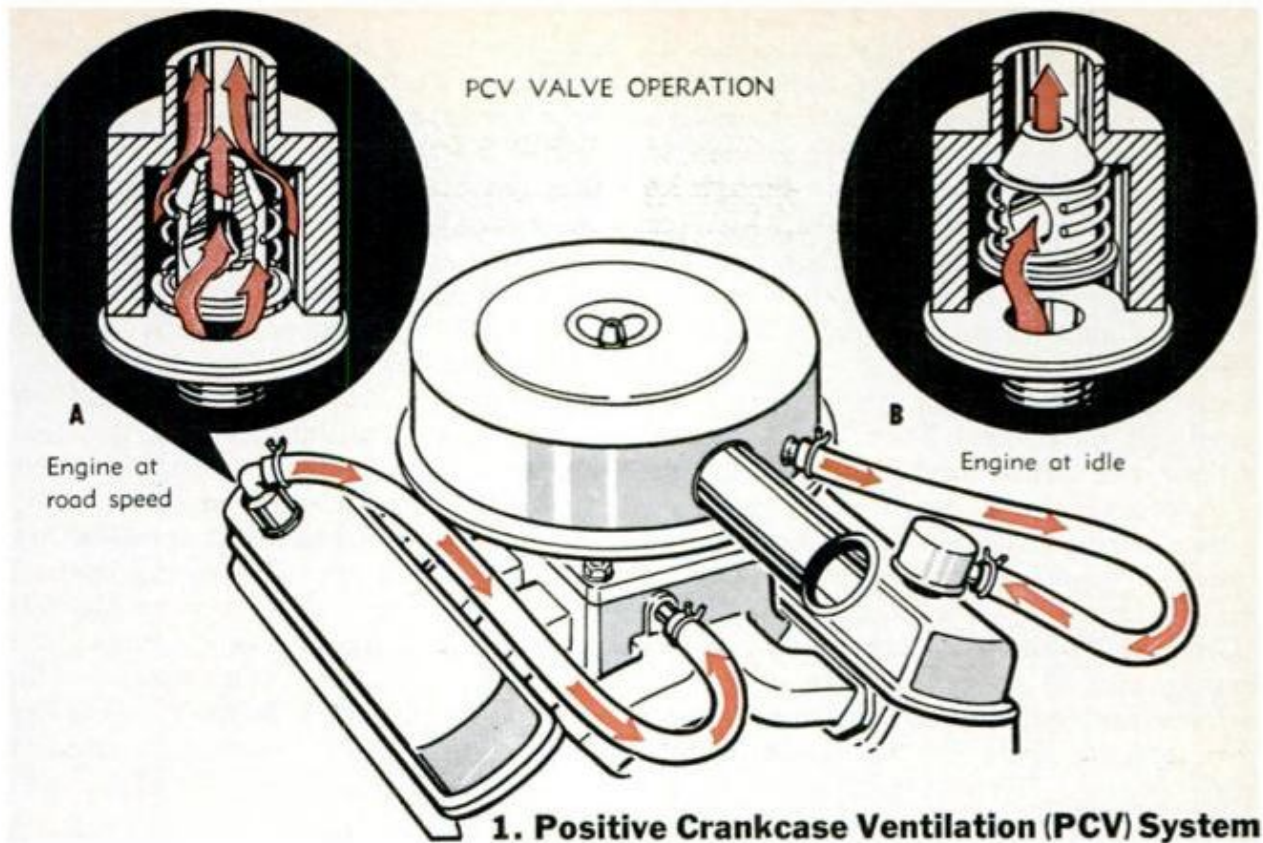
By ROBERT W. TEMPLE

Illustrations by the Author

BEGINNING WITH the 1968 model cars just introduced, all new automobiles sold *anywhere* in the United States must be equipped with "California-type" smog-control devices. The arguments concerning this federal edict have been many and heated.

At one extreme, the automobile has been accused of contributing 90 percent of the pollutants to the Los Angeles atmosphere. At the other end of the controversy is the charge by Joe Callahan, of the authoritative trade publication *Automotive News*, that requiring smog-control devices nationwide constitutes a half-billion-dollar-a-year hoax on automobile buyers. Joe could have a point.

About two decades ago, Dr. A. J. Haagen-Smit, of the California Institute of Technology, identified the components



PCV VALVE OPERATION

A
Engine at road speed

B
Engine at idle

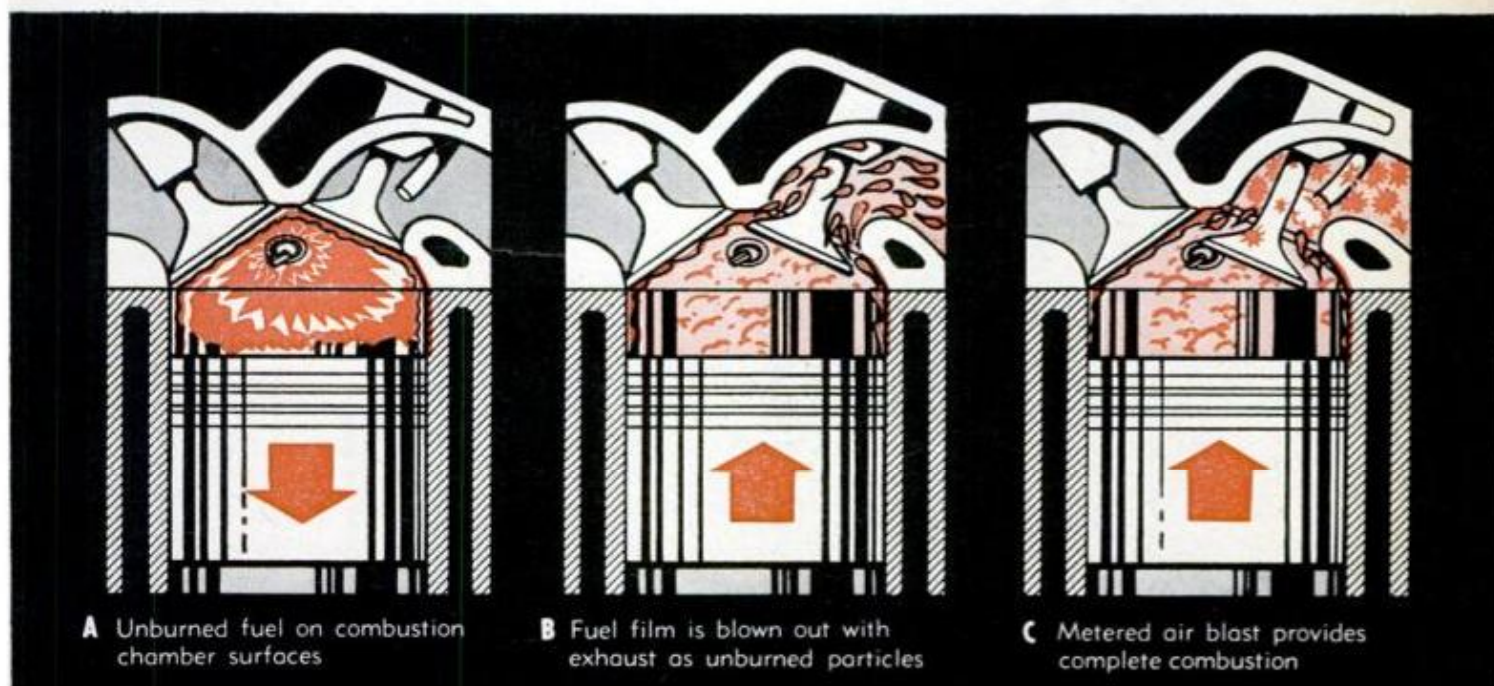
1. Positive Crankcase Ventilation (PCV) System

of Los Angeles smog and pointed an accusing finger at the automobile as a major contributor. In the ensuing years, California passed laws specifying the amount of pollutants that may be legally emitted by an automobile engine (less than 275 parts per million unburned hydrocarbons and less than 1.50 percent carbon monoxide). These restrictions necessitated the installation of control devices.

When the U.S. Department of Health, Education, and Welfare started drafting air-pollution control laws for the rest of

the country, the California statutes were used as a pattern. The reason was that they were virtually the only guidelines in existence.

There's nothing unusual about this procedure, but in the case of air-pollution control, there's a bit of a bug: California laws were drafted primarily for the purpose of alleviating the air pollution of the Los Angeles basin. The chemical components of Los Angeles smog, and the conditions that create it, are so unique that they appear almost nowhere else on



A Unburned fuel on combustion chamber surfaces

B Fuel film is blown out with exhaust as unburned particles

C Metered air blast provides complete combustion

2. Fuel-Film Formation and Function of Air Injection

earth. Using the California guidelines as the basis for drafting the national law means, in effect, that the purchaser of a new car will be paying for a device to reduce Los Angeles smog, even though he may be living in Madawaska, Me., or Broken Bow, Neb. The reduction that the device may make in air pollution in, say, Gizzard Cave, Tenn., will be difficult to detect.

But arguments aside, the fact is that variations of several basic smog control systems are being used by all U.S. auto manufacturers and they seem destined to be a permanent part of the automotive scene, so we might as well see what they are and how they work.

General Motors researchers discovered that around 20 percent of the unburned hydrocarbon emissions from an engine were coming from the crankcase ventilation system. The solution to this problem was to pipe the vented wastes back into the intake manifold for another trip through the engine, where the emissions would be further reduced. They called the system "PCV" or positive crankcase ventilation.

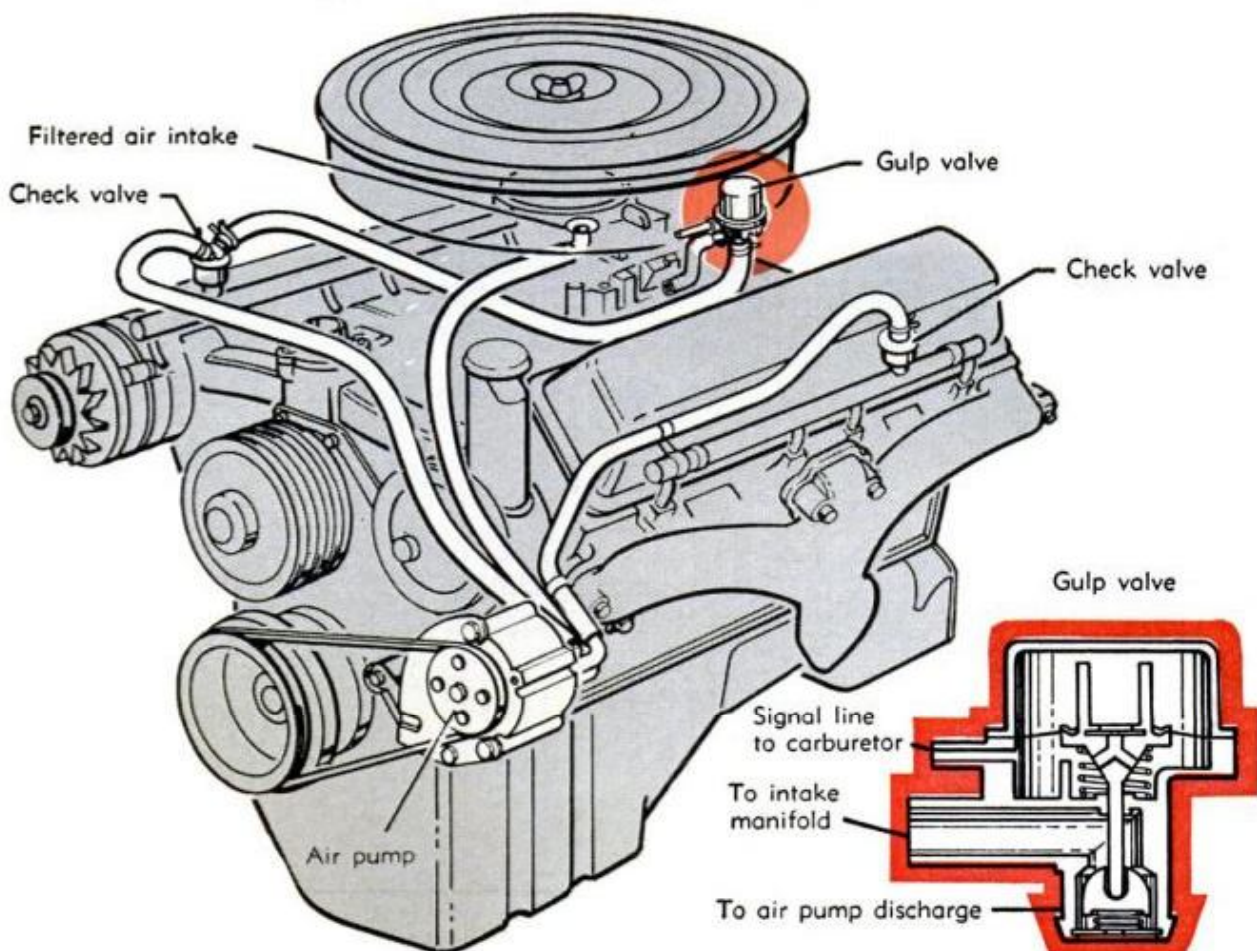
A typical positive crankcase ventilation

system—as applied to a V8 engine—is shown in Fig. 1. Air from the carburetor air filter is fed into the engine through the closed oil-filler cap. The air is circulated through all the chambers of the engine, where it picks up fumes and moisture, and then exits by way of a control valve on the opposite valve cover. A tube exhausts the polluted air into a tap in the intake manifold.

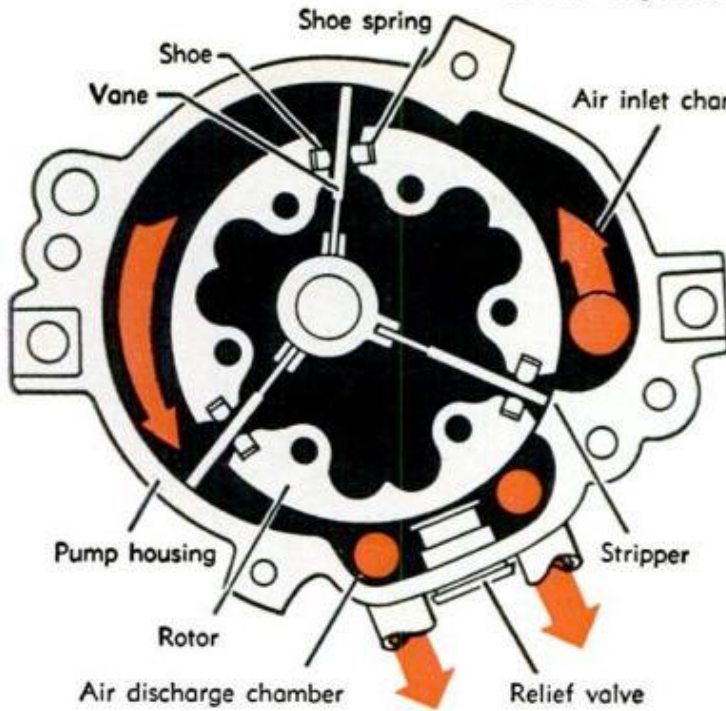
The control valve keeps the discharge of the engine pollutants into the intake air stream proportional to engine speed to avoid upsetting the fuel mixture ratio. In view "A" the engine is at speed and engine vacuum is low. The spring opens the valve, allowing the maximum discharge of pollutants around and through the valve. In view "B," with engine idling, the engine vacuum is high. Vacuum overcomes the spring tension, seating the valve. Crankcase fume discharge is diminished because flow is allowed only through the center orifice of the valve.

General Motors developed a means of photographing combustion processes inside a running engine and learned that the flame front progressing through the combustion chamber was quenched when

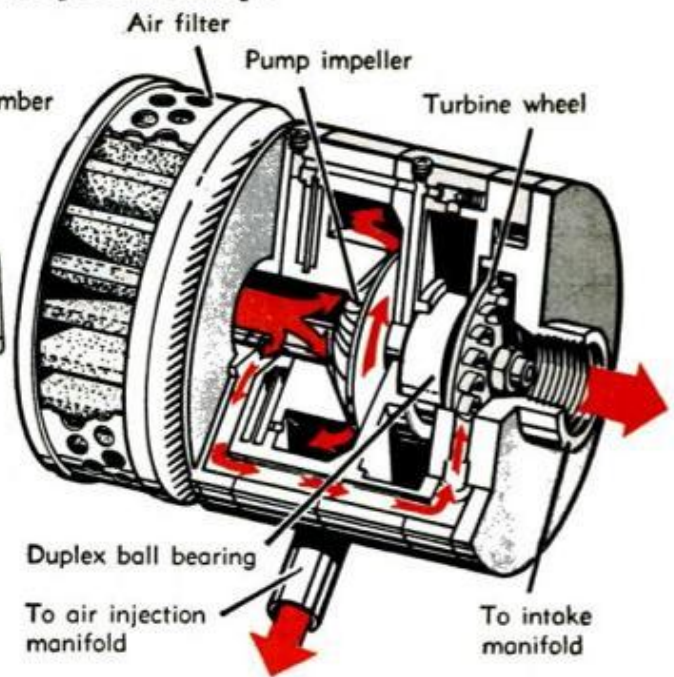
3. Typical Air-Injection System Installed



4. Air-Injection System Pumps



VANE TYPE BELT DRIVEN AIR PUMP



TURBINE TYPE AIR PUMP

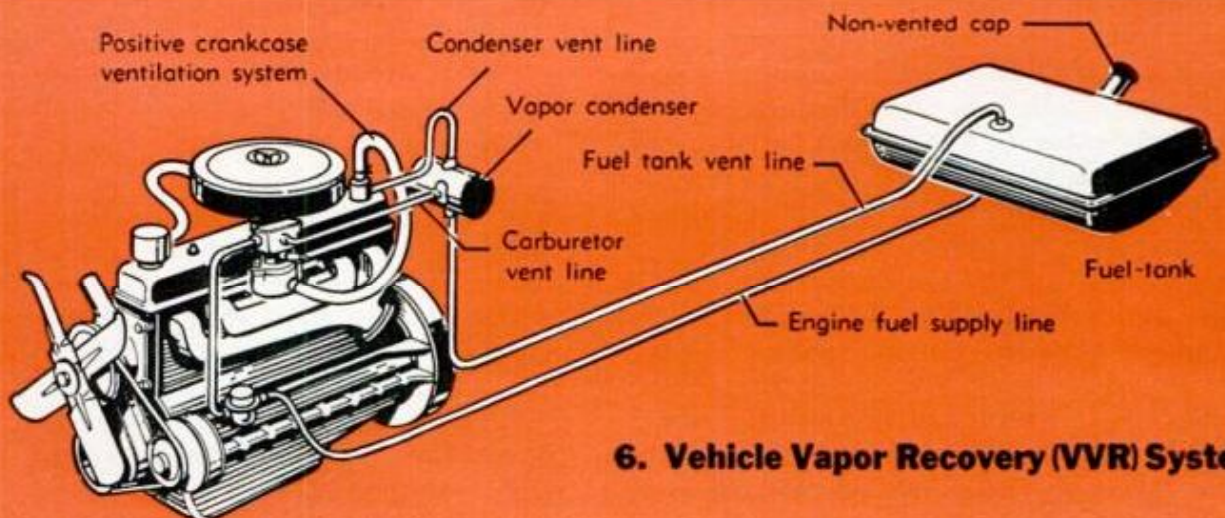
it contacted the cooler chamber surfaces, leaving a film of unburned fuel. Discovery of this source of unburned fuel particles indicated the possibility of being able to control their formation inside the engine, rather than eliminating them with hang-on afterburners or catalytic mufflers. Two methods of doing this have since evolved.

The first of these systems is the air-injection type that ignites the unburned fuel particles as they pass through the exhaust ports. To illustrate what happens refer to Fig. 2, view "A." The sparkplug has ignited the fuel, and the flame front is proceeding across the combustion chamber. In view "B" we see that normally the unburned fuel film blows out

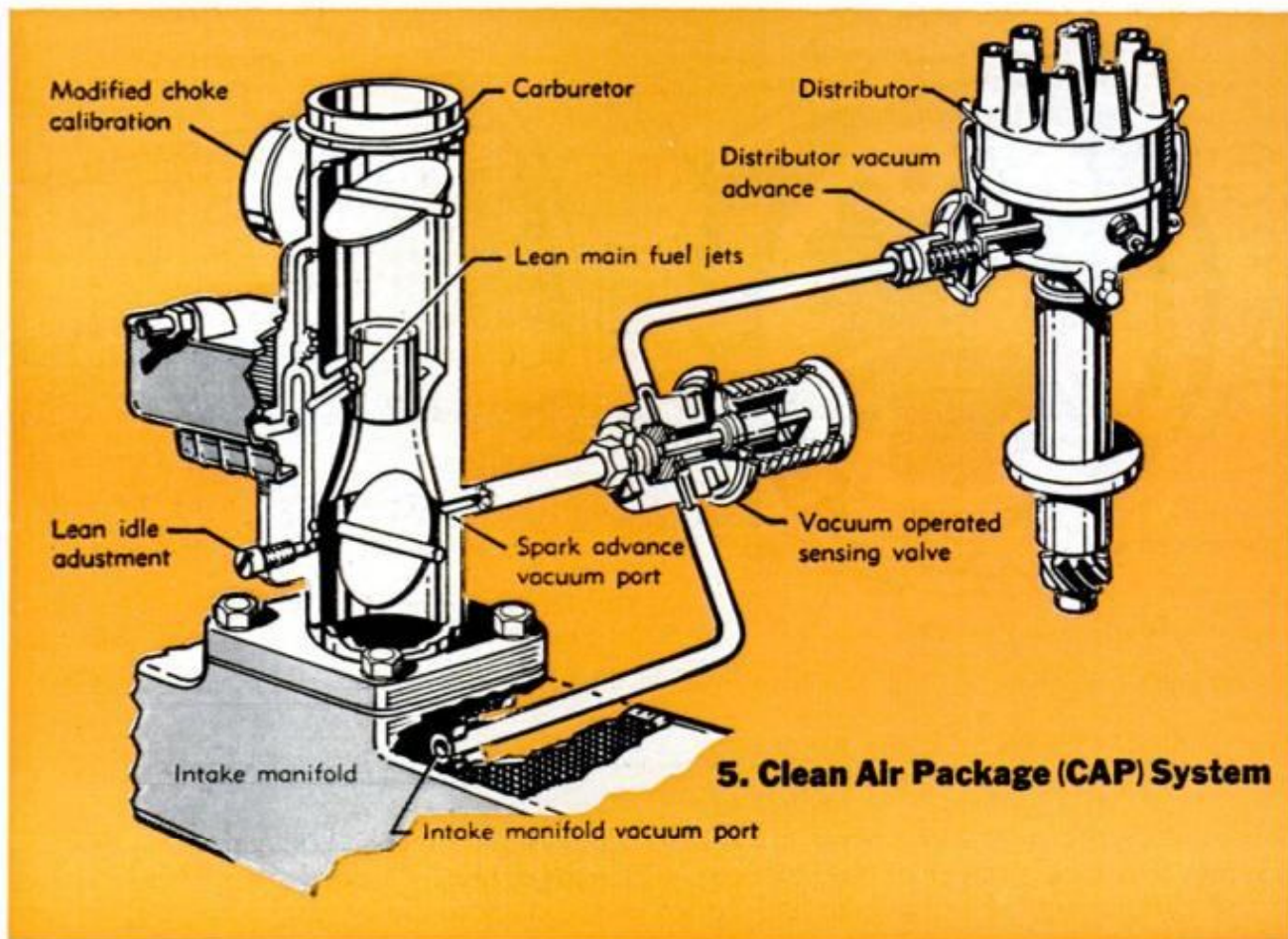
along with the exhaust gases on the exhaust stroke. These illustrations are exaggerated; actually, fuel loss is from one percent while cruising to around five percent while decelerating. With the air-injection system, a charge of air is delivered at the exhaust port providing additional oxygen to ignite the unburned fuel particles as shown in view "C."

The air-injection system adds a considerable amount of confusion to the already crowded engine compartment as shown in Fig. 3. A belt-driven air pump receives air from a tap in the carburetor air filter and delivers it under pressure to air manifolds along each exhaust manifold.

The check valve at each air manifold



6. Vehicle Vapor Recovery (VVR) System



keeps exhaust out of the air system.

Air from the pump is also fed to a vacuum-operated "gulp," or antibackfire valve, which is necessary since an oxygen deficiency results in the engine upon deceleration because of the closed throttle. The injection of air at the exhaust port would result in a backfire as the unburned fuel in the combustion chamber is ignited unless the oxygen deficiency is overcome. The vacuum-operated valve "senses" an approaching deceleration condition, the valve opens and enough air to overcome the oxygen deficiency is admitted to the intake manifold.

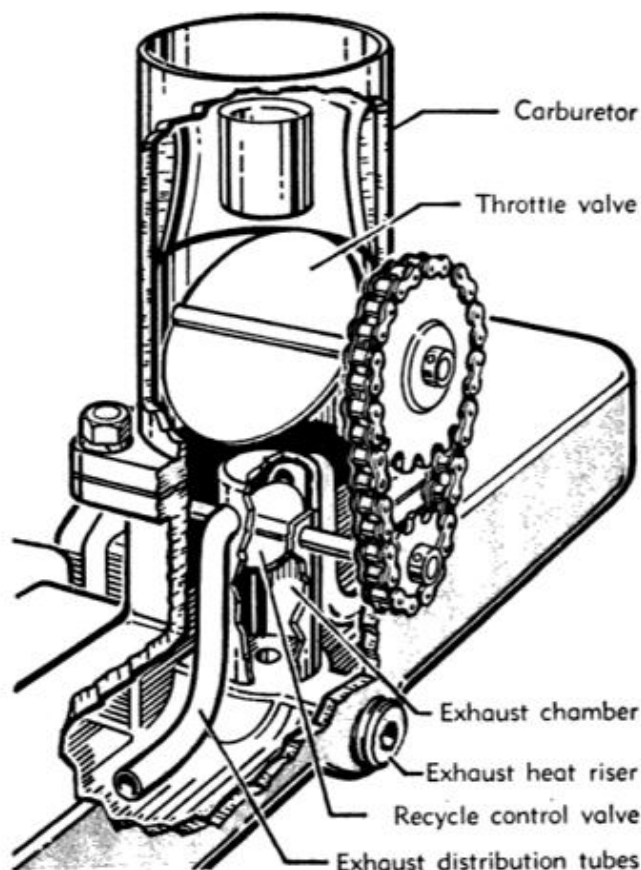
Air for the injection system is provided by a vane-type, belt-driven pump, shown in Fig. 4. The vanes in the pump are similar to a paddle wheel, with the axis being in the center of the pump housing. The vanes pass through the periphery of the rotor, which rotates on an offset axis, resulting in the alternate extension and withdrawal of the vanes through the rotor perimeter with each revolution. Air trapped between the succeeding vanes is squeezed between the converging peripheries of the rotor and the housing, as the rotor and vane assemblies rotate within the housing. The vanes are sealed where they pass through the rotor drum by

springloaded carbon shoes. Since the angular relationship of the vanes is constantly changing, they are pivoted individually on the vane axis.

Too much pressure at the air outlets in the exhaust ports would create seriously elevated exhaust temperatures. To control this condition and prevent high-pressure damage to the pump, a relief valve is provided in the pump discharge chamber.

The new smog-device requirements pose a problem for the imports and other cars with restricted under-hood area which makes installation of a belt-driven pump in line with the crankshaft pulley difficult. AMF-Chromalloy has developed a turbine-driven air pump that can be mounted anywhere because it needs only hose connections.

The pump action is illustrated in Fig. 4. It works on a differential of pressure between atmospheric and the intake manifold vacuum. Air enters the pump through the filter at the left and is ducted to both the turbine rotor and the pump impeller. Air striking the turbine buckets rotates the pump shaft and impeller at a speed of 30,000 rpm, and then exits to the intake manifold to the right. The pump compresses air through the restricted slot at the edge of the impeller.



7. Nitric Oxide Reduction (NOR) System

The air then goes out the outlet at the bottom to the air manifold. The rest of the exhaust-air system would be similar to that used with the vane pump.

Chrysler uses a different approach to the reduction of exhaust pollutants. Rather than use the hang-on paraphernalia of the air-injection system, Chrysler has chosen a somewhat less complicated system of fuel mixture and timing control to reduce harmful emissions.

The Chrysler system is called Clean Air Package (CAP). A combination of lean fuel mixtures and higher combustion temperatures due to retarded ignition during the more highly emissive periods of engine operation is the basis of this system, which is shown in Fig. 5.

A modified choke calibration is used in the CAP system. The choke opens sooner than usual, resulting in a reduction of the rich fuel mixture period during engine warm-up. The main jets and idling adjustment are both set leaner than usual. The distributor-advance mechanism allows about 5° more retard than usual, and vacuum advance of the distributor is controlled by a sensing valve that is interposed between the spark-advance vacuum port and a vacuum port in the intake manifold.

When decelerating or idling, strong vacuum in the intake manifold is overcome by the sensing valve spring, and the spark is retarded. The retarded spark and lean mixture cause increased temperatures in the combustion chamber. The consequent reduction in idling horsepower requires a wider throttle opening, allowing more oxygen for the consumption of the unburned fuel particles.

Two additional sources of unburned hydrocarbons are the fuel tank and carburetor bowl vents, which contribute emissions by evaporation. Atlantic-Richfield Co. of Los Angeles has developed a Vehicle Vapor Recovery (VVR) system, shown in Fig. 6, to eliminate these sources.

An average of 32 grams evaporational loss per short trip has been estimated to come from the fuel-tank vent. Carburetor evaporation loss is almost entirely during the "soak" period just after the ignition has been turned off. The engine retains residual heat, and the carburetor float bowl temperature will rise to the 150 to 200° F. range, causing rapid fuel evaporation.

With the VVR system, the vents of the fuel tank and the carburetor float bowl are ducted to a condenser mounted on the vehicle dash. There are no vents to the outside atmosphere. Condensed fuel is fed back to the fuel tank, while any remaining vapors are vented to the crankcase ventilation system for consumption.

A characteristic of the battle against the harmful elements of vehicular exhaust emissions seems to be that a gain in one area usually results in a loss in another. The elevated temperatures that result from the lean mixture, and the retarded timing that is used to reduce percentages of unburned hydrocarbon and carbon monoxide, are both conducive to the formation of oxides of nitrogen. These compounds are among the most noxious of the elements that make up photochemical smog.

One of the initial attempts at satisfying forthcoming requirements on reduction of the emission of oxides of nitrogen is the Nitric Oxide Reduction (NOR) system, also developed by Atlantic-Richfield. The system works by lowering the peak combustion-chamber temperatures, while cutting down on the oxygen concentration

(Please turn to page 240)



Art Mikesell tests Starcraft's Super Sport-V nimble and roomy

IF YOU STILL THINK of aluminum boats as shiny little 12-ft. fishing rigs, take a look at the snappy sportabout above. That's Starcraft's new Super Sport-V, and it's all aluminum.

To test this boat, I recently visited Starcraft's big aluminum and fiberglass boat plant located just outside Goshen, Ind. While there, I also took the opportunity to catch up on new developments in the marine aluminum field. Starcraft seemed like one of the best sources for such information, since they're not only one of the biggest manufacturers of aluminum boats (over 35,000 last year), but also have had about 40 years' experience in building boats of metal.

Before testing the SS-V, I was taken on a guided tour of the plant by Bill Dieterly, who is Starcraft's man in charge of distributor sales. The aluminum used by Starcraft, I learned, is a special marine alloy called 5052 in the trade. Corrosion resistant and designed specifically for building boats, it's made by adding magnesium and traces of other metals to the aluminum.

"Our hulls are all double-riveted," said

Bill, "but there's no seaming below the water line. Where the sides join the bottom, we use a triple-seal seam with Nu-chromeseal rubber tape between the two pieces of aluminum. We then drill through it with a double row of rivets, hand buck every one—every rivet in the boat is hand bucked, incidentally—and bead both extremes of the seam, inside and outside, with Goodyear Pliobond marine sealer. With this triple-seal seaming, we can guarantee our hulls against leaking or rivet popping for 15 years."

How about that old aluminum bugaboo, noise?

"The two main factors in noise here are the way you join the seams and the placement of sound-deadening materials," said Bill. "Instead of seaming the hull at the keel, we seam it at the chines with a rubber seal, then strengthen and 'unitize' it with a heavy-gauge rib structure. This cuts down on any tendency of the hull to 'work.' As for sound insulation, we lay pieces of styrofoam in the bottom of the hull, then put the plywood floor over them and pull it down tight."

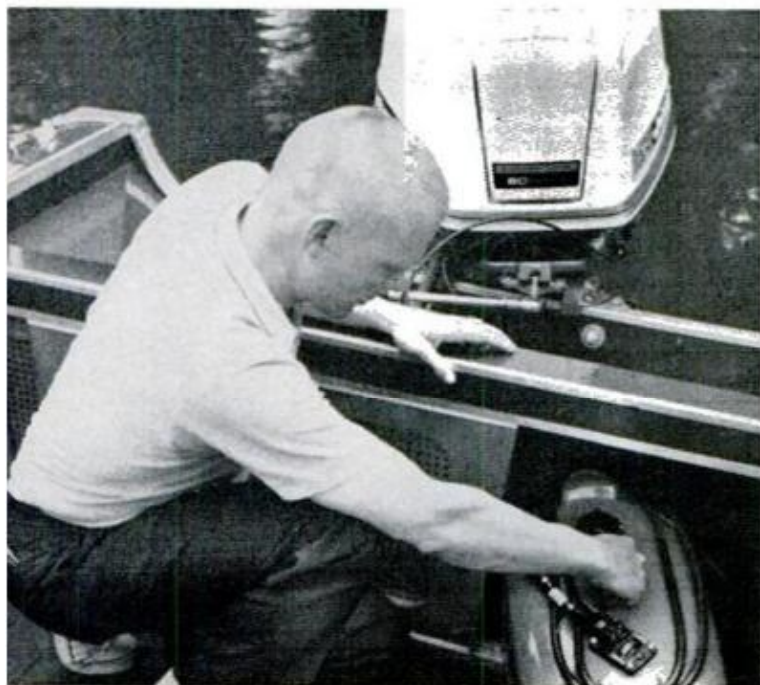
After the plant tour, I had just one



parting question: What's the biggest advantage of aluminum over fiberglass or wood as a material for building boats?

"Light weight and performance," Bill answered without hesitation. "Because of the weight advantage, it takes less horse-

FUEL COMPARTMENT is well vented with sliding doors of perforated aluminum in open woven-cane pattern



power to propel an aluminum boat. It then becomes cheaper to buy and cheaper to operate. Of course, the light weight makes it easier to trail an aluminum boat behind a car, easier to launch and easier to load on a trailer."

With these things to mull over, I headed up to Lake James in the northeast corner of Indiana where Alan Isley, Starcraft's advertising/promotion manager, was supervising photography of the 1968 line. The Super Sport-V was in the water and ready to go when I got there.

Dockside, this boat makes a fine first impression. The cockpit is clean lined and uncluttered. Finishing is excellent. I commented on the workmanship to Alan.

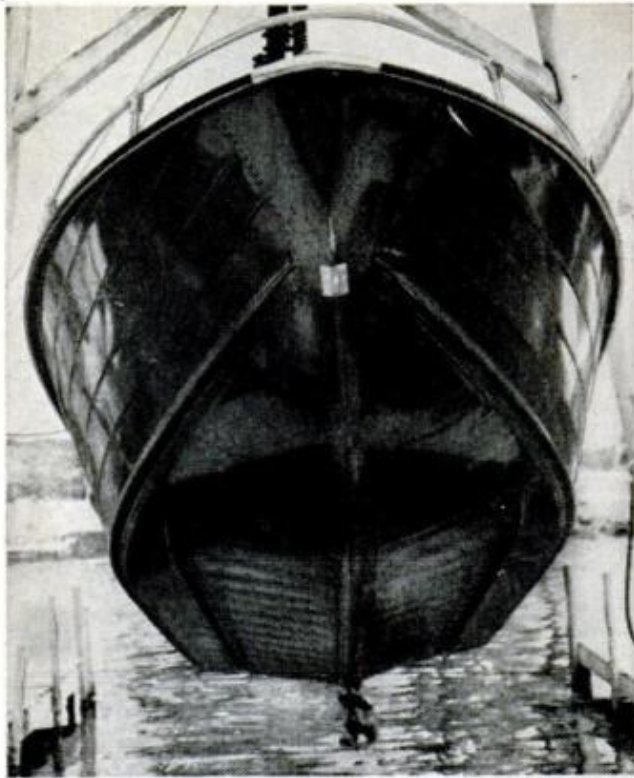
"We've got good employees, and most of them have been with us a long time," he explained. "Our plant is right in the middle of an Amish Mennonite settlement, and these people are steady employees, good at working with their hands. I'd say this is one of the reasons we've done so well, because of the loyalty and experience of our employees. It takes years to learn to bend and form metal."

I hopped down into the cockpit, started the Johnson 60, eased away from the dock and headed down the channel for open water. While getting the feel of the boat, I discovered a couple of minor things to complain about, neither exactly earth-shaking.

For one, there was only finger-width clearance between the throttle portion of the twin-lever control and the wind-

DRIVER'S SEAT is well positioned with good visibility, but throttle lever swings too close to windshield





CONCAVE-V HULL features a basic V shape to smooth out chop but curves down at chines for extra lift

ROOMY COCKPIT has storage compartments under the forward bench seats. It takes six people comfortably



shield strut, even though the control box was mounted on a plywood standoff plate. With other shorter controls, though, this problem would probably disappear. Also, the floor in front of the driver's seat was flat. Personally, I prefer an angled foot board or something similar to brace my feet against. So much for picking nits.

Once in the clear, I opened it up and started through the usual series of full-throttle turns, figure eights, wake jumps and the rest of it. I quickly discovered

another thing about the SS-V: It's one fun boat to drive.

Being light for a 16-footer, it made that Johnson 60 feel like at least a 75. The lightness of the hull showed up in all sorts of ways. With less inertia, it turned faster but with a minimum of skidding (which, I suppose, is due to that concave-vee hull design). It laid into a turn smoothly, maintained a good banking angle and came out quickly but without any

(Please turn to page 240)

SPECIFICATIONS FOR 16-FOOT SUPER SPORT-V

TYPE: SPORTABOUT

Center Length:	16'
Gunwale Length:	17'2"
Beam:	78"
Bow Depth:	34"
Center Depth:	34"
Transom Width:	69"

Transom Height:	21"
Approx. Weight:	645

RECOMMENDED CAPACITY

Pounds:	1500
Persons:	7
Horsepower:	80

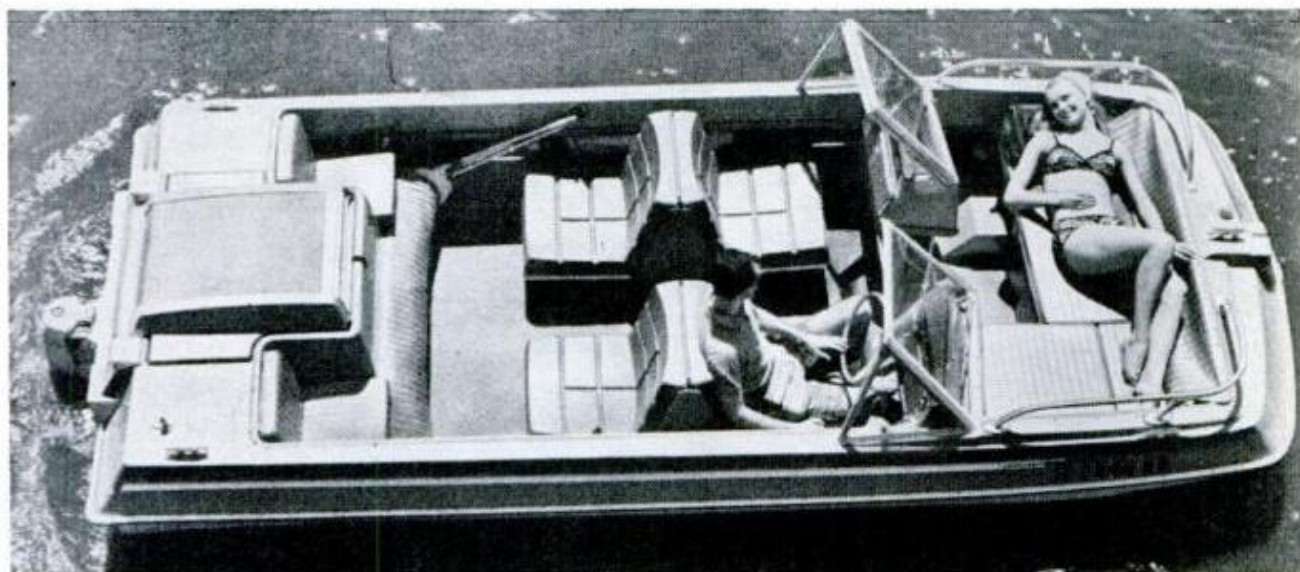
STANDARD EQUIPMENT:

Twin plexiglass windshields; upholstered bow seat; side steering station; back-to-back convertible sleeper seats; mechanical steering; bow and stern lights; bow rail; storage compartment under seat; flotation material under floor; vinyl floor covering; vinyl-covered side panels; side storage racks; motor well with drain; plywood motor mount; aluminum transom cap; bow eye; stern handles; siphon drain; stern cleats; step pads; gunwale moulding with vinyl insert; hull bumper with vinyl insert.

Three Slick New Boats for '68



CHRYSLER COMMANDO 151 is a 15-ft. utility version of the company's Hydro-Vee fiberglass hull. Wide-open cockpit features center-line seats and control console. Driver can either sit or stand. Large casting platform at the bow has a textured surface for sure footing, also provides additional seating space. Center seats have hatch tops, double as storage compartments. Interior is blue, exterior either blue or white. The Commando 151 has a 77-in. beam and is rated for outboards of up to 90 hp.



JOHNSON SEASPORT II, a 16-ft. open runabout, offers 96 sq. ft. of cockpit. Standard equipment includes single-lever Electromatic throttle and shift, walk-through folding windshield, convertible top, deck cover and bow rails. It's available with either 155-hp or 120-hp stern drive.



CRESTLINER MUSKIE comes in the original fishing version and a more luxurious package (left). It's a 15-ft. "Stabilized Vee Wing hull" (how about that for a name!) with a beam of 72 in. Both models have a full-width bow seat with storage underneath, plus two fold-down lounge seats. Rated up to 80 hp, the Muskie weighs 560 lbs. and will carry a load of over 1700 lbs. Crestliner has priced it at \$805, f.o.b. Little Falls, Minn.

Winter wrap-up for your stern drive

Here's the A-to-Z story on setting up your inboard-outboard for safe off-season storage

By HENRY B. NOTROM

WINTERIZING AN I-O is a two-phase operation which can easily be split in half if you don't have time to do the whole job in one day.

First, you go over the engine while the boat is still in the water, then haul the boat out, drain the cooling system and service the stern drive. Of course, you can do the whole thing in your driveway if you use one of those clamp-on fittings to supply water for the cooling system from a garden hose. But the first way is easier and simpler.

The general mothballing procedure is the same for all I-Os, but details may vary widely. Check your owner's manual (or better still, the shop manual) for specific instructions.

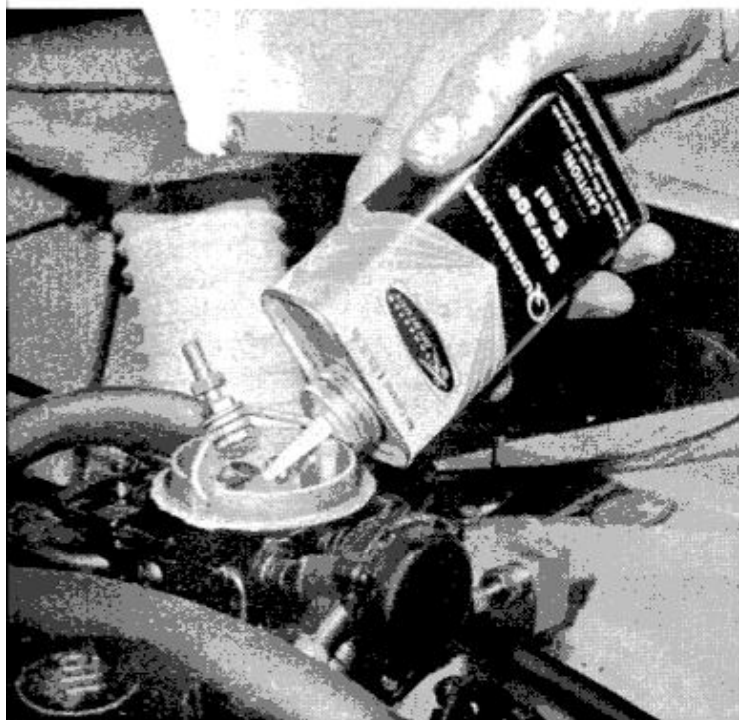
For example, all manufacturers agree on the importance of draining the cooling

system, but because of differences in the location of manifold and cylinder block drain plugs, there is no one correct procedure for this. Johnson Motors tells you to "be sure that the inboard-outboard drive engine is in a *horizontal position* to assure complete drainage."

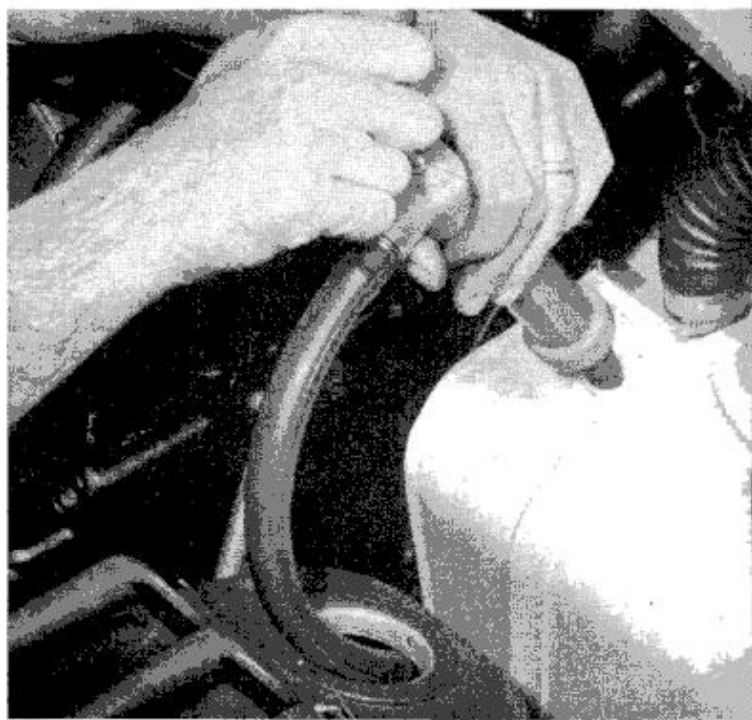
On the other hand, Mercury says this about draining all its engines from 110 up: "When draining the engine's cooling system, it is necessary that the bow of the boat be *higher* than the stern . . ."

With the MerCruiser 60, though, the rules are different. "When draining the engine's cooling system it is necessary that the bow be *lower* than the stern . . ."

So you can see that it's absolutely necessary to know the winterizing procedure for *your* particular rig in order to do the job right.



WITH ENGINE RUNNING, add storage seal or SAE 20 MS oil to carburetor to coat all internal surfaces



OIL DRAIN PUMP used to pump oil from crankcase is also handy for removing fuel from your fixed tanks



DISTRIBUTOR should also be protected, paying special attention to the cam and breaker point pivot

Also, the step-by-step program described here applies to gasoline engines only. While there is a great deal of similarity between winterizing a gas engine and a diesel, there are enough differences to make an article twice this size.

Begin by starting the engine and running it until it reaches normal operating temperature. This stirs up all dirt and foreign matter in preparation for draining the oil. Then shut off the engine and drain the

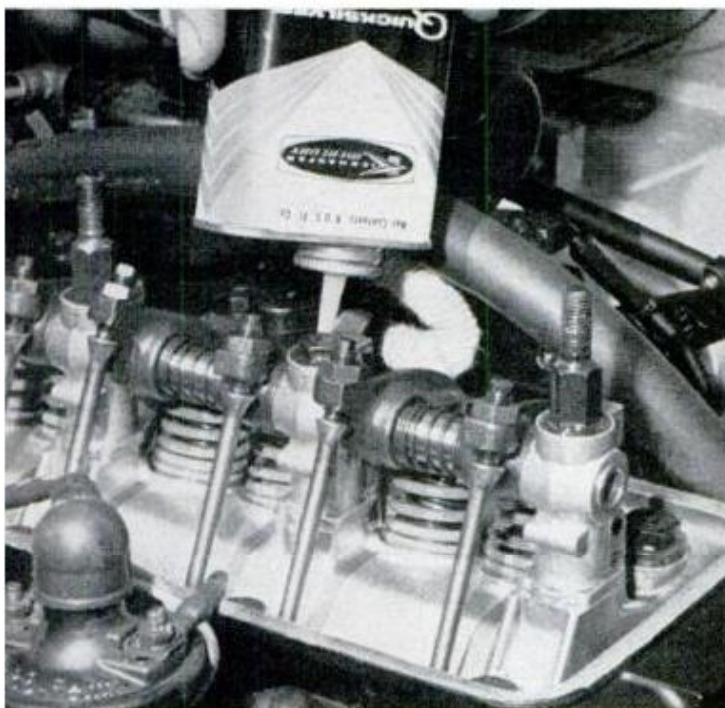


BATTERY should be removed from the boat, cleaned, charged and stored inside in a relatively warm place

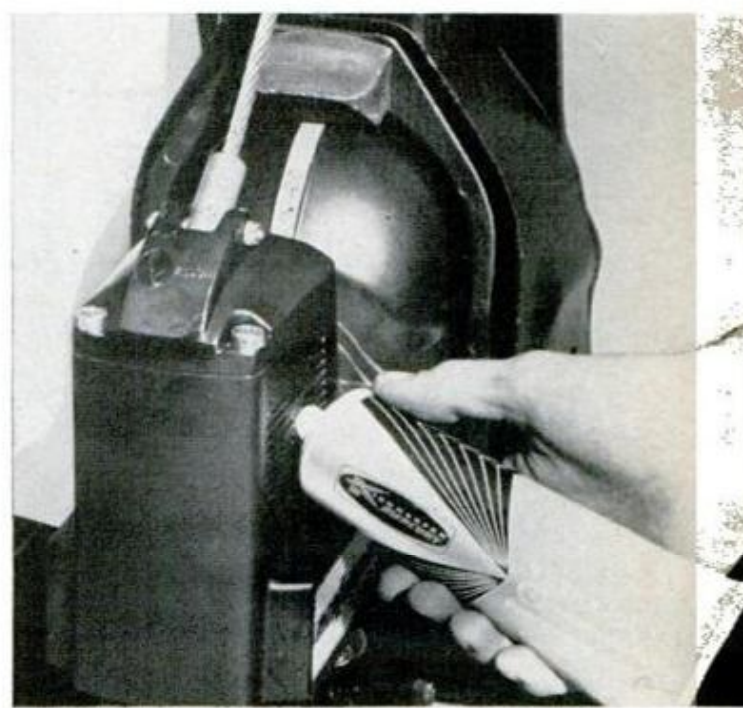
crankcase, either by removing the oil-pan plug or by pumping the oil out through the dipstick tube with an oil-drain pump.

Remove the old oil filter, clean the filter housing (if your engine uses a replaceable element) and install a new filter. There is no filter housing if a replaceable cartridge filter is used.

Refill the crankcase with fresh SAE 20 oil and an oil supplement such as Quick-silver 4-Cycle Engine Oil Supplement;



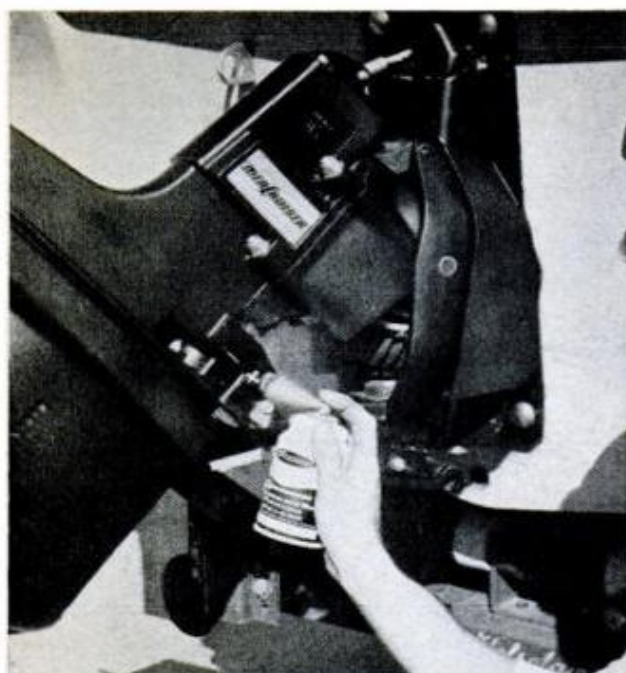
GIVE VALVE mechanism liberal coating of crankcase oil or storage seal. Also, coat inside of the cover
NOVEMBER 1967



ADD LUBRICANT through the upper gear chamber filler hole until it reaches the level of air vent hole



LUBRICATING individual parts of drive unit, such as gimbal housing upper pivot pins, is separate job



FINISH UP by wiping the stern-drive unit clean and spraying all surfaces with a good rust preventive

Mercury recommends this, and while other manufacturers don't spell it out, I'm sure they wouldn't argue against it.

Restart the engine and run it for a few minutes at between 800 and 1200 rpm to circulate the new oil. Check to make sure the new oil-filter cartridge is properly sealed. Then recheck the oil level and add oil if necessary.

Next, shut off the gasoline supply at the fuel tank. Remove the flame arrestor(s) and restart the engine. Run it at 800 to 1200 rpm while slowly pouring one cup of storage seal or SAE 20 MS oil into the carburetor.

Ventilate the compartment

You're supposed to allow the carburetor, fuel pump and fuel line to drain themselves of fuel. Finally stall the engine by pouring the last two ounces of oil rapidly into the carburetor.

Be sure that when you do this "draining" of the fuel system, the engine compartment is well ventilated and there aren't gasoline vapors around to cause engine backfire.

Replace or clean the fuel filter, clean the sediment bowl (if there is one), reinstall the bowl using a new gasket and drain all gas from the fuel tank. Also, as long as the flame arrestor is off, clean it before replacing.

So much for the engine. The next step is to haul the boat and drain the cooling system.

WINTERIZING YOUR OUTBOARD

Here are high points to hit in shelving your outboard for the winter. (If last run in salt water, run it in fresh water at least five minutes before winterizing.):

- Operate engine in test tank or on boat (in fresh water) while injecting rust-preventive oil into carburetor intake until motor begins to smoke. Stop engine. This lubricates internal parts of powerhead.
- Disconnect sparkplug leads and rotate flywheel several times to drain water pump.
- Remove and clean or replace sparkplugs.
- Squirt protective oil or storage seal into cylinders through sparkplug holes. Reinstall plugs and torque as recommended.
- Drain carburetor float chamber. Remove fuel filter. Drain and clean bowl. Clean and replace filter element and gasket.
- Clean and lube electric-starter drive.
- Drain and clean fuel tank.
- Remove prop. Clean and lube shaft. Replace prop drive pin if bent or worn. Reinstall prop.
- Drain and refill gear case.
- Lube all parts cited in lubrication chart, such as carburetor and choke linkage, throttle linkage, clamp screws, friction ratchet, tilt adjust rack and pinion, swivel bracket, throttle shaft and shift lever.
- Clean external motor surfaces with cloth soaked in light oil. Or clean and spray powerhead with corrosion preventive.
- Store motor in upright position in a dry, well-ventilated area.
- Remove battery from boat, clean and charge it. Store.

Remove the manifold and cylinder-block drain plugs, and also the water-intake hose if called for. Then tilt the boat as instructed in your manual and allow all water to drain out. To complete the cooling system, check all water hoses for cracks or interior rubber flaking, and replace any that need it. You could reinstall the drain plugs now, but I think it's a good idea to leave them out over the winter. It gives condensation that may build up a chance to drain, and assures that the plug threads won't "freeze" during cold weather.

Put the plugs in a small cloth bag, like the ones used for Bull Durham roll-your-own, and tie this to the instrument panel or ignition key.

Although it's not absolutely necessary if all water is drained, there are some who advocate filling the cooling system with an antifreeze and rust inhibitor. If you want this added protection, use a good-quality ethylene glycol antifreeze which contains a rust inhibitor.

Okay, release and inspect the alternator and water-pump drive belt. If it's in bad shape, get rid of it. No need to replace it now, but if you don't, make a note to that effect so you won't forget, come spring.

If the old belt is in good shape, put it back on, but leave it loose.

Electrical system comes next

Now, turn your attention to the ignition and electrical system.

Start by lubricating parts—such as the starter, alternator (generator) and control linkage. Here you'll need the lubrication chart for your engine to find out what has to be lubricated and what lubricant to use. Whatever the case, in all situations apply a small dab of cam and ball-bearing lubricant to the distributor cam surface and add a drop of light engine oil to the breaker lever pivot. You want to keep these two spots well protected during cold weather.

Next, remove all the sparkplugs and squirt an ounce of storage seal or SAE 40 MS oil into each cylinder. Pull the high tension lead from the distributor and ground it. Now, crank the engine for at least 15 seconds to make sure a good coating of oil gets on the cylinder walls.

If the plugs aren't in good shape replace them with new ones now. If they're okay, clean and regap them and reinstall with

(Please turn to page 224)

Outboard Clinic

Q. Can you tell me the proper way to clean my outboard fuel tank? It's been some time since this was done, and I want to prepare it for winter.—D.F., N.H.

A. This is simple, but important. Just run the tank completely dry and check the bottom for dirt, rust or water. If you find any, pour a little kerosene or commercial alcohol into the tank, slosh it around and drain. That's all there is to it. Clean the tank at least twice a season—around mid-summer and at the end.

Q. Upon removing the fuel bowl of my 9½-hp Evinrude for winter service, I noticed a lot of gum on the inside. I can't get all of it off. Can you recommend something to do this job? A.D., Minn.

A. Try lacquer thinner.

Q. I use an ether starter fluid to get my car going in cold weather. If I decide to use my stern-drive boat this winter, can I use this same fluid for quicker starting?—F.R., N.Y.

A. No, sir! Ether starter fluid in capsules, spray cans or any other form *must not* be used in a marine engine. It causes extremely high pressure in the cylinders, which could lead to serious (and expensive) damage. You should have no problem starting in cold weather provided:

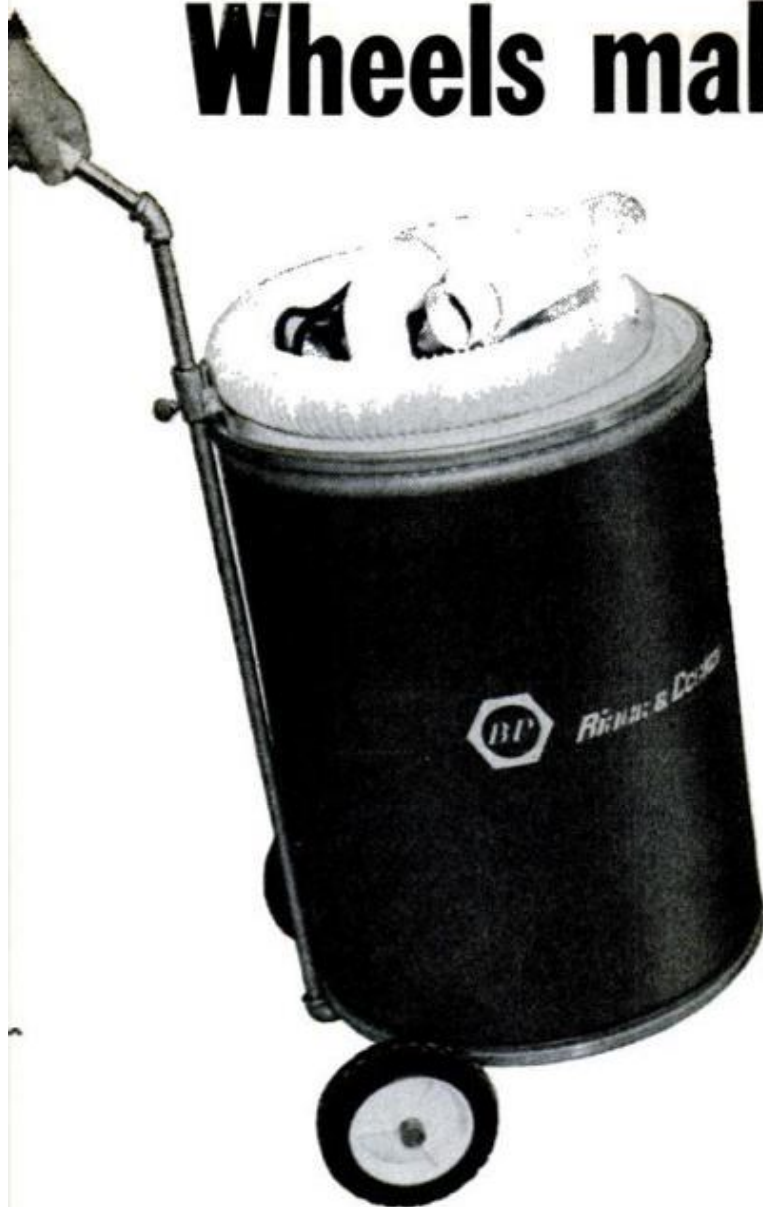
- the engine is tuned to perfection;
- the battery is fully charged and in good condition;
- you're using the correct viscosity oil;
- you prime the fuel system properly;
- you follow the correct cold-weather starting procedure outlined in your owner's manual.

Q. I have a 65-hp outboard; my buddy has a 95-hp model. Both are in good shape. I get 4½ mpg at cruising speed, he gets 5½. How come?—F.S., Calif.

A. The smaller engine has to work harder to do the same job, so it uses more gas. Generally, it's conceded that a bigger engine running at ⅔ throttle will use less fuel than a smaller motor going full bore.

FOR A PERSONAL REPLY to your outboard motor question, write Outboard Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Enclose 25 cents in coin.

Wheels make your shop



YOU CAN DOUBLE the usefulness of your powerful workshop vacuum by mounting it on this three-wheeled dolly that allows you to perform tough clean-up jobs around the garden or garage, as well as in the shop.

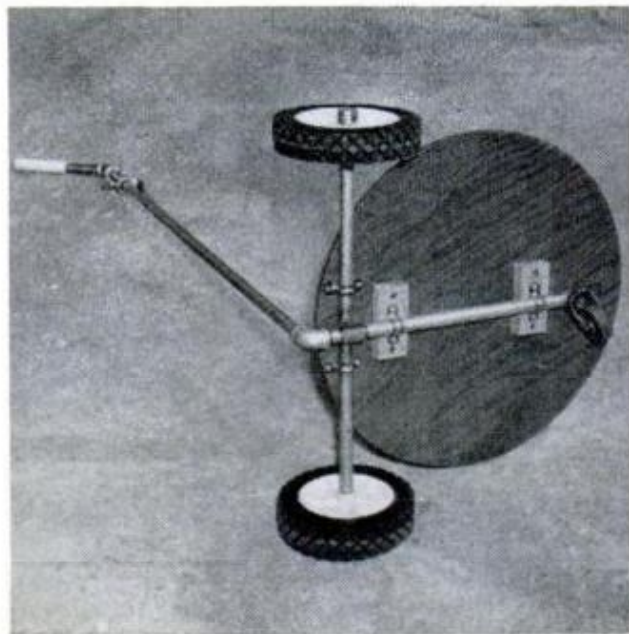
Construction is mainly a matter of screwing together standard $\frac{3}{8}$ -in. pipes and fittings. The axles for the wheels are short pieces of $\frac{1}{2}$ -in. shaft driven into the $\frac{3}{8}$ -in. pipe. No further fastening should be needed as the inner diameter of a $\frac{3}{8}$ -in. pipe is $\frac{1}{2}$ -in. Thus you not only have easily fitted axles, but built-in shoulders for the wheels as well.

The size of the wheels isn't too critical, although 5 or 6-in. diameter wheels are recommended. Either ball-bearing or sleeve-type wheels will do, and shouldn't be too difficult to find locally. The caster used on the front of the dolly also is a common part that you can salvage or buy cheaply.

The $\frac{1}{2}$ -in. plywood platform that supports the vacuum tank should be cut to fit inside the bottom rim of the tank. The novel clip detailed on the opposite page fastens the top rim of the vacuum to the handle of the dolly.—*William G. Waggoner*

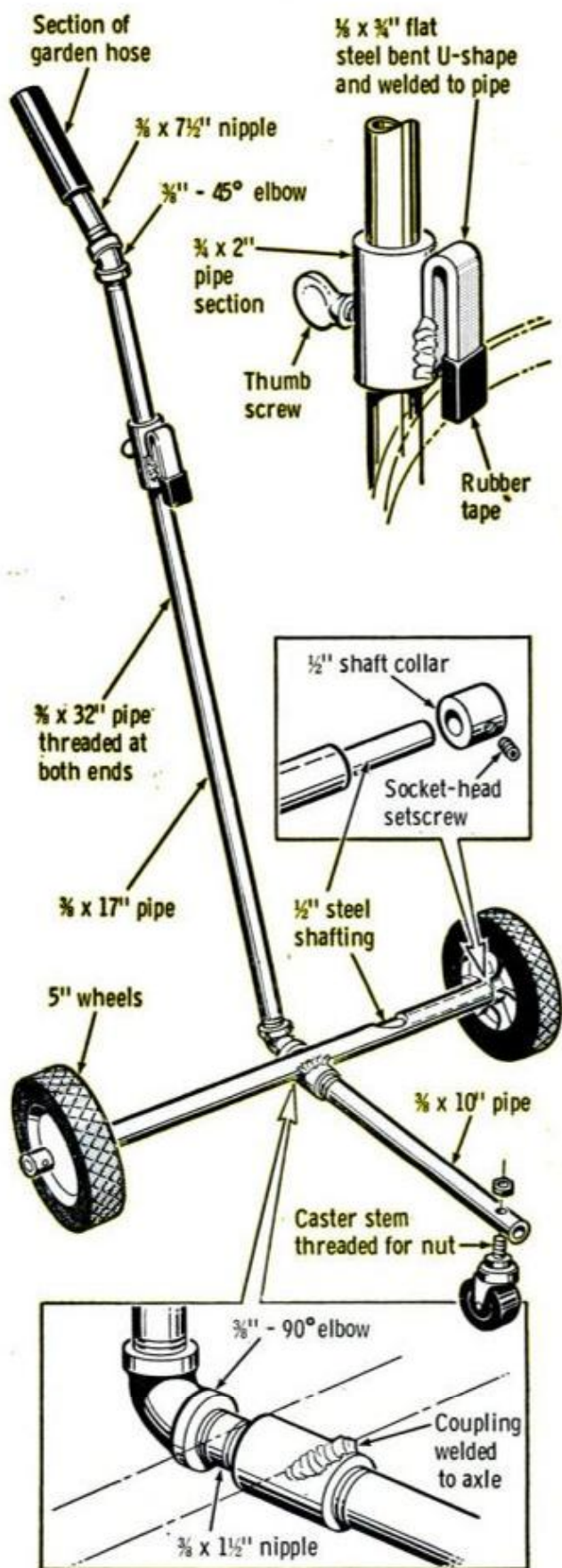
POWERFUL ENOUGH to suck up accumulations of dry leaves and other debris, the shop vacuum is ideal for use outdoors, yet it is too awkward to be carried. Solution: mount it on a dolly made of scrap pipe

THE PLATFORM SUPPORTING the vacuum tank is cut from $\frac{1}{2}$ -in. plywood and should be made to fit inside of the rim or lip on the bottom of the tank. Secure it to pipe with sheet-metal strips and screws



vacuum twice as useful

Technical Art by Graphic Presentation Services



How to repair aluminum storms

Now is the time to give storm windows and doors a thorough going over for top protection throughout the winter

By STEVEN J. HOWARD

NO MATTER HOW DURABLE your aluminum storm windows and doors may seem, they still require periodic inspection. Doors may sag out of alignment, windows can be cracked and door closers will deteriorate with time if not properly maintained.

Now is the best time for such an inspection and, if necessary, repair. Take care of the job now, and you can be assured of top protection when the weather turns cold.

Take aluminum storm windows, for instance. They are designed to seal off your regular windows from winter's icy blasts. A cracked pane will allow cold air to leak through, greatly decreasing the efficiency of the storm sash.

Yet many homeowners who would replace a regular window pane without giving the job a second thought still shy away from the *easier* job of replacing glass in storm sash. How come? It's those little vinyl strips that hold the glass in the aluminum sash. People seem to feel that once

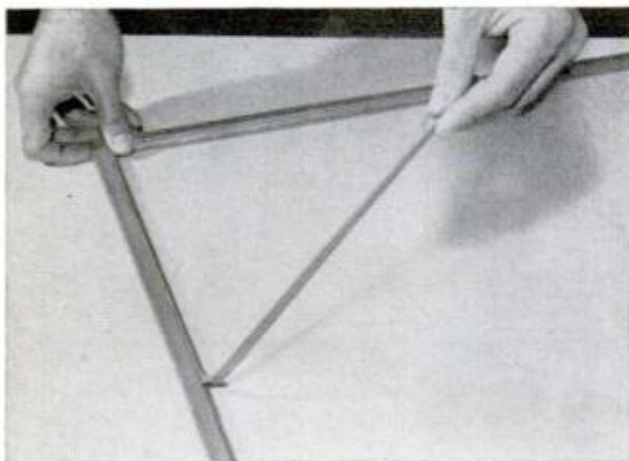
those strips are pulled out, it's almost impossible for the average homeowner to reseal them.

Professional glaziers aren't exactly enthusiastic about allaying such fears. Several told me that a "special tool" is needed to reposition the vinyl. This is nonsense. Anyone who can replace a regular window pane can replace the glass in aluminum storm sash, and without the aid of any special tool (unless you call a putty knife special). And as you might expect, you'll save money in the bargain.

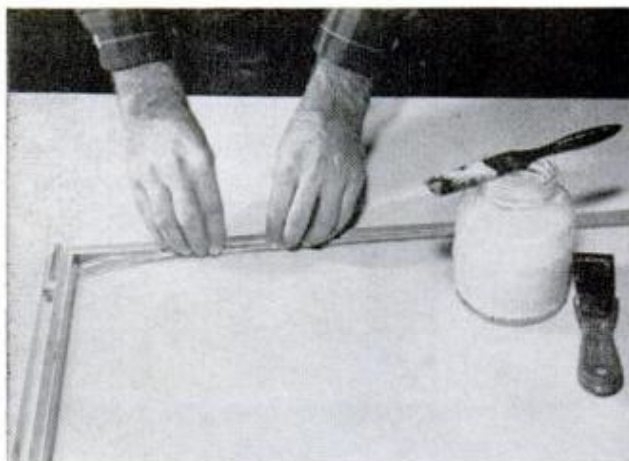
To find out how much can be saved, I repaired one aluminum storm window at a cost of \$1.70—the price of the pane of glass. Then, for comparison, I took a duplicate window to a glazier's to be repaired. His "special-tool" technique cost me \$3.50.

My technique, on the other hand, was simplicity itself, though there were a few tricks involved. This is how you do it:

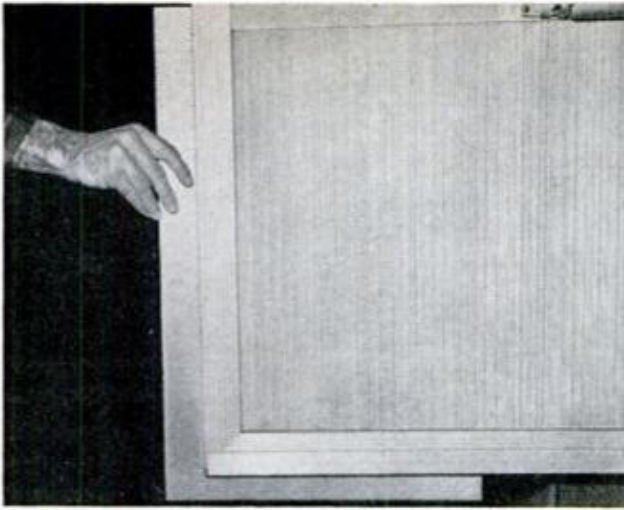
Start the job by slipping a putty knife beneath one of the vinyl strips running along the edges of the glass. Lift a small



TO REMOVE BROKEN PANE of glass from aluminum sash, simply pull out the vinyl strips holding it



SECRET OF RESEATING vinyl strips is lubrication with soapy water. Use a putty knife to push strip in



TO CHECK PLUMB of an aluminum storm door, use a square as shown. Corner should line up perfectly

section, grasp the strip with your fingers and pull the vinyl off its seat. Do this with each of the other strips. Now, simply remove the broken pane.

Carefully measure the length and width of the opening from channel to channel. Go to a glazier and have him cut a pane of glass to size. Put the new pane into the frame.

Now, here's the trick to reseating the vinyl strips. Make up a soapy-water solution. Brush it around the vinyl seat in the channel and on to the backside of the strip itself. Press the vinyl into the channel with the tips of your fingers and it will slide in smoothly. If you hit a tight spot, don't press too hard. Instead, use a putty knife (and more soapy water) to wedge the vinyl into its seat.

And be careful when you get to the edges of the window. Do not use finger pressure here. These are the weakest areas, and too much pressure could crack the glass. Use that putty knife.

What other parts of aluminum storm sash need care? Well, one thing that irritates homeowners and causes many a sore finger is lack of lubrication of the latch mechanism. It becomes hard to operate, and the windows themselves scrape or bind in the channels as you raise and lower them. The trouble is easily alleviated with some lightweight household lubricating oil, such as 3-in-1.

Remove the windows and screen from the frame. Then, working at the top of the frame, squirt a few drops of oil down each of the frame's channels. Replace windows and screen, and raise and lower each a few times.

A shot of lightweight oil on the sliding



WHEN SQUARE and door line up, tighten screws in test corner. All corners will then fall into adjustment

lock mechanism and spring of window latches makes that part operate smoothly.

Another job which might be necessary is to tighten up the screws holding the aluminum frame to the house. This cuts down on the gaps around the frame and, of course, on the amount of air that seeps in.

One final task is to inspect each window for sufficient weep holes. These are small holes drilled into the bottom section of the window frame through which water and condensation can escape. If there are no weep holes, drill a few. Three are sufficient for the average-size window—one on each end and one in the middle.

Aluminum storm doors are just as easy to maintain as aluminum windows. The most important check is to make sure each door is aligned properly. A door can lose plumb if the screws holding the door frame to the frame of the house loosen, if hinge screws loosen or if the house settles and causes the door to shift.

In extreme cases, it's not difficult to



TO ADJUST DOOR, loosen screws (at least 18) which attach the door pieces to the internal reinforcement



EACH WINDOW should have at least three weep holes to let trapped water escape outside the frame

know when a door has gone out of adjustment. The door's bottom will scrape against the threshold. However, you should try to catch the problem before it gets this bad.

Inspect the top of the door. That space between door and frame should be even all the way across. If not, tighten up on all screws holding the aluminum frame to the wooden frame. Tighten the door's hinge screws as well.

This may be enough to set the door right again, so recheck the top. If the space is still not even, the door should be re-adjusted.

How much adjustment is needed can be determined by placing a square on the top or bottom of the door. The space between the square and the door tells you how much the door is out of alignment.

Aluminum storm doors are held at each corner by an internal corner bracket. They are held across the middle by an

internal reinforcing piece that stretches from one side of the door to the other. At least 18 screws attach the door pieces to the internal reinforcing pieces. Four screws are positioned in each corner and one on each side of the sash in the middle.

Some doors have 20 screws—18 as described, plus two additional ones in the middle to hold a wider reinforcing piece.

To adjust the door, loosen *all* screws. Position the square, either at the top or bottom of the door, and shift the door by hand.

Hold the door firmly and tighten the screws at that corner. As long as this one corner is square, all others fall into place, so retighten all the screws.

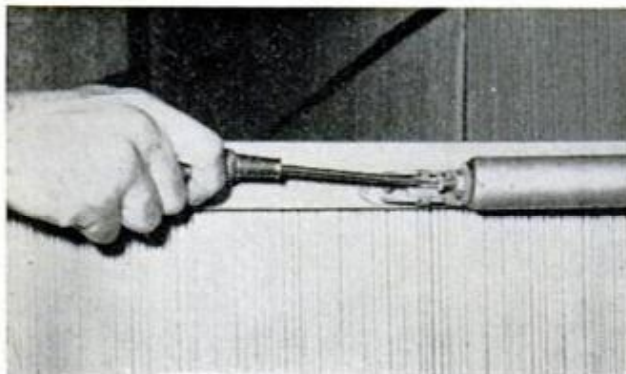
Aluminum storm doors also require periodic lubrication. For example, the door is equipped with a pneumatic or hydraulic cushion control that dictates the speed at which the door will close. The rate of closure is adjusted by a screw on the end of the cylinder.

These units usually have leather piston cups inside which, in time, can dry out and crack. When they do, the device loses its snubbing action and can't be properly adjusted. The result is a door that slams.

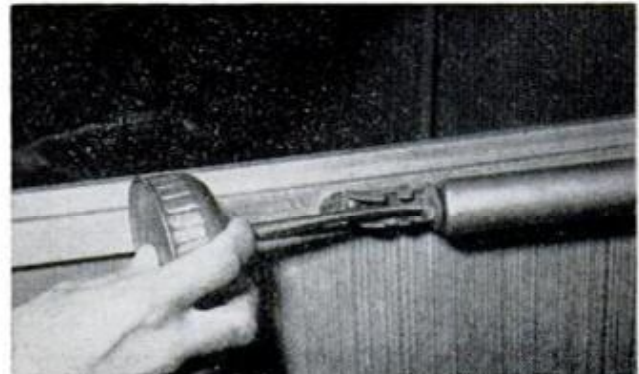
To avoid this, remove the screw at the end of the cylinder and squirt in a few drops of lightweight household oil. Slowly work the door open and closed several times to distribute the oil. Do this once a year to keep the leather piston cups soft.

Other parts of an aluminum storm door that should also be lubricated are the hinges, latch mechanism and lock.

Finally, check the chain guard at the top of the door. Its job is to prevent the door from swinging out too far when blown by the wind. The chain should be adjusted to stop the door just short of a right angle to the frame. ★ ★ ★



CUSHION CONTROL inside the door requires annual lubrication. To do this, remove the adjustment screw



SQUIRT LIGHTWEIGHT OIL through opening, then re-install screw and operate door to spread oil around

HINTS

FROM READERS

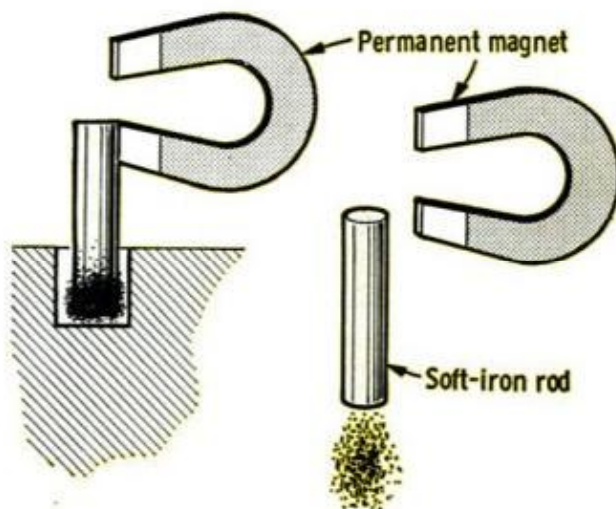
Target core of cardboard

When the straw core of your archery target becomes unserviceable, replace it with an inexpensive core of corrugated cardboard. Cut the cardboard into strips about 6-in. wide and tape the ends together with masking tape to form one long strip. Wind this as shown in the photo and then wrap the core with wire. Be sure to bring the target indoors at the first sign of rain.—*A. L. Pickens Jr.*



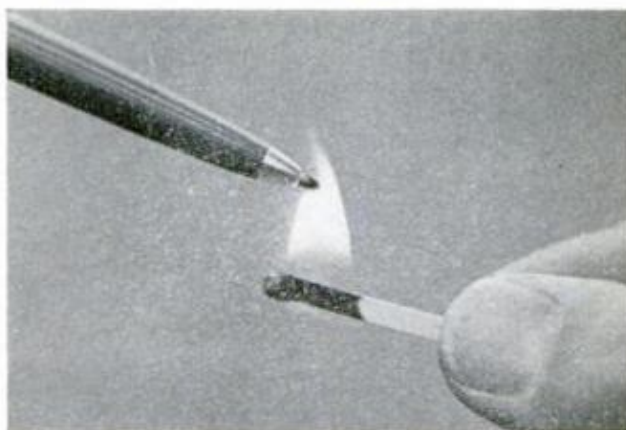
Magnet and rod attract chips

The next time you have to remove metal shavings or chips from a tight or seemingly inaccessible spot, try using a permanent magnet and a short soft-iron rod as shown. The rod actually acts as an extension of the magnet and will pick up fine metal dust as well as fairly heavy scraps. When the rod is pulled from the magnet, the shavings and dust fall from the rod since it has little residual magnetism.—*B. F. Borsody*



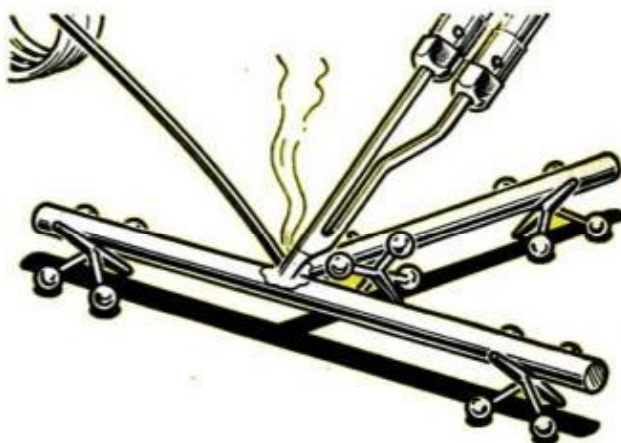
Match gets ballpoint going

You can squeeze quite a bit of extra mileage out of your ballpoint pens by giving them an occasional hotfoot. Most pens will clog and stop writing long before their ink supply runs low. In this case, the heat from a single match often will start the flow of ink again. Try it the next time a ballpoint begins to act balky. It'll cure the worst case of skipping in just a few seconds.—*John Capotosto*

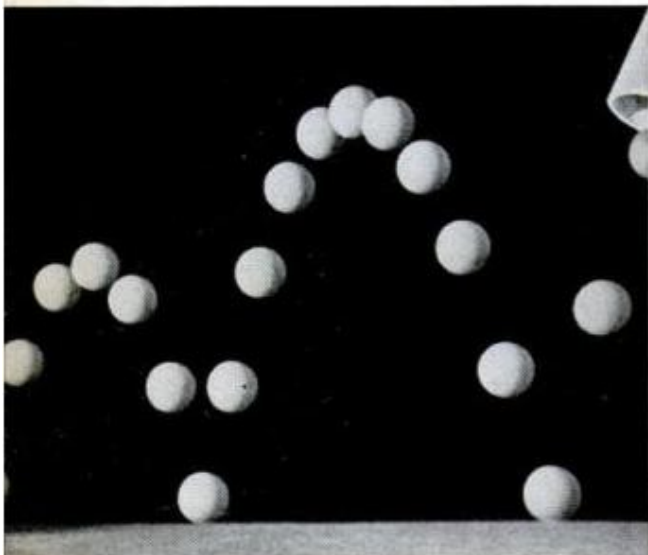
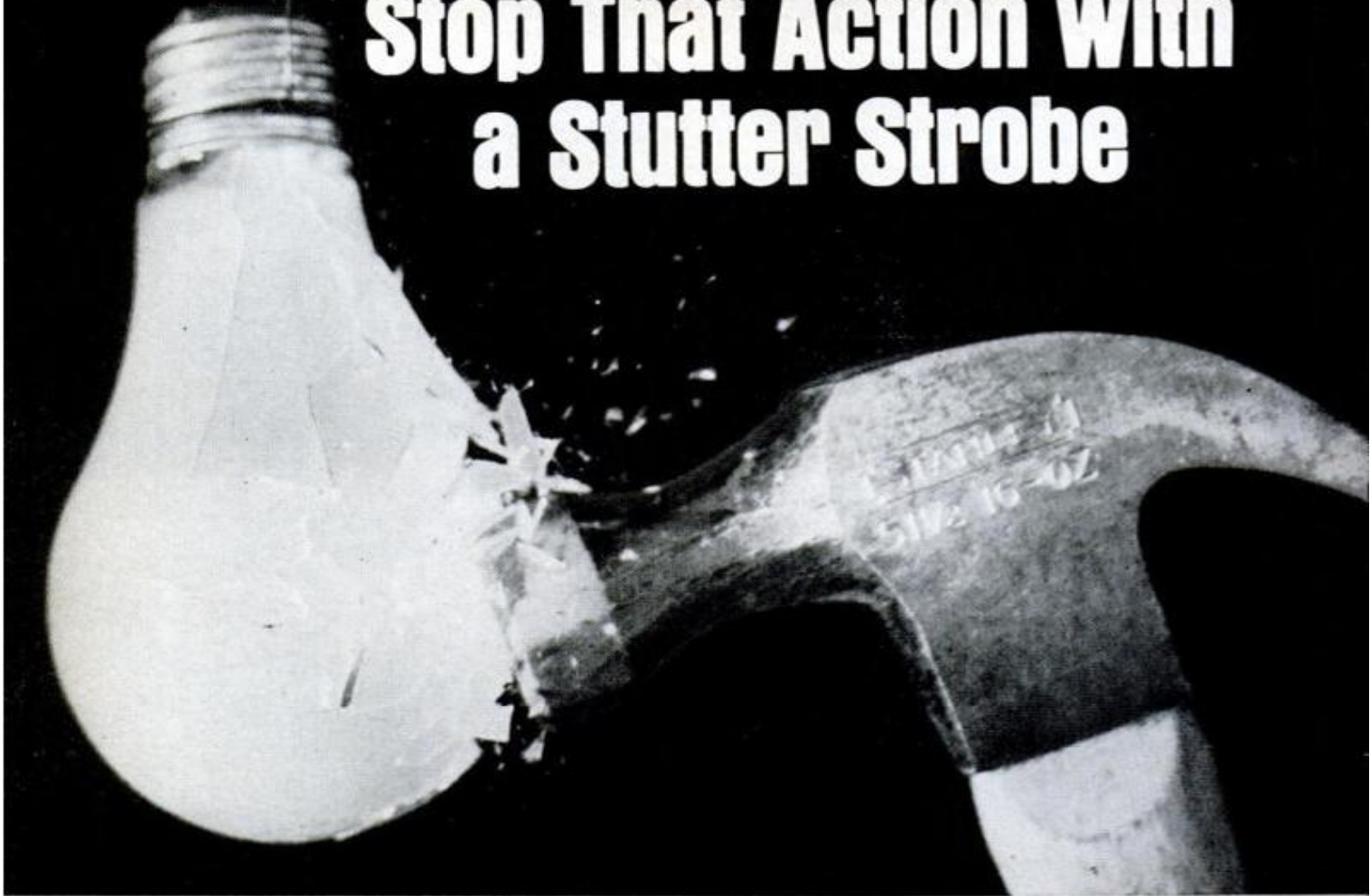


Jackstones aid soldering

Small round tubes and other hard-to-hold objects are easy to solder when they're supported on a few jackstones as illustrated. The jacks keep the work off the top of the bench and also allow the solder to flow completely around the joint. An important additional advantage is the fact that they also act as alignment guides, thereby assuring a neat, smooth and strong bond between the two pieces.—*James E. Kniseley*



Stop That Action with a Stutter Strobe



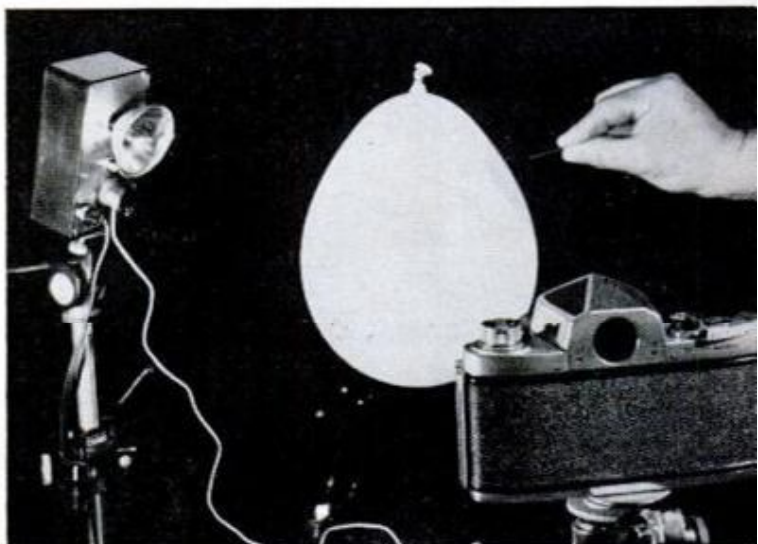
This rapid-fire speedlight, the first moderate-cost unit to hit the market, gives you up to 30 flashes a second to create spectacular motion-freezing flicker pictures like those shown here

By PAUL WAHL

Photos by Robert D. Borst

BOUNCING PING-PONG BALL traces graceful arcs as it's illuminated by successive flashes. Rolling it down a tube lets you control its bounce pattern

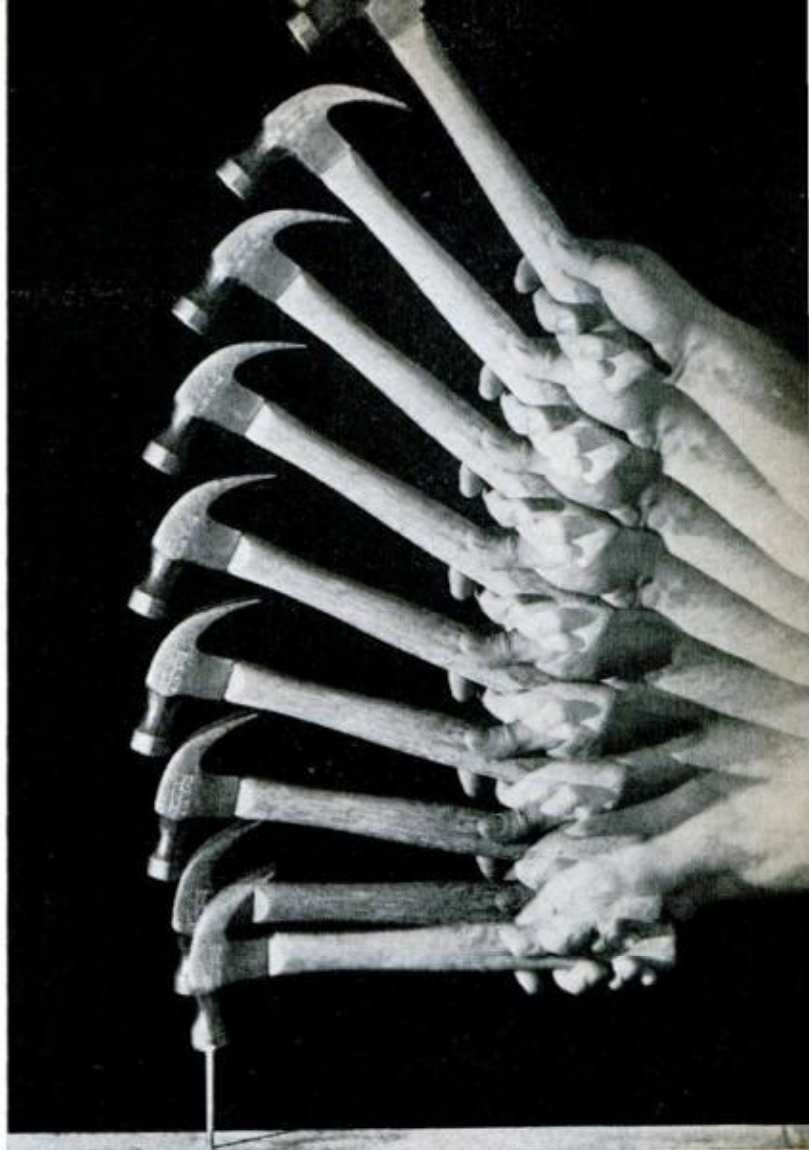
BURSTING BALLOON was shot with the setup at right. In this case, the explosion itself tripped the strobe by means of a tiny microphone placed under the balloon. You open the shutter, prick the balloon, the light flashes, then you close the shutter. By varying the distance between nuke and balloon, you can catch the explosion at different stages, as shown in the pair of photos on the facing page





DRAMATIC HAMMER SHOT at right was made at about 15 flashes per second, is typical of the intriguing multiple-exposure effects you can get with a rapidly repeating strobe. The speedlight, only a small box, is shown above. A standard ¼-20 threaded socket in the bottom makes it easy to mount the light on a tripod, light stand or homemade support

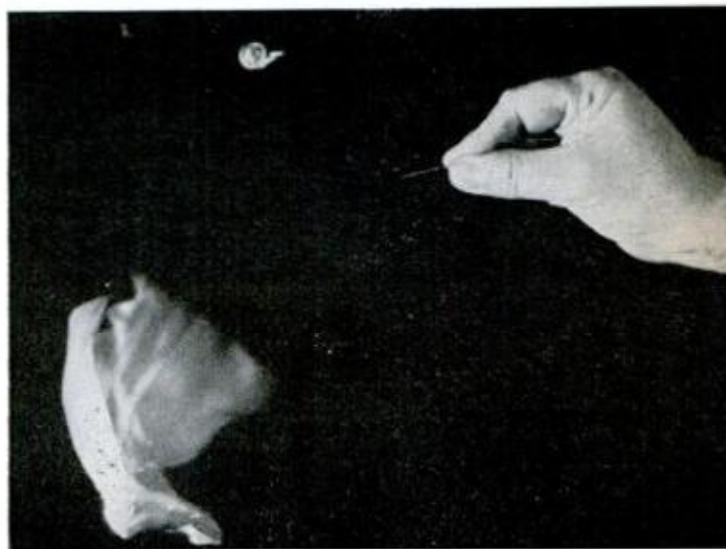
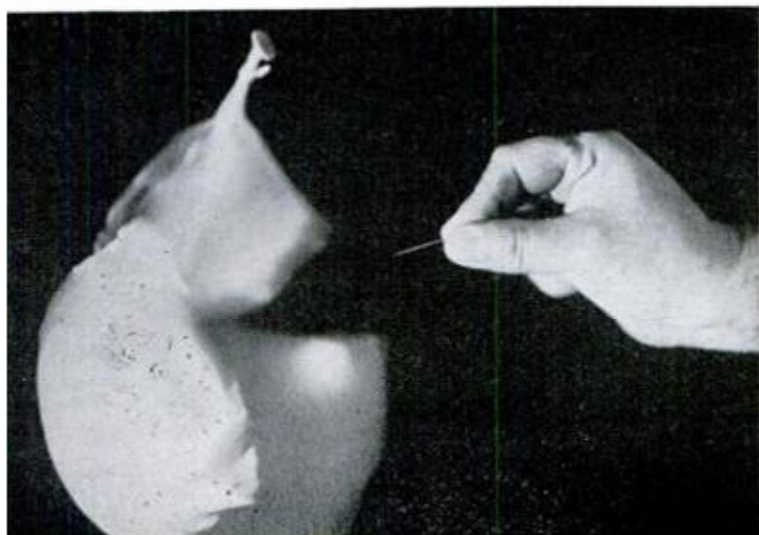
EXPLODING LIGHT BULB on the facing page, caught at the instant it started to shatter, is the result of a single 1/500,000th-second flash. The light was triggered by the sound of the impact in a setup similar to that shown below for the balloon. All photos on these pages were made on Tri-X film at f/8



HOW WOULD YOU LIKE to photograph a light bulb shattering at 1/500,000th of a second? Or create striking multiple-exposure effects at 30 flashes a second? You can do both with a remarkable new speedlight called the Cronoscope. The light functions both as a conventional electronic flash and as a high-speed repeating strobe for exciting stop-action photography.

Used as a repeating strobe, the Cronoscope "stutters" on and off so fast it can record 30 separate images in a single second on one piece of film. Every time the light flashes you get a picture. A bouncing ball, a swinging hammer—or any other object

(Please turn to page 202)



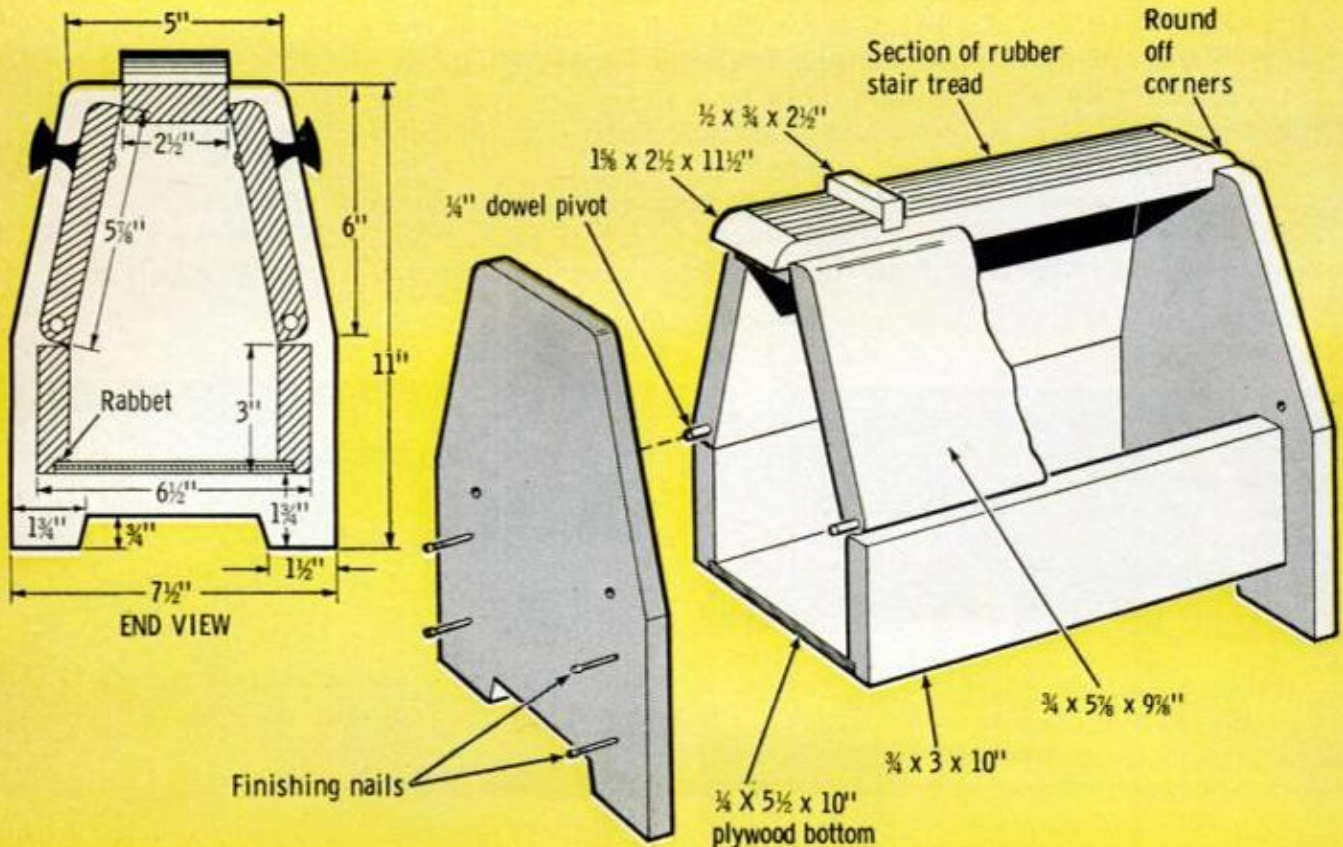


CHRISTMAS Gifts

SEVEN WANTED ITEMS YOUR

1. Shoeshine kit

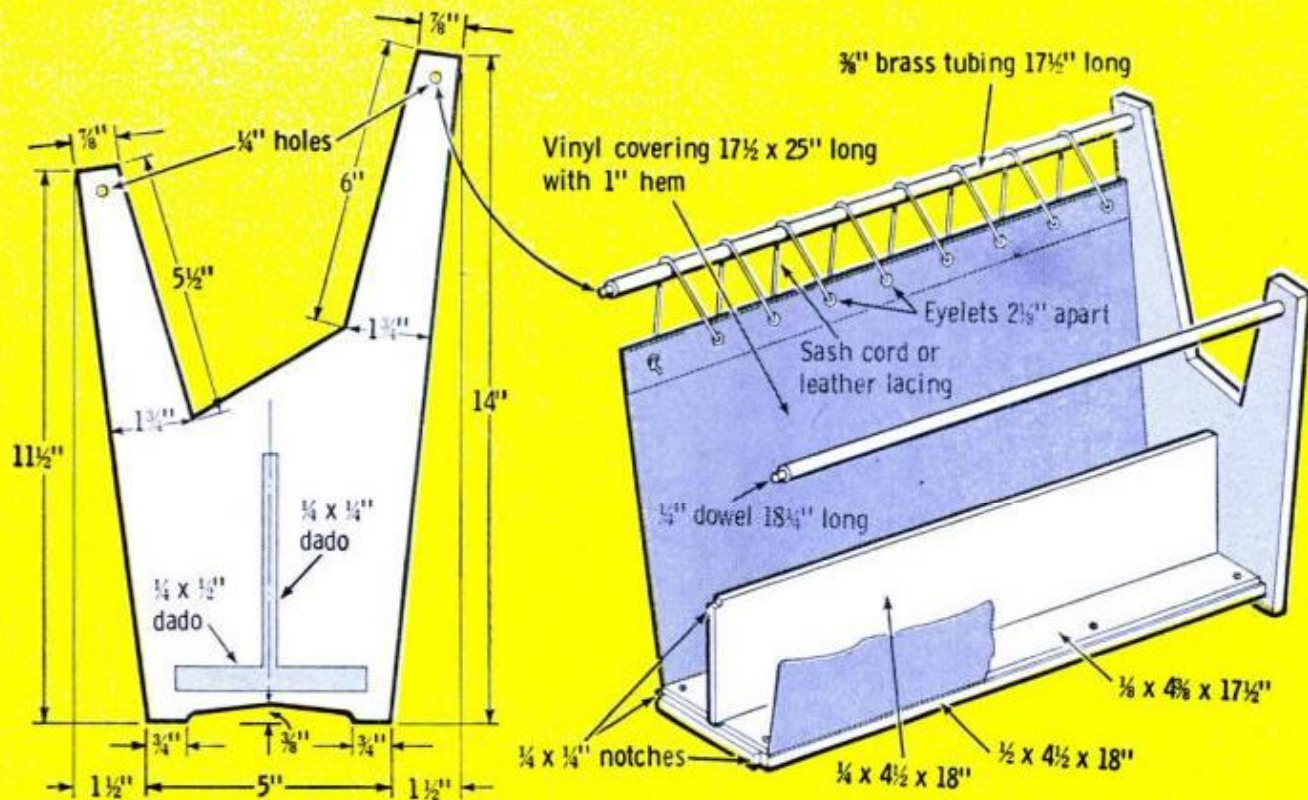
THAT OLD FAVORITE, the shoeshine kit, is still a great gift for all the members of your family. Young and old alike can't help but appreciate the ease and convenience with which it becomes possible to put a last-minute gloss on a pair of shoes before a night on the town or a dance at the local high-school gym. And construction is so simple that the single drawing below contains all the details and information you'll need to complete the case. Then just fill it with the proper items and you'll always be ready to rise and shine.—Richard Arnot, Philadelphia, Pa.



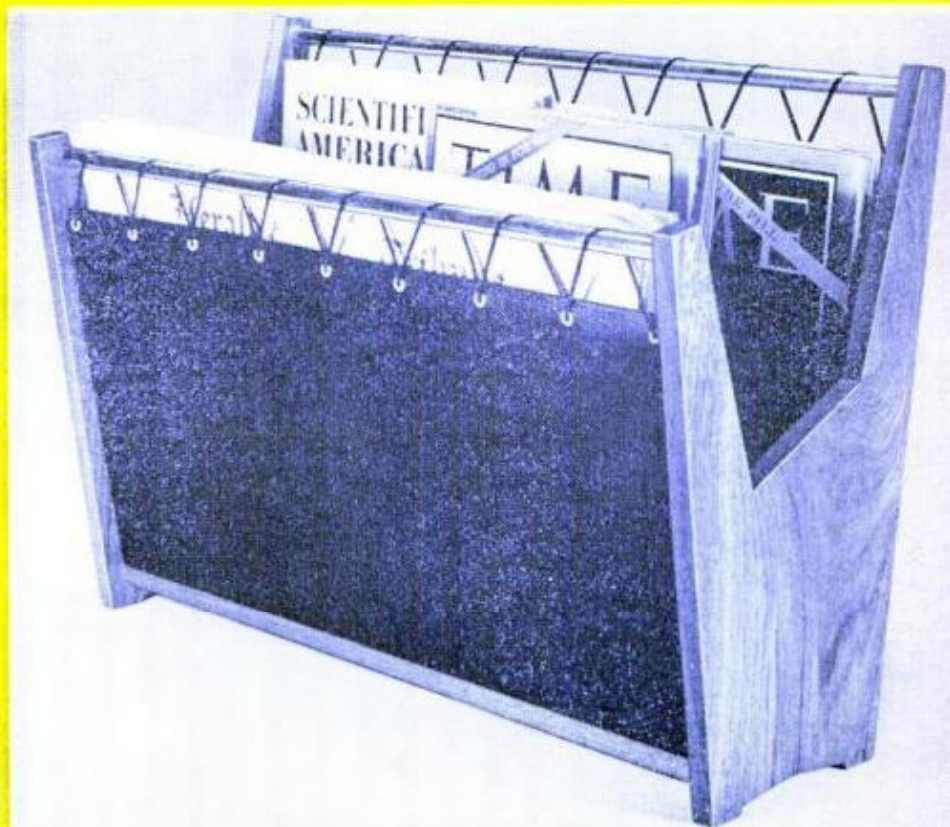
FROM YOUR WORKSHOP

HOME WILL BE TICKLED TO RECEIVE

2. Magazine rack



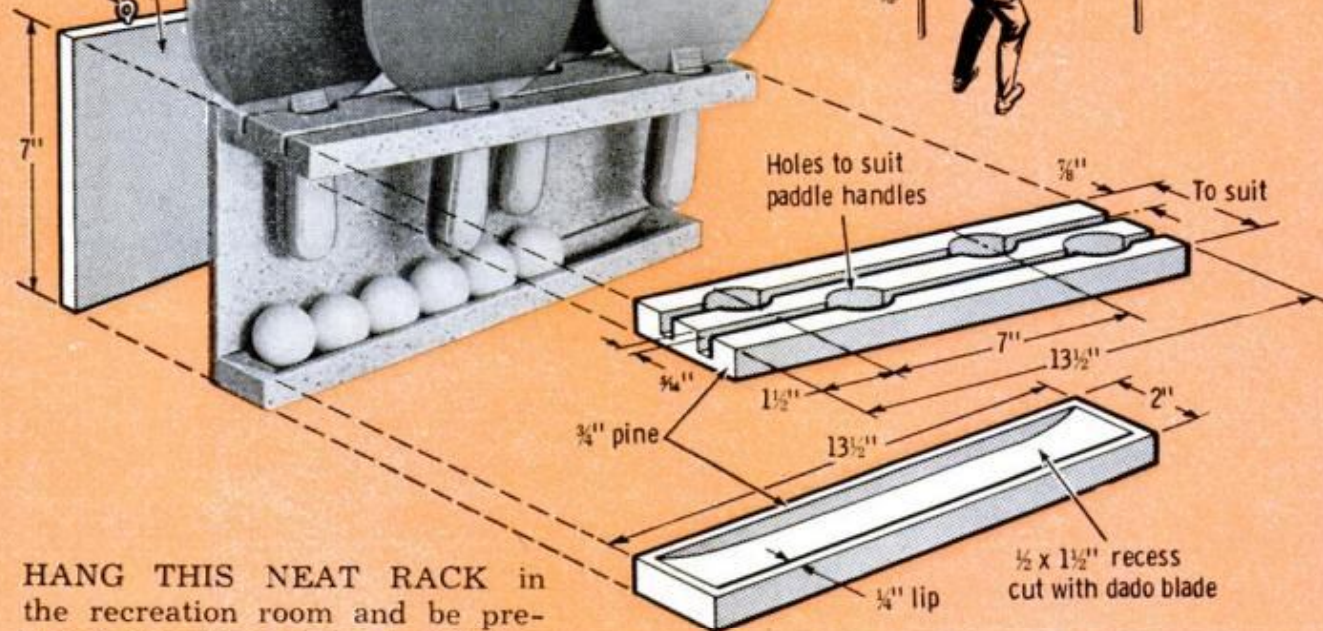
REGARDLESS of whether it's tucked in a corner or set out in the center of the room, this nifty magazine rack will prove functional and extremely good-looking. What's more, it's so easy to make that you could probably run off a half-dozen this weekend, thereby providing enough gifts for all long-lost relatives throughout the country. If you'd really like to make a lasting impression with one of your in-laws, shape the end pieces from a select length of hardwood, use stainless steel in place of the brass tubes, and lace on sides of real leather, using leather thongs. — *Kenneth Wells, Portsmouth, England.*



3. Ping-Pong rack

$\frac{1}{2}$ " plywood back
13 $\frac{1}{2}$ " long. Tapers
from 7 to 5 $\frac{1}{4}$ "

Screw eye



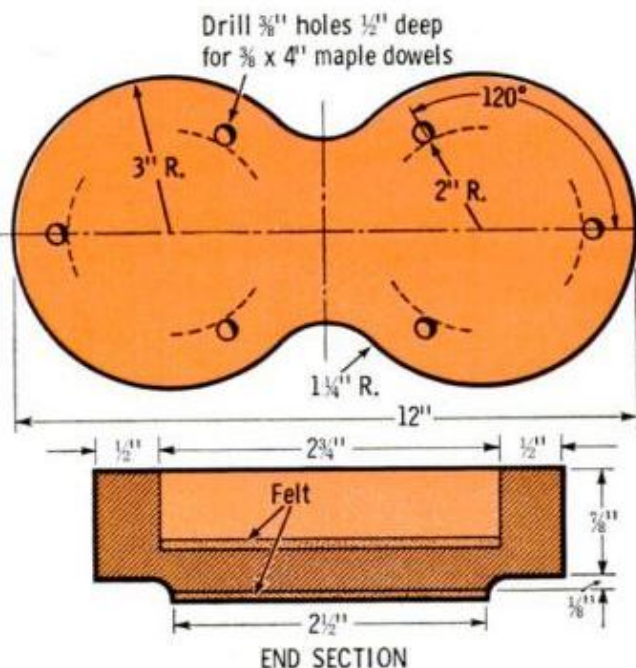
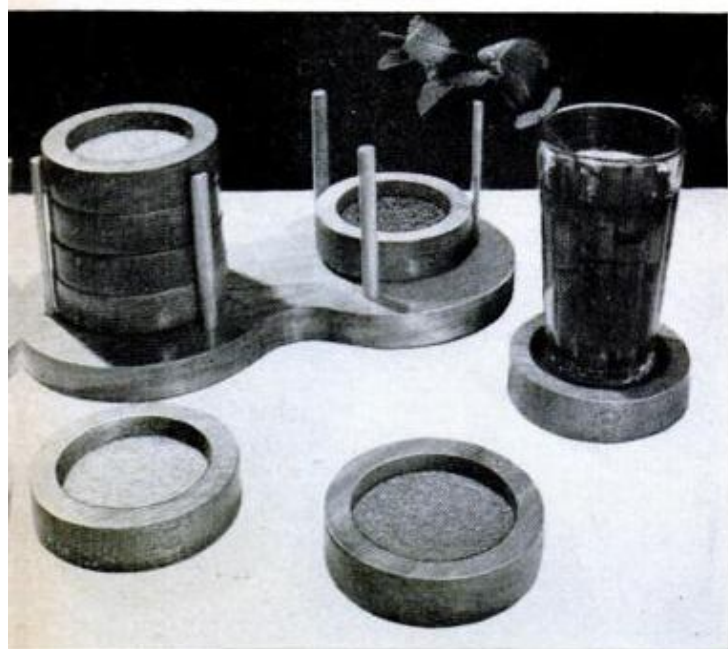
HANG THIS NEAT RACK in the recreation room and be prepared for the next spur-of-the-moment tournament. Compactly holding four paddles and enough balls for even the grand slammer

of the family, the rack will make a nice looking addition to any wall.
—Gene Florida, Florissant, Mo.

CUT
FOLD
TAPE

WORKSHOP
GIFTS

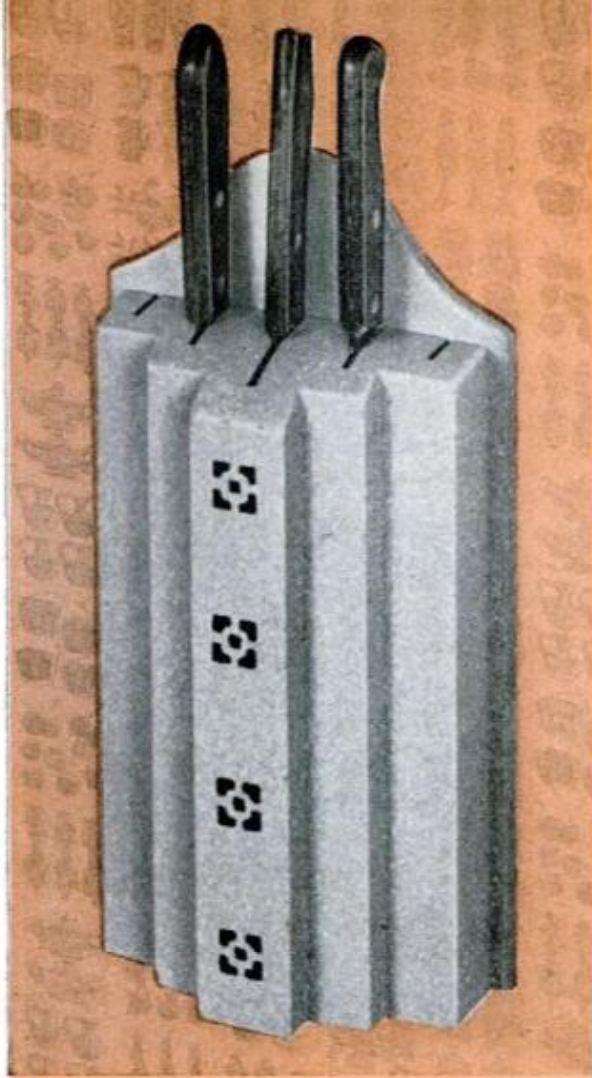
4. Coaster caddy



RICH IN APPEARANCE but easy on the wallet, a set of coasters like these won't get lost or misplaced when accompanied by a matching base that cries to be used. Turned of naturally attractive

woods like birch, mahogany or walnut, the pieces need only a thorough sanding and a clear shellac finish. Finally, cement colorful pads of felt in the bottom recesses.

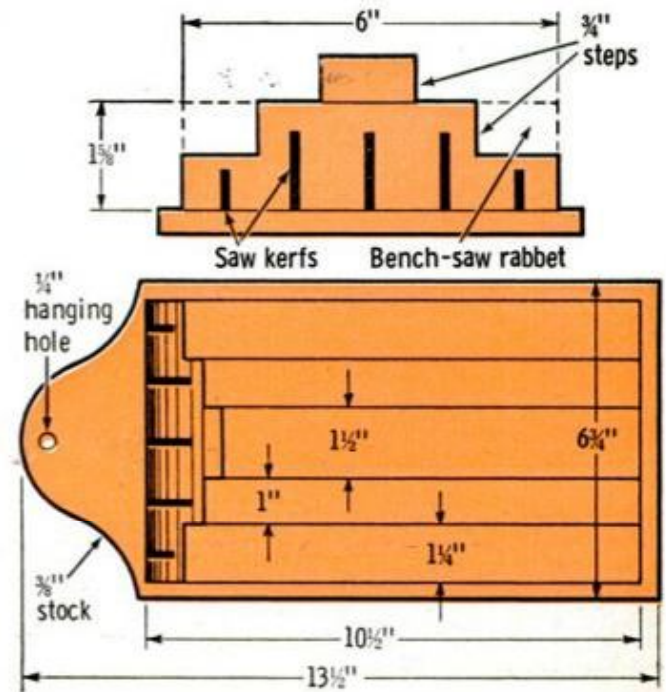
—Jerry Collins, Nuevo, Calif.



5. Kitchen knife rack

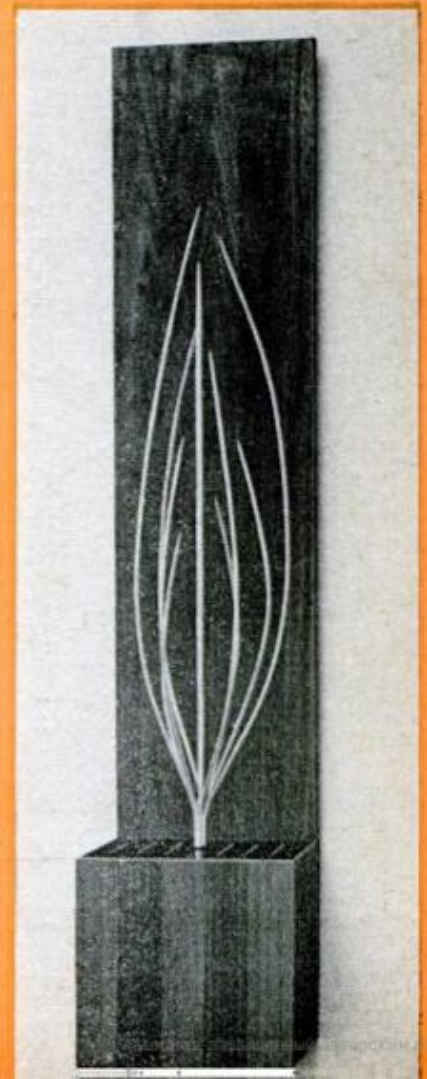
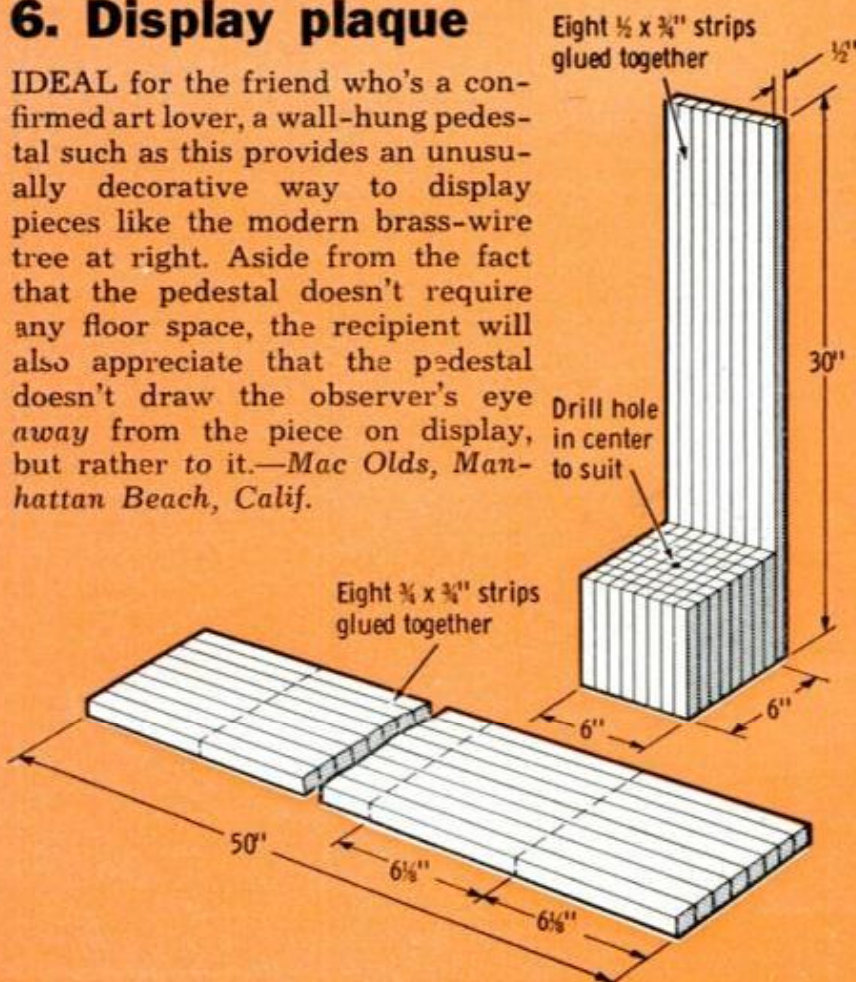
SOLVE THE DILEMMAS of what to make for your wife and where to put the kitchen knives in just an hour or so by fabricating this knife holder that will nicely share any kitchen setting. To make it a gift from the family, have the children paint the rack.

—Victor H. Lamoy, Upper Jay, N.Y.



6. Display plaque

IDEAL for the friend who's a confirmed art lover, a wall-hung pedestal such as this provides an unusually decorative way to display pieces like the modern brass-wire tree at right. Aside from the fact that the pedestal doesn't require any floor space, the recipient will also appreciate that the pedestal doesn't draw the observer's eye away from the piece on display, but rather to it.—Mac Olds, Manhattan Beach, Calif.

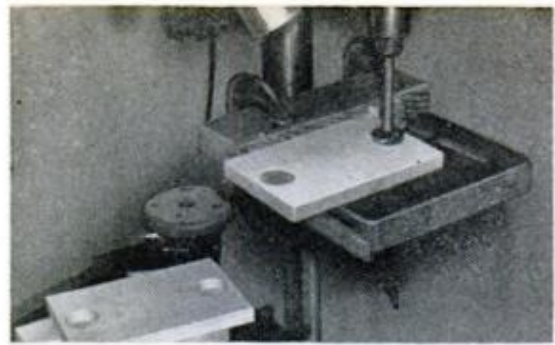




7. Chip and card rack

SIT IN at the next Saturday night session with this stylish poker chip-card-and-cash rack and you'll soon be swamped with soft, hinting innuendos as well as hard offers of purchase. Oddly enough, the distinctive unit is so simple to make that you might just as well present one to each of "the boys." Follow through with a series of bluffs and the giver may indeed wind up the receiver by the end of the night. As detailed in the drawing and the photos on this page, all you'll need is a drill press and a bench saw.

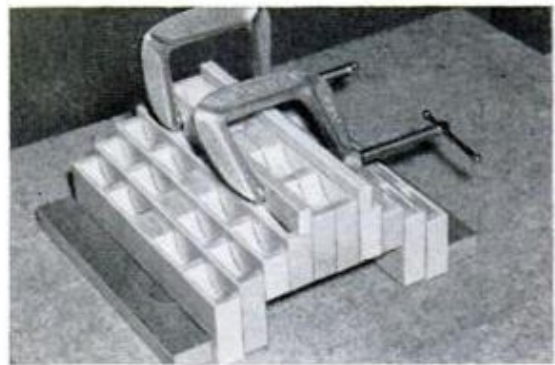
—William G. Waggoner, Sacramento, Calif.



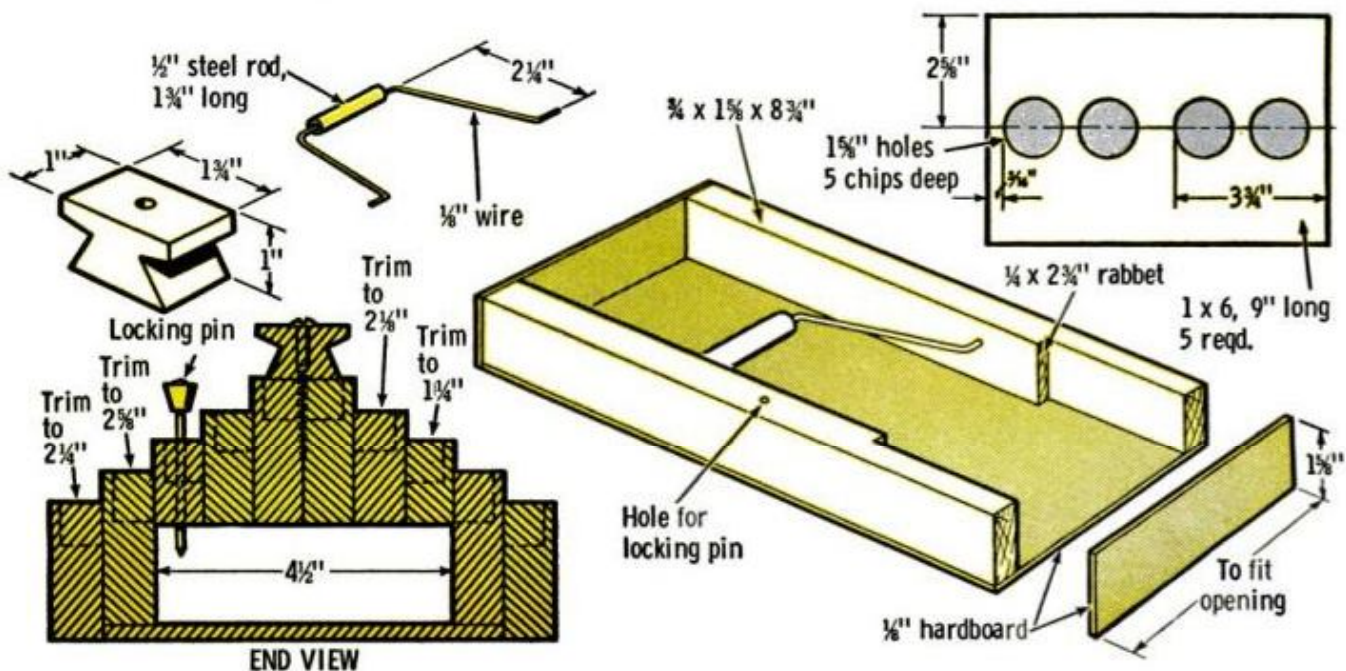
BORE outer holes, then reset stop block and bore inner holes. Drill press regulates depth



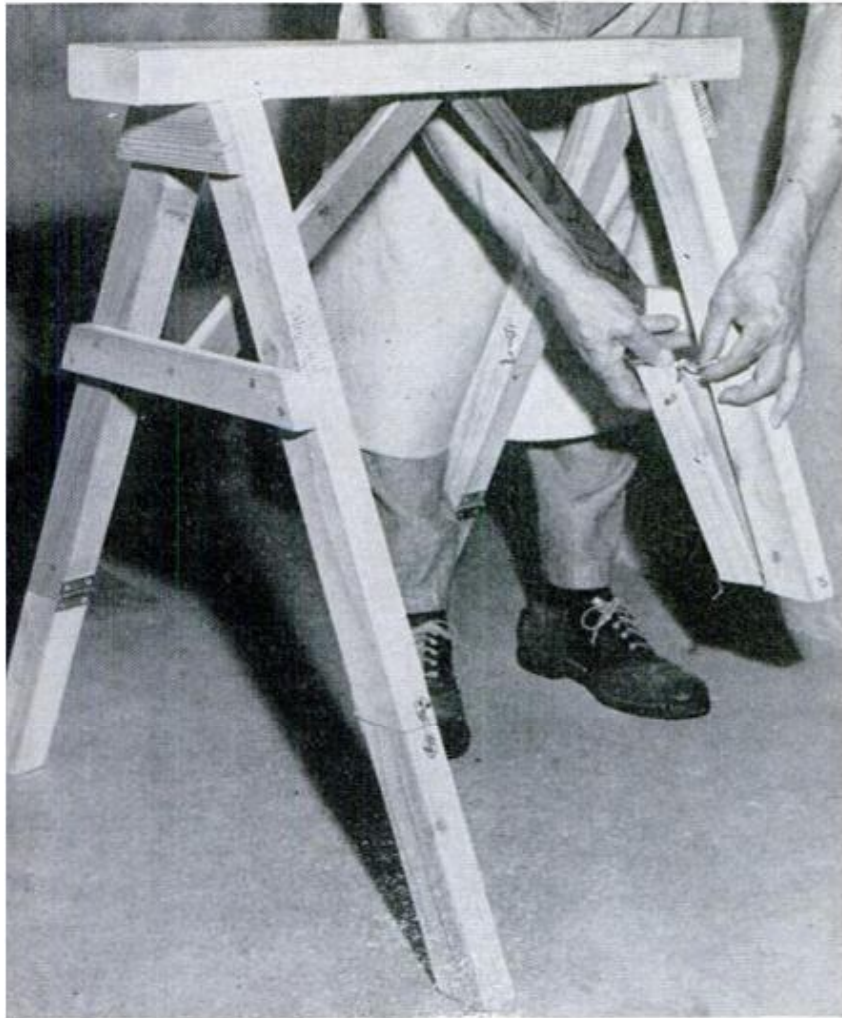
SPLIT each section exactly through the center of holes. This also cuts out pilot hole left by drill



TRIM all but the two ends to the sizes given in the drawing. Glue and clamp, let dry, finish



Hitch up a team of high-low horses



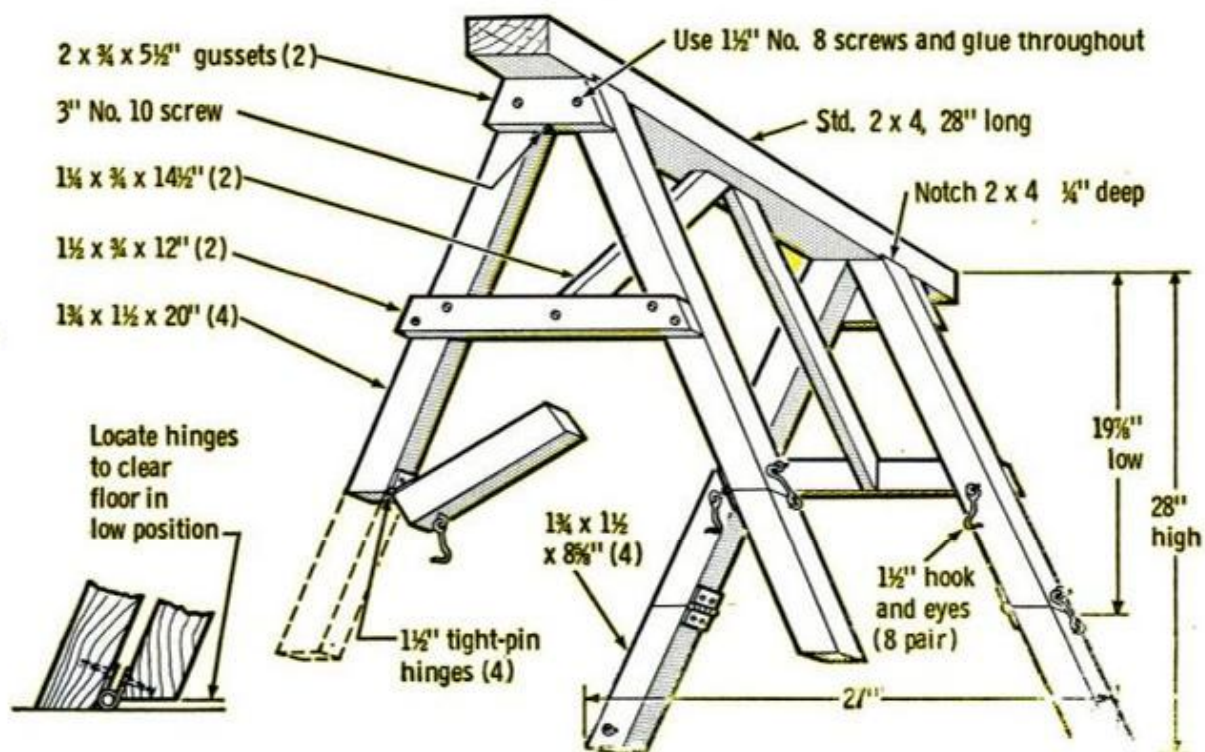
WITH A PAIR of these high-low sawhorses at hand, you'll find that suddenly the job seems easier to finish. Set in low position, one horse becomes a convenient, knee-high work surface upon which to clamp and saw wood. With legs extended, the sawhorse grows to a handy height of 28-in., enabling you to erect a work scaffold or table quickly for use indoors or out.

The top, legs and leg extensions are cut from standard 2x4 fir or yellow pine. Braces and cleats are also ripped in $\frac{3}{4}$ -in. thicknesses from the same stock. Because all parts are made in pairs, duplicates should be made with each machine setup.

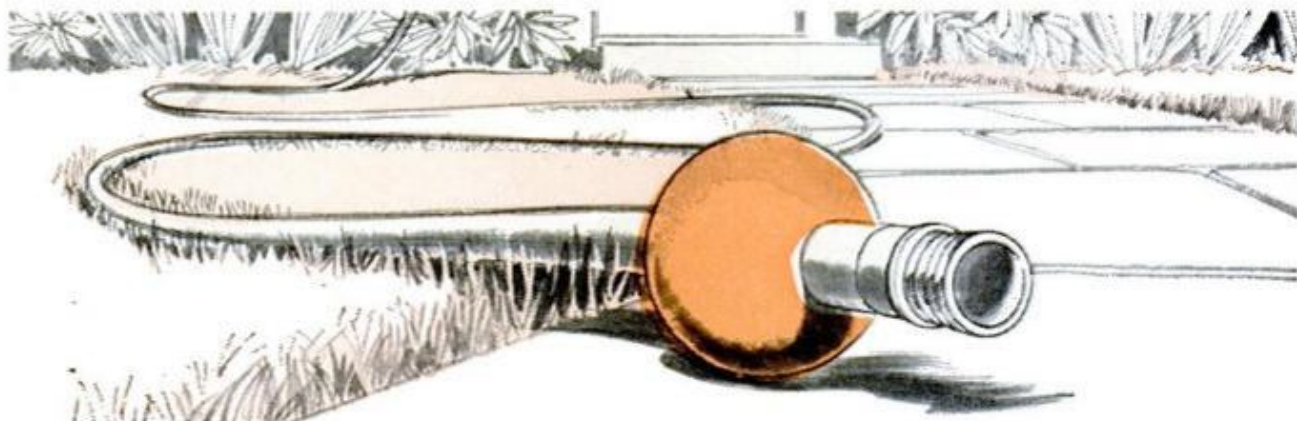
It's best to cut each piece slightly longer than the dimensions given. Assemble the main A-frame legs first and then trim at the apex and bottom of the legs to provide a surface level with the ground. Then set the miter gauge on a bench saw to duplicate the angled cuts. Secure the hooks and eyes to lock the legs in either position, possibly add rubber cushions to the bottom of the legs, and your horses are ready for duty.

—Harold T. Bodkin

CONVERSION FROM HIGH TO LOW is accomplished by folding up the leg extensions, locking them in place with hooks and eyes. Other hooks lock legs in the high position



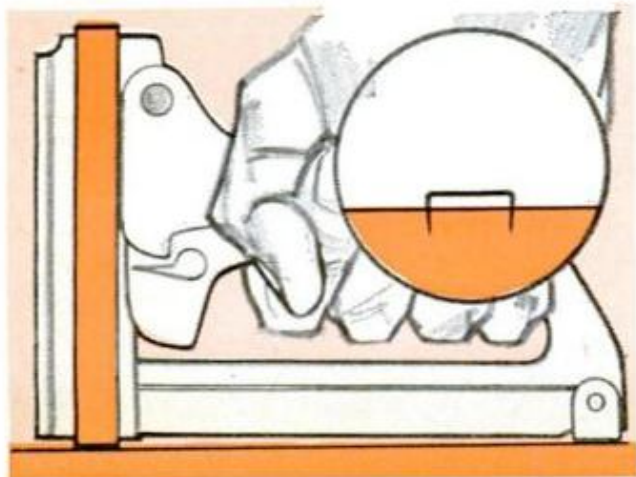
Solving home problems



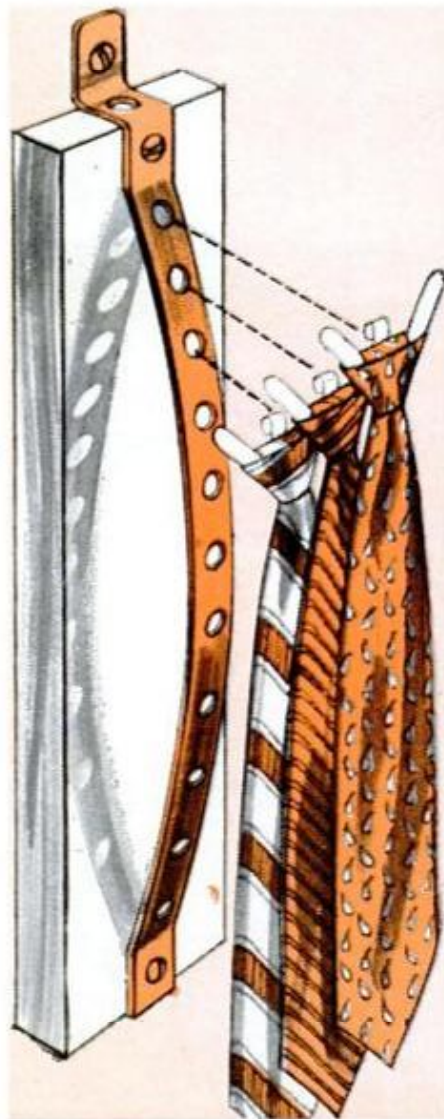
PROTECTIVE BUMPER for the male end of a garden hose will prevent the threads from being damaged when the hose is dropped. Make it from rubber ball or tennis ball, cutting hole slightly smaller than hose



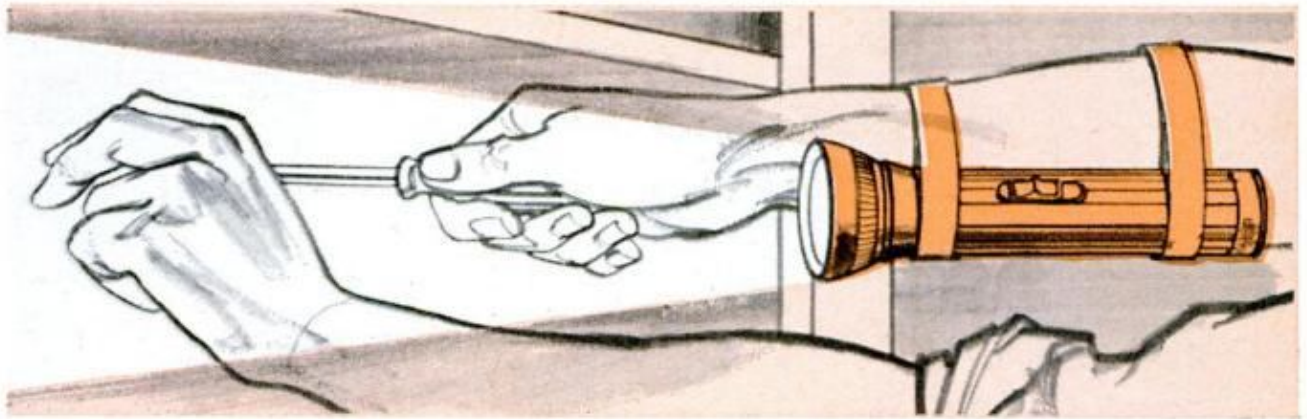
NEAT METHOD of working oil into putty is to put the whole thing in a plastic bag and then knead it well. This way putty can't stick to your hands, though you can still do thorough job of mixing in oil



TEMPORARY STAPLES which protrude above the surface and can be removed without gouging the material are easily installed by slipping thick rubber band over gun so end is raised slightly above work



RACK FOR PRE-TIED TIES will hold all of Junior's ties neatly, yet take only a minimum of wall space. Make it from a 1x3 and perforated iron strap of the type used to hang water pipe. Bend strap as shown



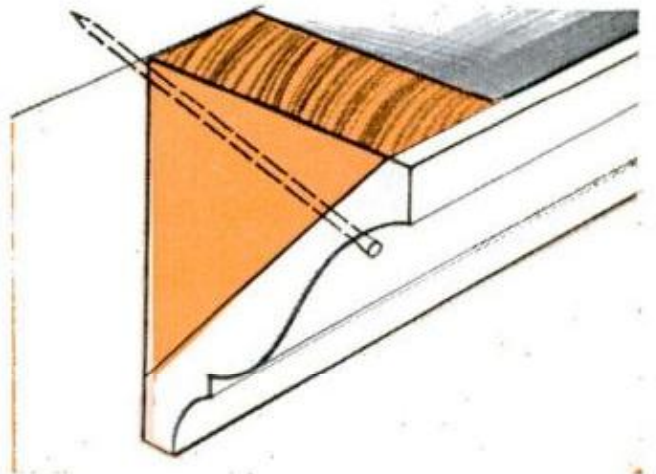
TO LIGHT UP those "three-handed" jobs where the workspace is cramped, strap a medium-sized flashlight to inside of your lower arm with tape or a couple of heavy rubber bands. It'll put light right on work



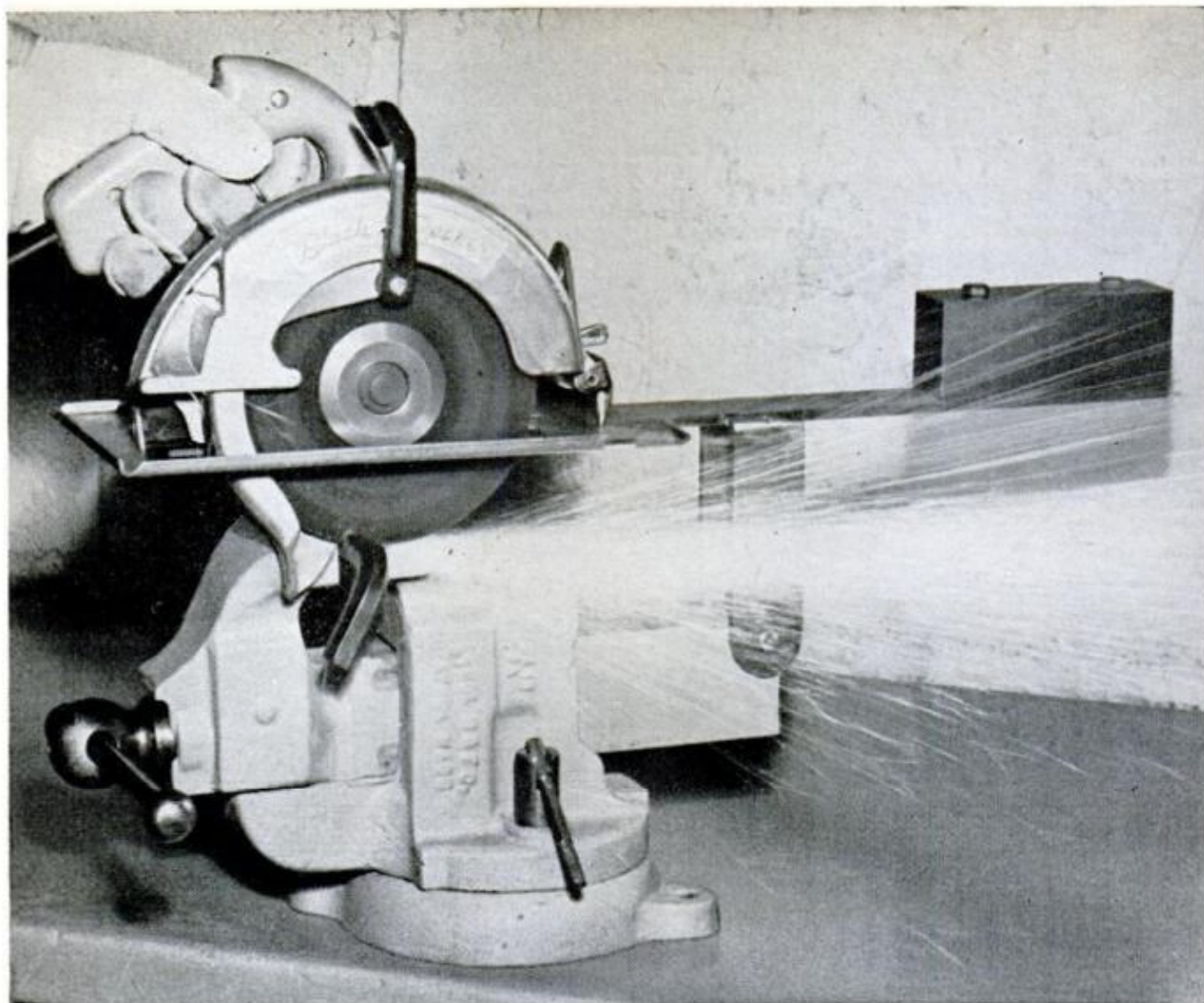
DOG WINDOW in the lower panel of the front door is a real furniture saver for one homeowner. Now, instead of climbing on the sofa to look out of a window, the dog sits quietly on rug in front of the door



WHEN YOU RUN INTO a small gluing job requiring that the glue be spread, don't bother dirtying a brush. Instead, improvise a spreader from a matchbook. Use rounded end; spread with wiping motion



WHEN INSTALLING cove molding, cut triangular nailing blocks and glue them to the molding at each nailing location, then drill for long finishing nails. Molding goes up square and nails will hold better



Here's an easy way to make an abrasive cutoff machine

By RAY SHOBERG

Technical Art by ZIK Associates Ltd.

ALUMINUM OXIDE cutoff wheels are much too brittle to be used freehand—but with this simple support, you just slap the wheel into a portable electric saw to safely send sparks flying from hardened and tempered steel.

The support consists of a bracket that pivots on the slide of a machinist's vise so you can cut squarely without twisting or binding the wheel. The work is held in the jaws of the vise, which also serves as a heat sink to dissipate heat that might otherwise draw the temper from the work.

It thus becomes possible to cut through drills, taps, tool bits, Allen wrenches, auto valve stems, axles and practically any

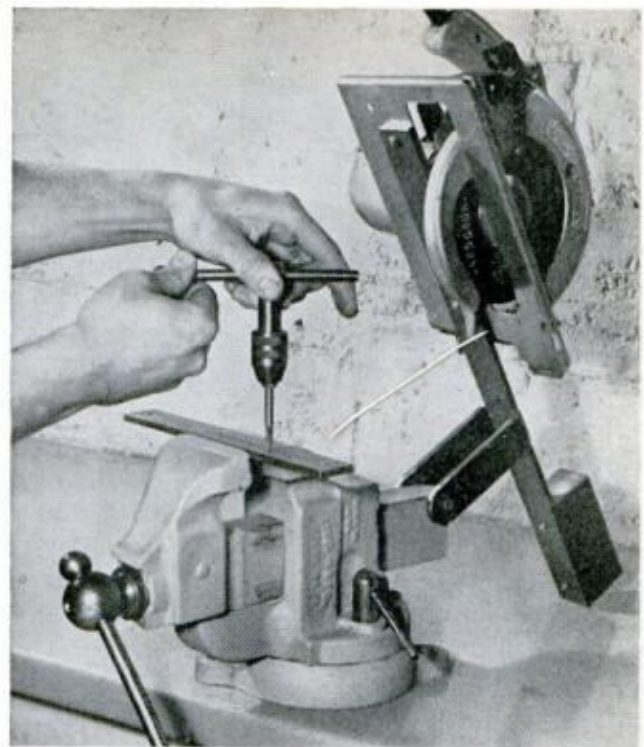
other hardened stock. Soft steel can also be cut with a minimum of effort. You can cut nonferrous metals, provided you change to a silicon carbide wheel. Such a wheel will also cut masonry and tile materials, including ceramics, marble and even garden-variety stone.

Three pieces of $\frac{1}{4} \times 1$ -in. flat iron are welded together to form the bracket. Note, however, that the sizes shown in the drawing on the opposite page may have to be changed slightly to accommodate the thickness of the slide on the vise you use.

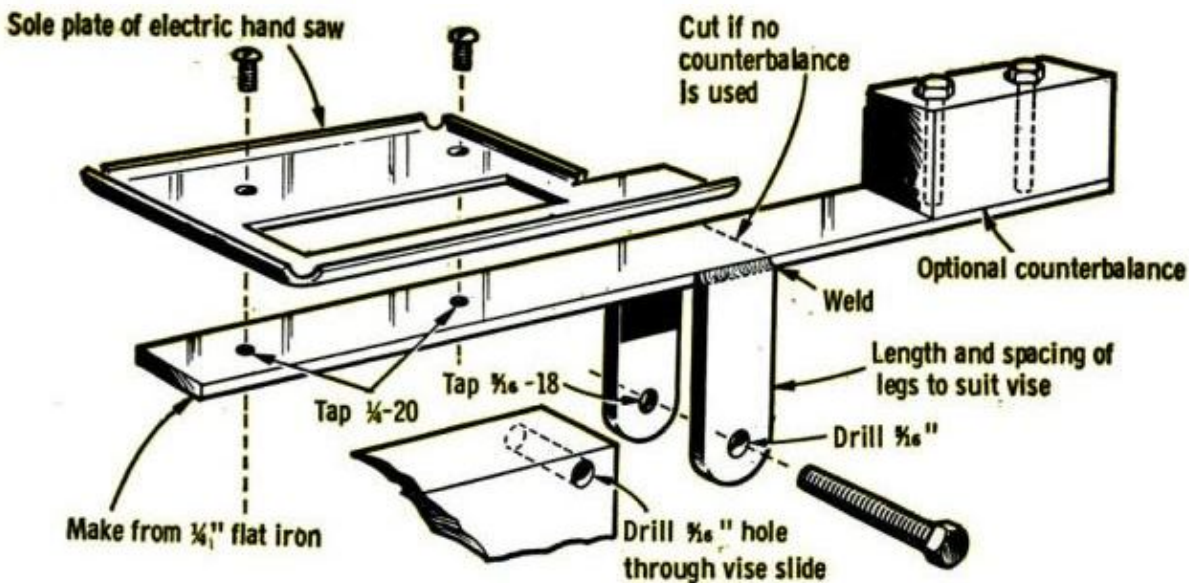
Drill a $\frac{5}{16}$ -in. hole through the vise slide as shown. Then drill a clearance hole through one leg of the bracket and drill



CLAMP THE ARM of the bracket to the legs and weld. Make arm longer if a counterbalance is needed



COUNTERBALANCE FEATURE allows you to use vise for other work without removing the saw and wheel



and tap the other leg for a $\frac{5}{16}$ -in. bolt.

Secure both legs to the slide with a suitable bolt and position the arm on the bracket legs. This is best accomplished if you first tighten a wooden 2x4 in the jaws of the vise. The block then offers both a base for positioning the arm, and a means by which to C-clamp the arm to the rest of the support. Weld the arm to the legs, lugging the entire affair to a welding shop if necessary.

Two screws hold the sole plate of your saw on the bracket. Tap the arm to accept the screws, then thread a jam nut on the slide pivot bolt to lock the legs lightly.

Attach the wheel to the saw and screw

or bolt the vise to the bench top. Most wheels are readily available at power-tool dealers and are made to fit practically every make of saw. The dealer should also have arbor flanges, if required. Be sure, however, that your saw will not turn the wheel at a speed exceeding the figure shown on the label.

You may also choose to counterbalance the saw by making the bracket arm long enough to extend beyond the bracket legs. Weights then are bolted to the extended arm to offset the weight of the saw. In either case, the entire unit can be removed to free the vise by simply removing the bolt through the slide. ★ ★ ★

Getting the most from your zippy little jigsaw

Whether it's called a sabre, recipro, reciprocating, or even a bayonet saw, this spunky tool packs a punch

By JOHN BURROUGHS

IF SOMEONE WERE TO ASK YOU to single out the power tool that represents the best value in terms of tool per dollar, you couldn't go wrong recommending a quality-model portable jigsaw.

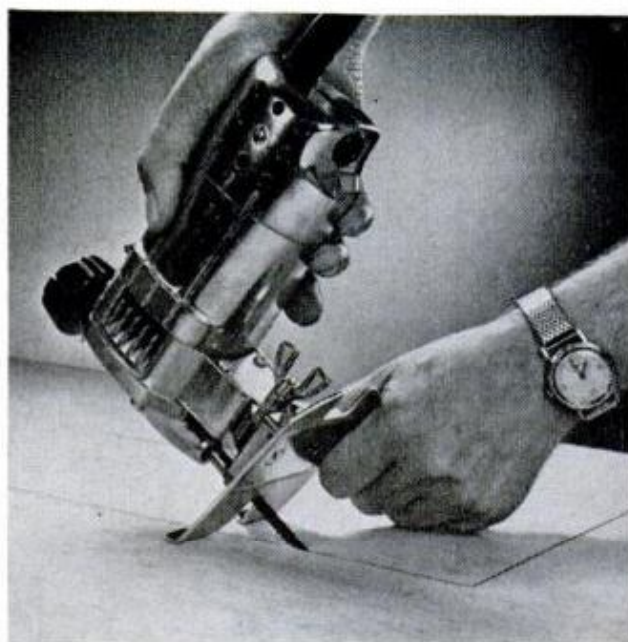
However, because some tool manufacturers feel that the word "jigsaw" is often translated into a mental image of curlicued scrollwork cut in tissue-thin plywood, the tool actually goes by many names. But whether you see it listed as a sabre saw, reciprocating saw or bayonet saw, a portable jigsaw is nevertheless capable of cutting fairly heavy items. In fact, using one of these versatile saws as your only wood-cutting tool, you could build a cabin cruiser, from keel to flying bridge, and then erect a boathouse in which to store the craft.

Basically, all leading makes of jigsaws are similarly built, incorporating series-wound (brush commutator) motors driving counterbalanced reciprocating mechanisms designed to withstand thrust forces. Some saws have a straight up-and-down cutting action, while others have a forward-tilted, orbital or quick-return stroke.

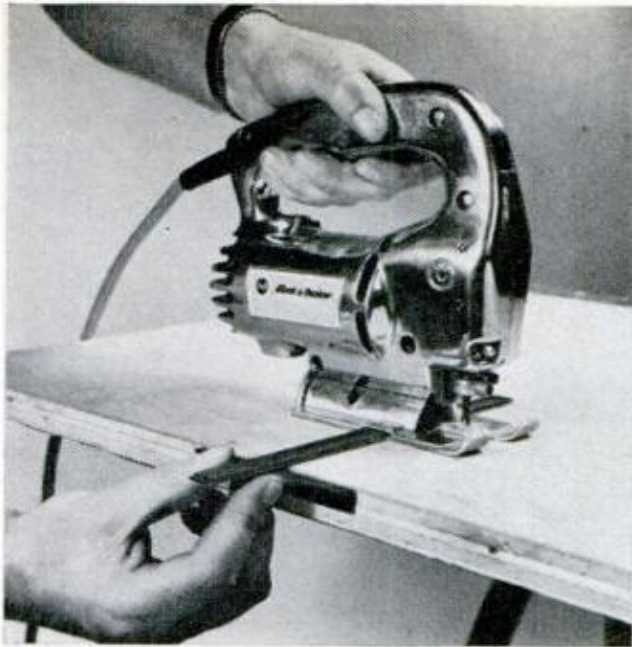
The larger models may draw more than



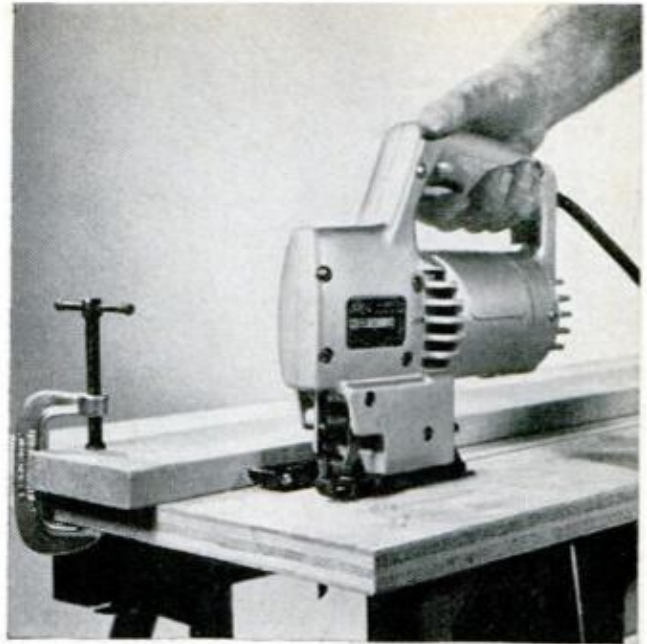
3 amps. to power inch-long cutting strokes. The light-duty jigsaws commonly found in the home workshop will draw from 2 to 3 amps. to drive the blade at about 3000 strokes per minute, each stroke being $\frac{5}{8}$ -in. long. In both the light and heavy-duty



NO STARTING HOLE for the blade is required in most cases. Tilt the saw forward on the toe of the shoe and then gradually tilt the blade into the work, allowing the end teeth to start the cut



ADJUSTABLE RIP GUIDES that clamp in slots on the saw's shoe are available for most models. When ripping as shown, take care that the T-head doesn't catch on a sliver, pulling the blade from the cutline



CLAMPED-DOWN STRAIGHTEDGE is good guide if long, straight cuts must be made in panel stock. Avoid forcing the cut—just let the blade do the work and you'll find the job goes twice as quickly

categories can be found the special features of multi or variable-speed provisions, built-in blowers or lights, blade guide bushings, auxiliary handles and tilting or two-position bases.

The models with a 1-in. long stroke can crosscut through 2x4s in seconds. Some building contractors prefer them to circular-blade portable saws for rough construction work because a jigsaw is easier to guide freehand and is also more suitable for notching. Later the same saw can be

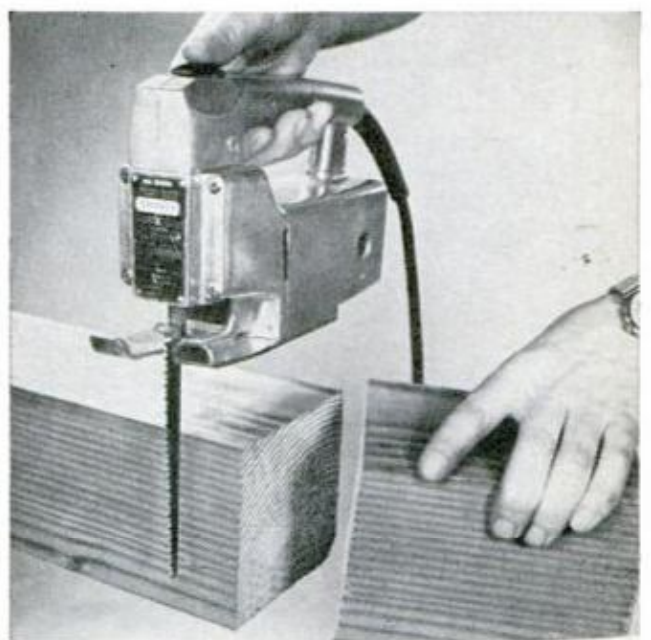
equipped with a fine-tooth blade for interior finish work, including cabinets and prefinished paneling.

The smaller, short-stroke jigsaws may not cut as quickly, but they do possess a surprising capacity. They will readily slice through 2-in.-thick softwood, and when fitted with a suitable blade, will gradually cut through mild steel plate, plastic laminates and other hard-to-cut materials.

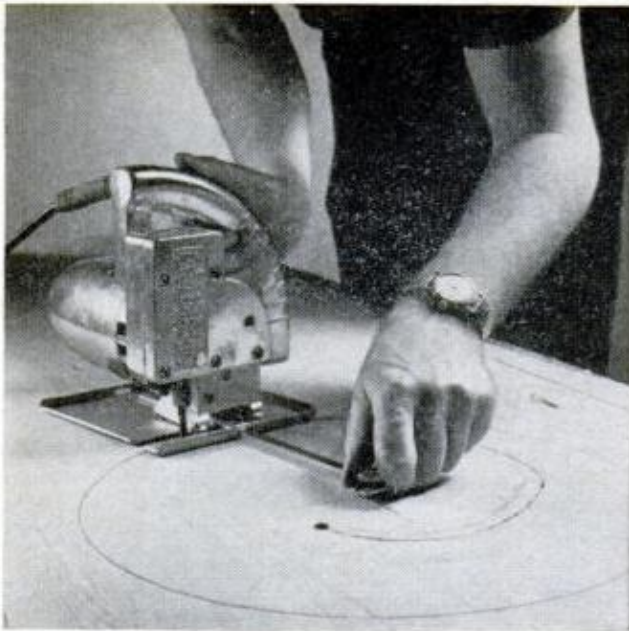
In fact, about the only common wood-



SQUARE CROSSCUTS are guaranteed by the use of either combination square or try square as a guide. The square needn't be clamped. Just hold it firmly in place and run the shoe of saw along the square leg



A LONG BLADE chucked in a portable jigsaw can cut through 4x4-in. posts, small logs or partition walls. When using a 6-in.-long blade as shown, apply a slow, even rate of feed to avoid overloading tool

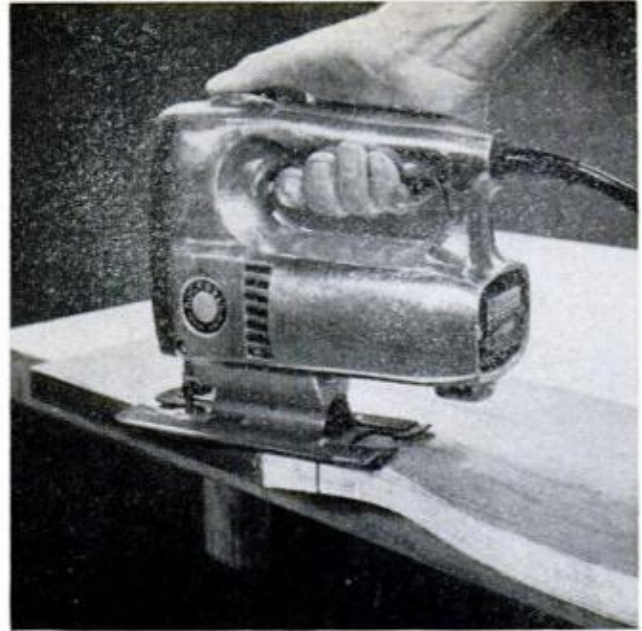


A RADIUS GUIDE simplifies the cutting of large circular holes in panels. After laying out the circle, saw a spiral out to the circumference line. Then center the guide and slowly pivot the jigsaw

working jobs you can't complete with a jigsaw are rabbeting and dadoing—and these are special jobs that are best accomplished with a router or bench saw.

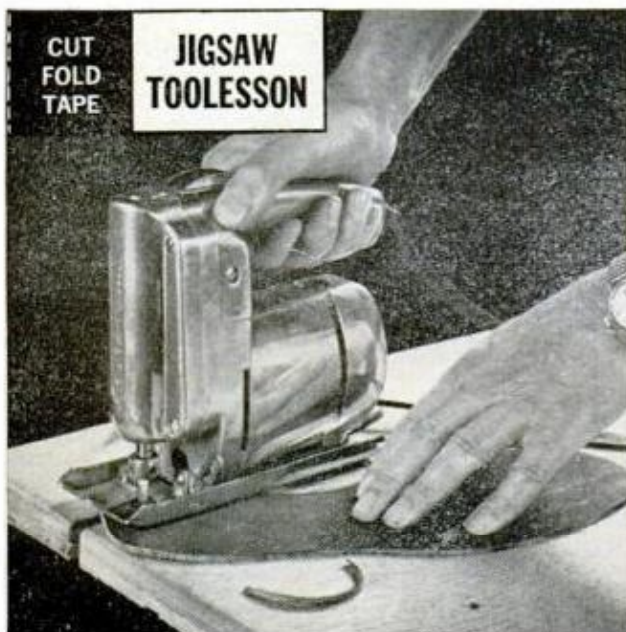
Blade selection is another important point to be considered. Although top-quality jigsaw blades cost quite a bit more than cheap blades, they are likely to perform better and last longer, making them a wise buy in the long run.

Good woodcutting blades are made of top-grade alloy or high-carbon steel.



CURVED CUTS can be made freehand if you navigate through the curves slowly, giving the teeth time to cut their own clearance. This will avoid lateral pressure on the blade and prevent skewing of cut

They're likely to be rigid rather than springy, and therefore will break if twisted or bent. Some of these have alternate-set teeth like those on a handsaw, and will make fast cuts, chew wide kerfs, and turn tight curves without binding. Other blades may be hollow or taper-ground, but while hollow-ground blades make smoother cuts and rake up fewer splinters, they're not as easy to guide accurately around intricate cutting patterns, especially where the outlines have small-radius curves.



KNIFE-EDGE BLADE chucked in a jigsaw will cleanly cut through leather, chipboard, veneers and balsa. Both the saw and the work should be supported; in this case, on a slotted piece of scrap plywood



DECORATIVE PIERCEWORK in panels makes for attractive fences, dividers or windscreens. Cutting it is easy if you avoid designs with tight curves. The unusual but easy cutout above is propeller-shaped



MEDIUM-GAUGE SHEET METAL like galvanized gutter above can be cleanly cut with a fine-tooth, wave-set blade. Very thin pieces should be sandwiched between two pieces of ¼-in. plywood and then cut

Alternate-set 6-teeth-per-in. blades do the best job of rough-cutting heavy green or resinous lumber. Hollow-ground 10-teeth-per-in. blades are best for precision cutting of dry, finished lumber or hardwoods under ¾ in. thick.

Fine-tooth metal-cutting blades are made of tough tungsten-alloy steel. Blades for cutting nonferrous metals usually have raker-set teeth, whereas those for cutting steel are wave-set to minimize chipping of both the metal and teeth.

While it's possible to cut mild steel using



HACKSAW THROUGH PIPE with fine-tooth, wave-set blade chucked with teeth to the rear. Squirt on oil and apply just enough pressure to keep teeth cutting. If saw has variable speed, use slow speed



GREASE-STICK LUBRICANT should be applied when cutting nonferrous metals more than ⅛-in. thick. This keeps teeth from filling with metal. Unless saw has chip-shield, always wear protective glasses

a single-speed, 3000-strokes-per-minute jigsaw, hacksawing at that speed soon dulls the toughest blade. Accordingly, a low or variable-speed jigsaw is preferable to a high-speed model when heavy hacking must be performed.

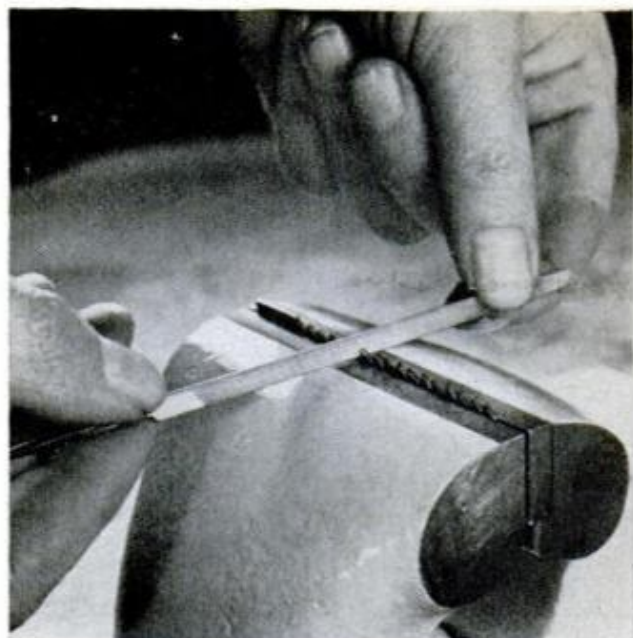
Blades will normally wear dull along only a portion of their length—the section immediately below the saw's shoe. Often you can squeeze extra service from a dull blade by grinding approximately ½ in. from the shank end of the blade, thereby raising the still-sharp teeth up to working level.

Using a portable jigsaw like a professional is largely a matter of avoiding sideways pressure on the blade. Because the blade is chucked only at one end, any lateral pressure is sure to skew the cut.

The shoe of the saw should always be kept in firm contact with the work to minimize jouncing. Always, even when turning curves, keep the feed pressure in line with the tool's axis, and moderate enough to let the blade cut at its own rate.

Take particular care to avoid lateral pressure on the saw when you're cutting bevels or small-radius curves. For either of these cuts, the rate of feed should be very slow to let the blade cut its own clearance.

Remember, too, that the blade of a jigsaw cuts on the upstroke, splintering the kerf on the top of the work. Thus, hardboard, paneling, plywood or other finished stock should always be cut with the good



APPLY A FEW STROKES with a small, sharp three-corner file to resharpen dull coarse-tooth blades. Maintain the original shape of the teeth, and don't hesitate to discard blades that have lost their set

side down to avoid unsightly splinters.

Never attempt to jigsaw through work that's not supported solidly. Usually it's easiest either to tack spacer blocks to a benchtop and clamp the work to the blocks, or to secure the work across a pair of sawhorses. When working small items, a nailed-down section of plank can be slotted at one end to form a convenient support for both the saw and the work.

It's worthwhile to remember to switch on the saw before the blade comes in con-



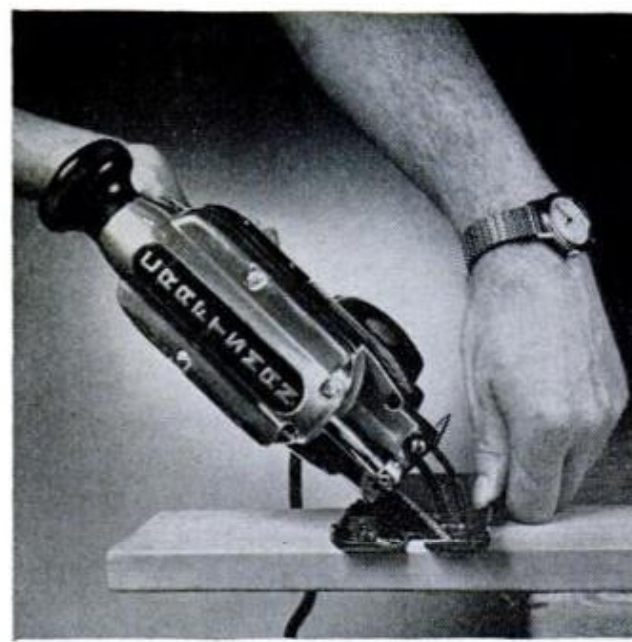
SELECT THE RIGHT BLADE for the job at hand and you'll obtain professional results every time. Usually the blades will cost less if purchased in an assortment package than if they are bought one at a time

tact with the work, thereby easing the starting load on the motor.

About the only accessory you'll need for your jigsaw is a T-head rip guide that also can be used as a trammel for cutting circles or discs. Also available for some jigsaw models is a bench stand that mounts the saw upside down to form a table saw of sorts. However, as this type of stand leaves the blade completely exposed, you should follow every operating precaution the manufacturer specifies. ★★



RELUBRICATE REGULARLY and prolong the life of your zippy jigsaw by many years. If saw has a grease-filled gearcase, refill yearly per the owners' guide. Oil holes need two drops every three months

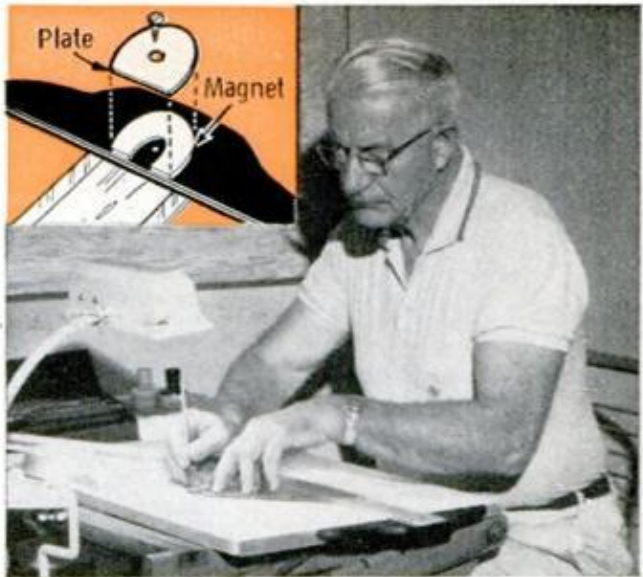


MAINTAIN AND CARE FOR your jigsaw and you'll find that operations like ripping, trimming, beveling and crosscutting will seem to be a snap. Most saws have a tilting shoe (above) that's useful for beveling

HINTS FROM READERS

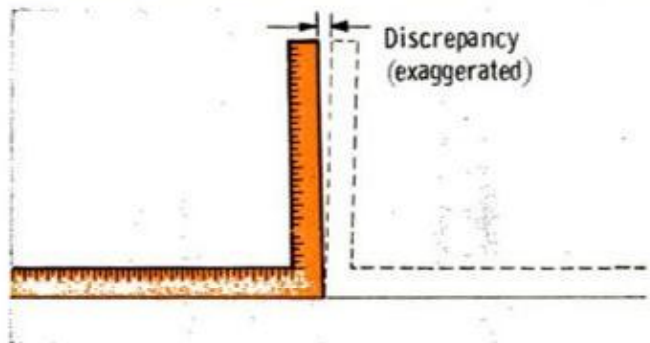
Magnetic T-square frees hands

Add a magnet to your T-square and you'll find that it will stay put, even on a slanting board, so you can use both hands for drawing. The modification is simple. A thin but straight bar of steel is attached to the edge of the drawing board (use either epoxy cement or countersunk screws). Then secure a small horseshoe magnet to the head of the T-square.—*Tallmon Horst*



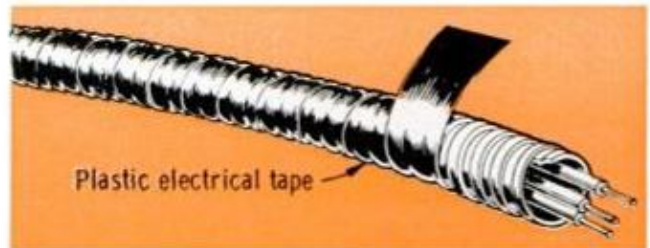
"Doublecheck" carpenter's square

Drop a carpenter's framing square just once and it may no longer be accurate. To test yours, first draw a long line with a reliable straightedge. Align the base leg of the square with this line and draw another line along the short leg. Flip the square over and repeat. Any discrepancy between the two vertical lines means the square is off.—*Andrew Vena*



Tape waterproofs conduit

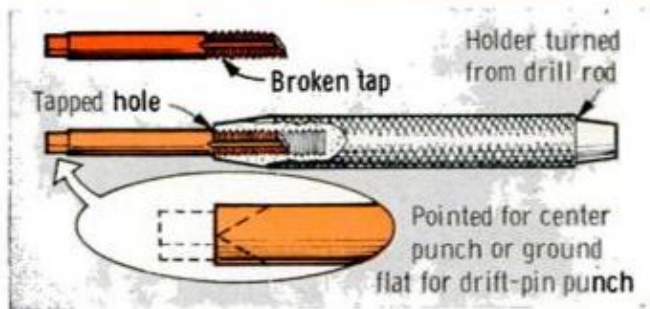
Before running a length of flexible conduit or BX cable in a wet location, wrap the cable with plastic electrical tape. This ounce of care will prevent shorts due to corrosion.—*Joseph Braunstein*



Uses for broken taps

Taps are made of metal too good to be thrown away indiscriminately. To make excellent center punches or driftpin punches, form suitable holders from drill rod and tap them for the broken taps. Then just grind the tips as desired.

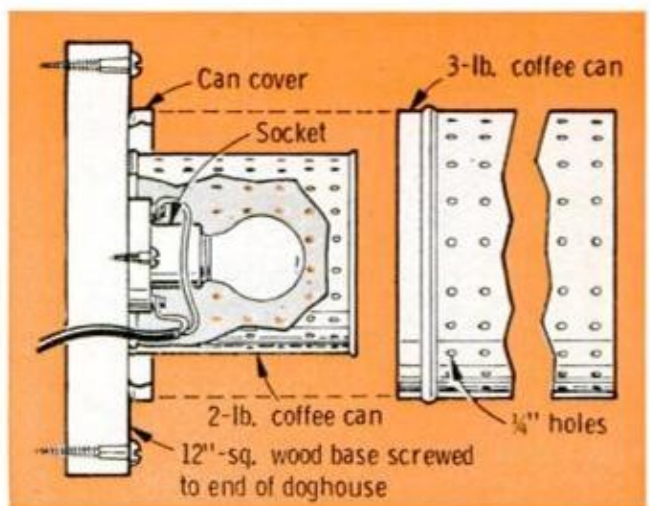
—*Edward Hilbon*



Lamp-heater for doghouse

Keep your pooch comfortable on the wettest and coldest nights by installing this simple heater in his doghouse. Enclosing a 40-watt light bulb, the cans serve two purposes. First, they cut down the light to a warm glow, and second, they evenly radiate the heat provided by the protected glass bulb. Two- and three-lb. coffee cans, if available, are ideal for the heater, especially as they are fitted with their own retaining rings (their lids).

—*Lewis S. Pooley*

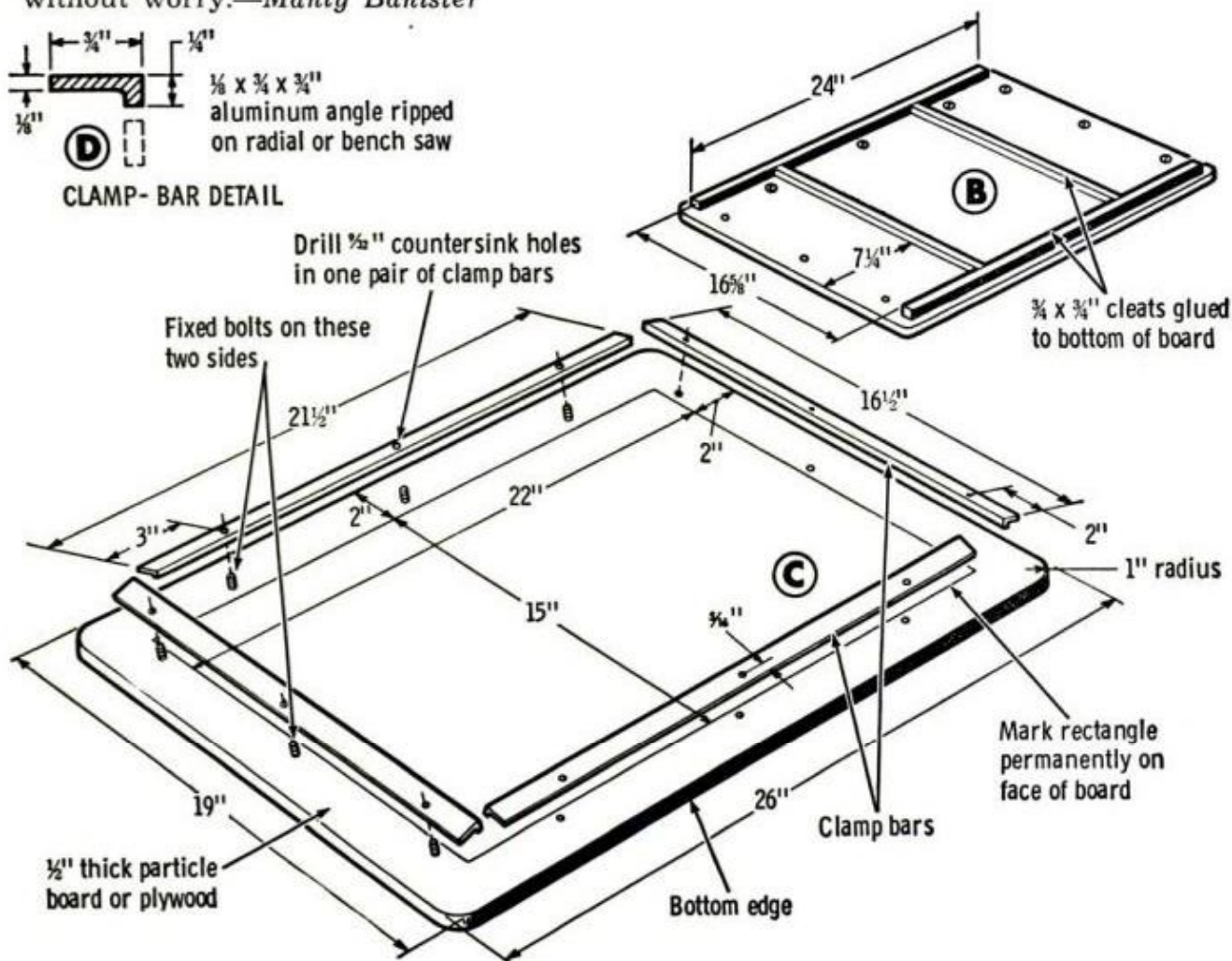
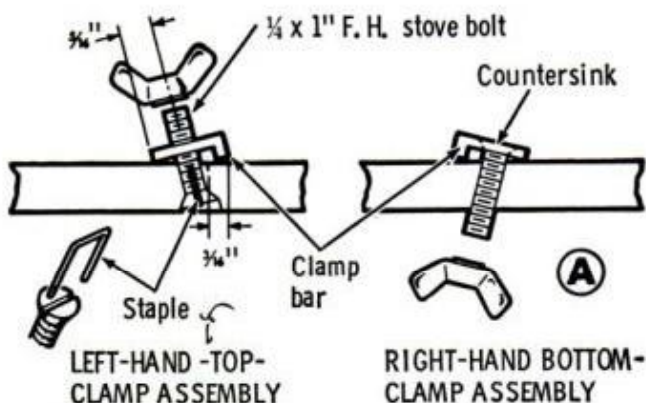
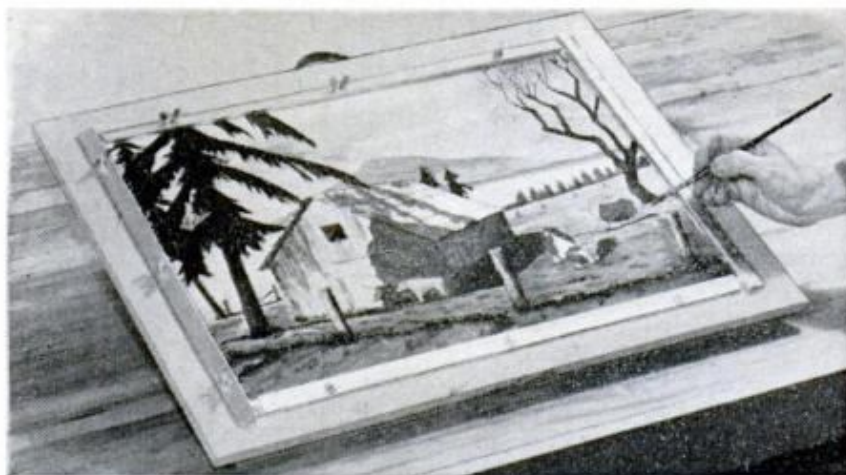


Easel lets you wet-mount paper for water colors

IF BUCKLING is to be avoided when the colors are applied to water-color paper, the latter must be wet-mounted and dried. Taping and sponging may be one solution, but it's messy and far from foolproof. This easel, however, offers a practical way to achieve consistently professional results.

The dimensions given are based upon the fact that standard water-color paper is purchased in 22x30-in. sheets. Since pictures are usually half of a standard sheet, the boards accepts 15x22-in. sheets.

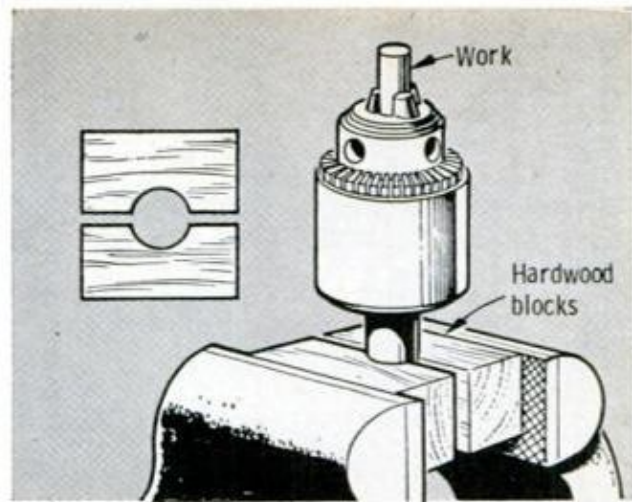
To use the easel, soak a sheet in cold water for at least five minutes. Lay it on the board and quickly slip the left-hand bar over its bolts, followed by the top bar, and the bottom and right-hand bars and their bolts. Then tighten the wingnuts on the face of the board, flip the board over and install the remaining wingnuts. Let the paper dry thoroughly and paint without worry.—*Manly Banister*



HINTS FROM READERS

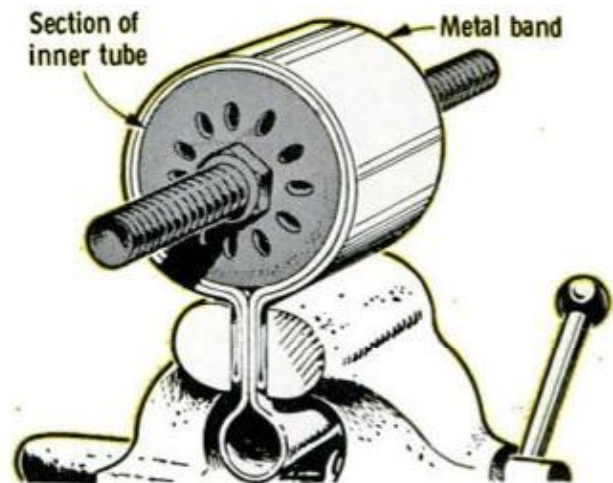
Chuck substitutes for pin vise

A drill chuck can double as a pin vise to hold small round pieces of work that might be marred by jaws of a regular vise. Drill a hole the size of the chuck shank in a wooden block, then split the block on a bench saw. Because the kerf makes the hole smaller, squeezing the halves in a vise will hold the chuck.—*James Kniseley*



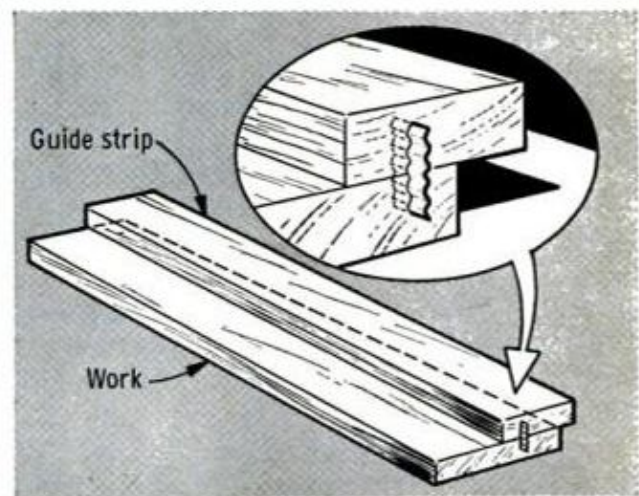
Strap holds cylindrical work

To grip a large cylinder or other odd-shaped object in a vise without damaging the finish, this simple method does the trick. First cut a band from an old inner tube and slip it around the object. Then place a metal strap over the rubber band and position the bent ends of the strap in the vise. When the jaws of the vise are closed, the strap tightens around the rubber-protected part without marring or scratching the surface.—*Mark J. Bir*



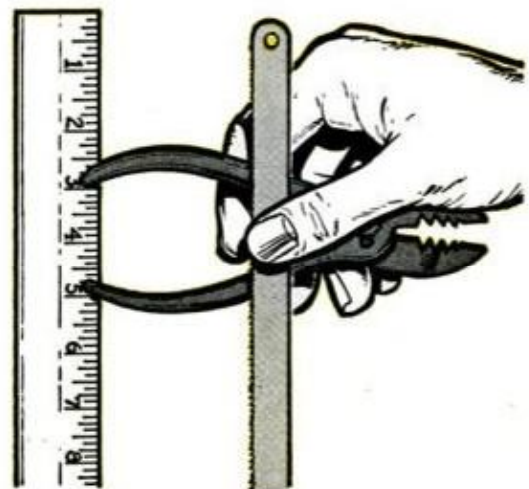
Fasteners hold work to guide

When you wish to taper a board and there really isn't any waste area in which you can drive the nails needed to hold a guide strip, try using this stunt. First cut the guide strip to the same length as the board to be tapered and then drive a pair of corrugated fasteners into the ends of both boards. This will join the two securely, yet won't leave any telltale marks or holes on the finished piece of work.—*G.E. Hendrickson*

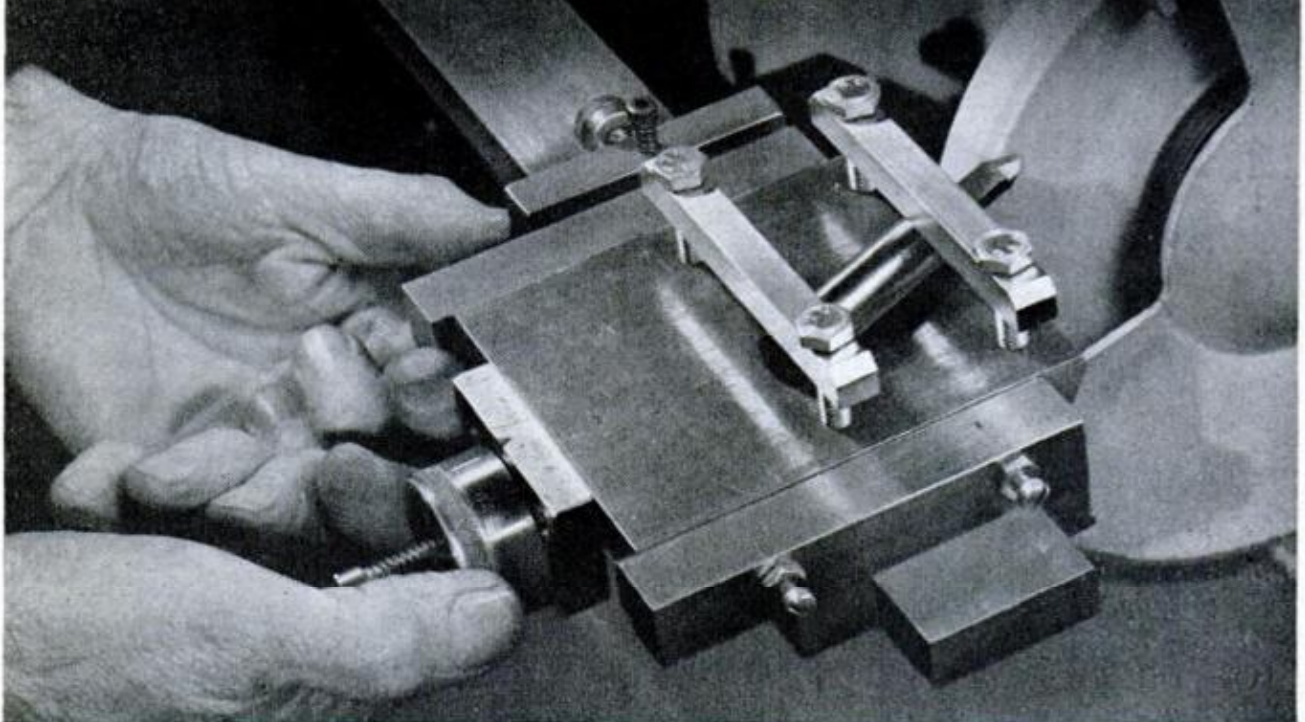


Pliers serve as emergency calipers

In a real pinch where relative and approximate measurements are needed in a hurry, you can draft a pair of pliers and a hacksaw blade for use as a set of calipers. Place the ends of the handle across the item to be measured and then position the hacksaw blade across the handle. Apply and maintain steady pressure to keep the teeth of the blade against the handles and transfer the pliers to a ruler. The handles then indicate the distance.—*James Kniseley*



How to Grind Work with Micrometer Precision



Assemble this all-metal workholder and you can feed work into your power bench grinder in increments as small as 1/1000th of an inch

By **WALTER E. BURTON**

Technical Art by Graphic Presentation Services

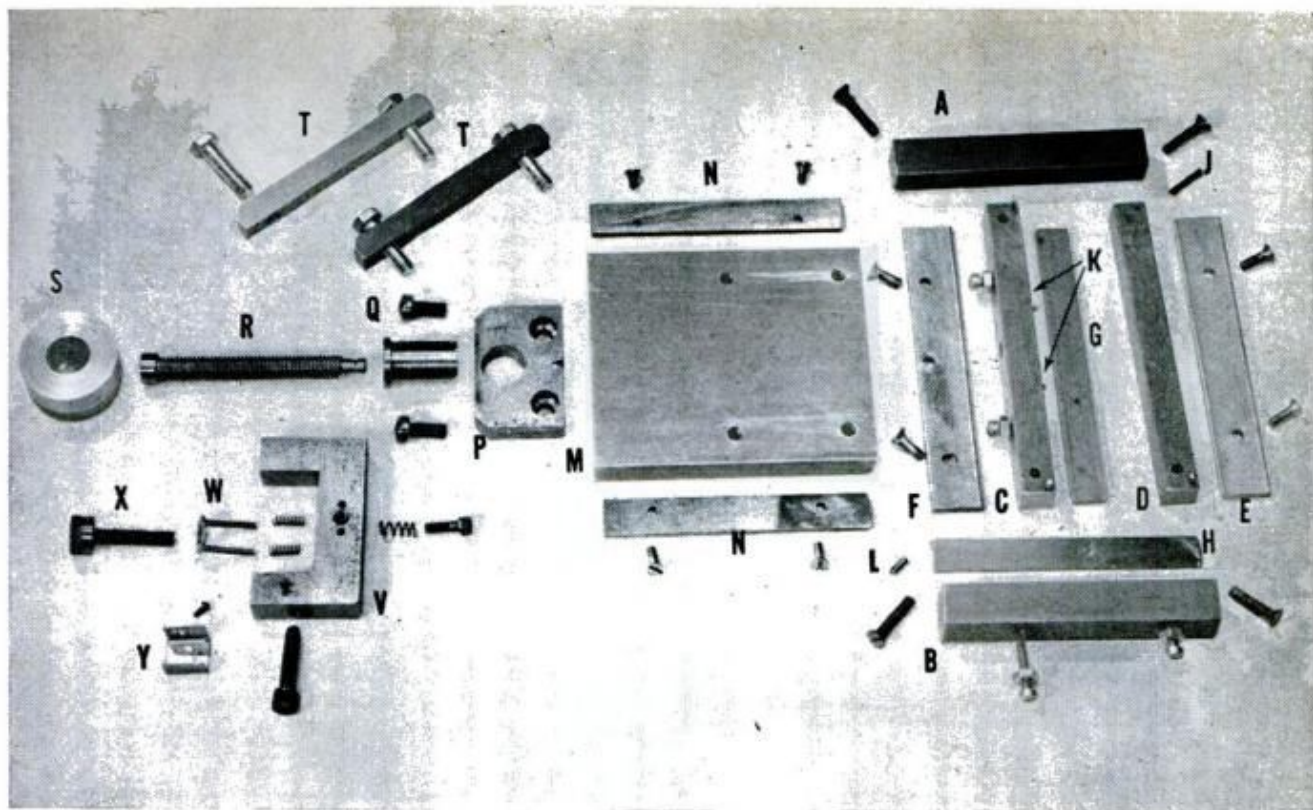
GRINDING A UNIFORM BEVEL on a plane iron (normally a frustrating if not impossible task when held by hand) will be a cinch after you assemble this workholder for your bench grinder. In fact, using the adjustable holder, you'll be able to sharpen lathe bits, chisels and twist drills precisely, and also make child's play of operations like shaping metal parts, finishing hardened pins and even dressing the grinding wheel itself.

The workholder consists of a steel frame that moves easily, but without excessive play, along a rail or track that's mounted to the body of the grinder. The frame carries a cross-slide or bed that holds the work to be ground. The movement of the cross-slide is controlled by a knurled knob and sleeve assembly that's threaded over a feed screw, which, in turn, is permanently secured to the main

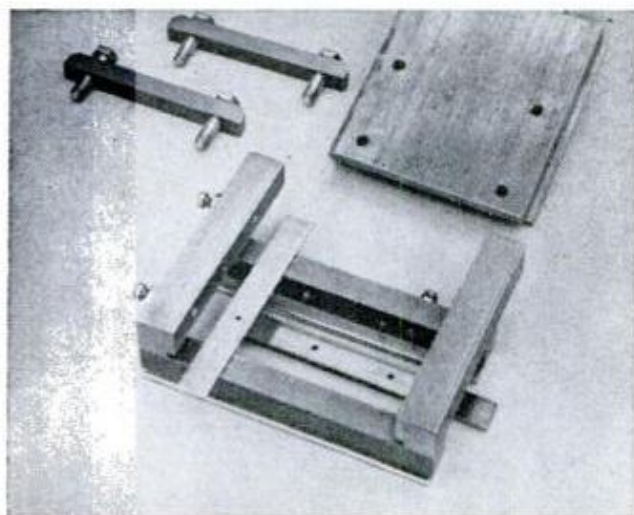
frame of the holder. Thus, simply turning the knurled knob and sleeve moves the cross-slide, and the work, either forward or backward. Calibrate the knob and you then have a means of feeding the work into the grinder with near-micrometer precision.

On the unit shown, a $\frac{3}{8}$ -16 x 3-in. bolt is used as the feed screw. Each 360° turn of the knob moves the slide $\frac{1}{16}$ in., therefore if you divide the knob into 16 equal segments, you'll have calibration marks every $\frac{1}{256}$ in., or 0.0039 in. If calibration marks are desired every thousandth of an inch, simply use a 20-thread screw, such as $\frac{7}{16}$ -20 or $\frac{1}{2}$ -20. Divide the knob into 50 equal segments and you wind up with a scale calibrated every 1/1000 in.

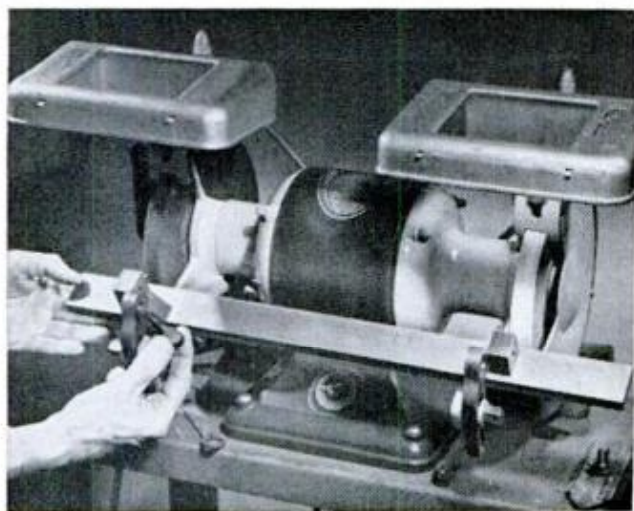
The rail is a $\frac{1}{2}$ x $\frac{1}{2}$ -in. steel bar extending across the front of the grinder. On the Delta grinder shown, the rail is



PARTS OF THE WORKHOLDER. Part Q must be positioned with the flange at right when unit is assembled



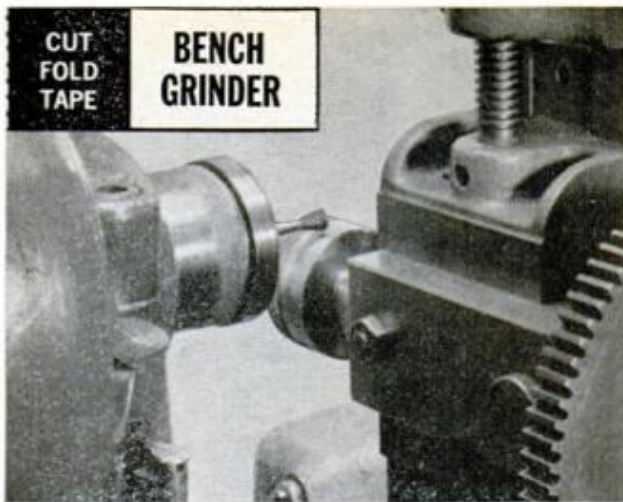
PROJECTING PINS prevent the two gibs from shifting. Gib H on the left has only one 3/32-in. pin



TWO STEEL BLOCKS link rail to original rests. Method of mounting holder may vary with grinder you use

DETAILED PARTS LIST

LETTER DESIGNATION AND QUANTITY	DIMENSIONS IN INCHES	NAME OF PART
A, B	5/8 x 5/8 x 3 13/32	Slide-guide bars
C, D	1/2 x 1/2 x 4 3/4	Frame members
E	1/8 x 9/16 x 4 5/8	Retaining strip
F	1/8 x 5/8 x 4 5/8	Retaining strip
G	1/8 x 1/2 x 4 1/2	Gib
H	.040 x 3 3/4	Gib
I	1/2 x 1 1/2 x req'd length	Rail or track
J (4)	3/32 x 5/16	Pins for corner joints of frame
K (2)	3/32 x 5/16	Pins for gib G, 1/8" projection
L	3/32 x 5/16	Pin for gib H, 0.040" projection
M	1/2 x 3 1/2 x 4	Cross-slide
N (2)	1/8 x 1/2 x 3 3/4	Retaining strips
P	3/8 x 1 5/16 x 2	Blank for slide bracket
Q	3/4 x 1	Blank for threaded sleeve
R	3/8-16 x 3 bolt	Slide control screw
S	3/4 x 1 1/2 diameter	Blank for micrometer knob
T (2)	3/8 x 3/8 x 3 1/2	Hold-down bars



MICROMETER KNOB, calibrated with aid of lathe indexing attachment, provides precise slide control

21 in. long to allow operation of the workholder on both wheels. The brackets on the original workrests offer the best means by which to attach the rail. The rail on the Delta is coupled to the two brackets by means of two steel blocks bolted to the bottom of the rail, then secured to the brackets with the bolts that held the original rests. Of course, the length of the rail and the arrangement of attaching it to the grinder will depend upon the physical dimensions of the grinder itself.

In use, the work is clamped to the cross-slide and the entire workholder is pushed by hand along the rail. In this case, the position of the cross-slide determines the amount of material removed by the face of the wheel. When the flat side of the wheel is being used, however, the amount of travel into the wheel must be carefully controlled.

Precise control in this direction is provided by a micrometer-stop assembly



MICROMETER STOP provides control of travel in sideways direction, is calibrated to 1/1000 in.

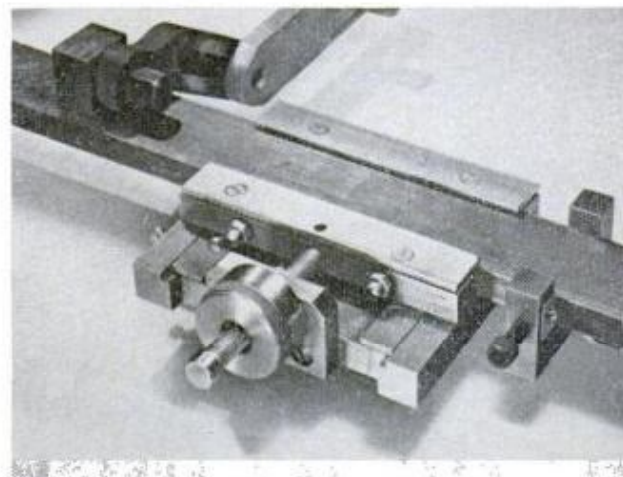


FEED SCREW is secured to frame member C with setscrew. Knob and sleeve ride screw, control slide

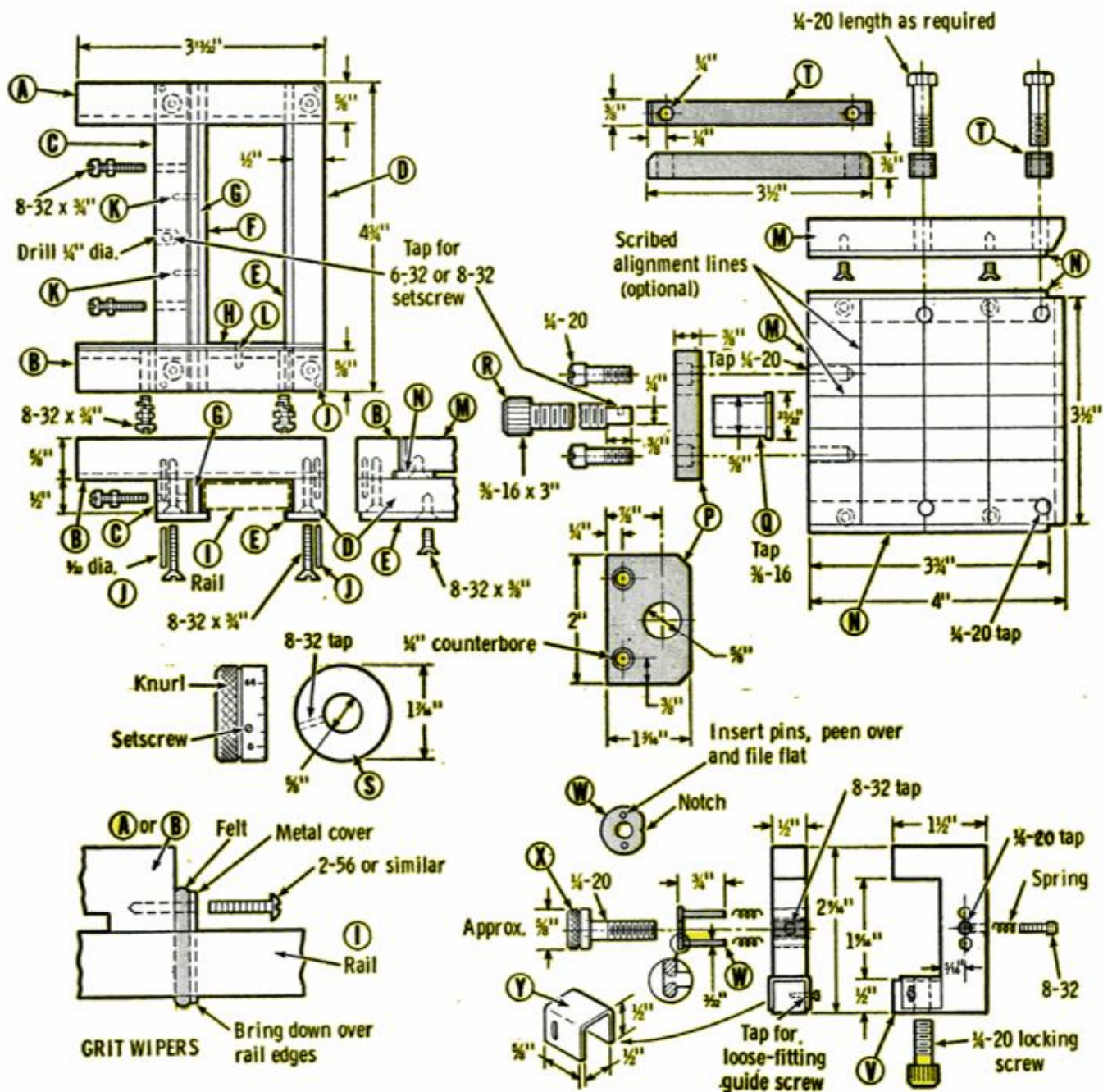
that's not unlike a C-clamp. The body of the assembly is shaped from the bar stock used for the rail and is fitted with a clamping screw that forces a thin pad of sheet metal against the rail, thereby locking the stop assembly on the rail.

Also fitted to the body is a screw that acts as a bumper to stop the movement of the workholder. A micrometer-type knob controls the amount of screw travel and is kept from vibrating loose by a washer, two pins and two springs that form an index-mark and support mechanism. The screw has a 1/4-20 thread and is fitted with a knob divided into 50 equal segments to produce calibration marks every 1/1000 in.

To use the micrometer stop, first make certain that it's firmly clamped to the rail. If the work is being ground on the side of the rail, and you wish to remove, let's say, an additional .005 in. of material, run the stop screw up against the workholder and read the mark on the calibrated knob.



BOTTOM VIEW reveals feed-screw mounting. Protect holder from metal dust with wipers (see drawing)



WORKHOLDER DIMENSIONS. For exact length of frame members C and D, measure across parts A, B, H and M in assembled position. Then add .010 in. to this length to assure free movement of slide M

MICROMETER-STOP PARTS

LETTER	DIMENSIONS (Inches)	PART
V	1/2 x 1/2 x 2 1/2	Blank for body
W	Washer 9/16 o.d., 3/4 hole; Two 3/32 x 3/4 rods; two coil springs	Index-mark assembly
X	9/16 rod, 5/16 long	Micrometer-screw knob
Y	0.020 Sheet aluminum, 5/8 x 3/4	Pad for locking screw

Then back off the screw five divisions, or .005 in. Pushing the workholder up against the stop screw then limits the cut of the grinder to the desired amount. It's also possible to back the cross-slide away from the wheel before moving the holder. Then the slide is fed forward to remove the additional material.

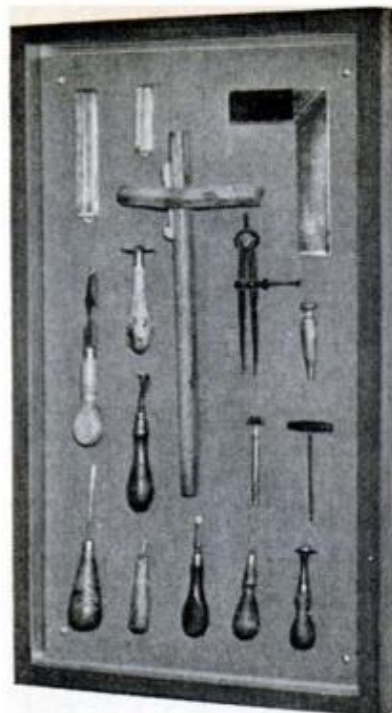
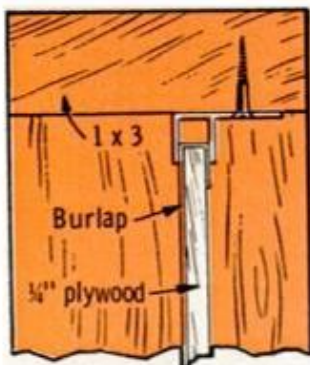
The simple arrangement of two hold-down bars will handle most common grinding jobs. However, it may be necessary occasionally to use longer bolts, elevating blocks or other special holders to place the work at the proper height and angle. Just make certain the work is always held securely in the cross-slide. ★★★

HINTS

FROM READERS

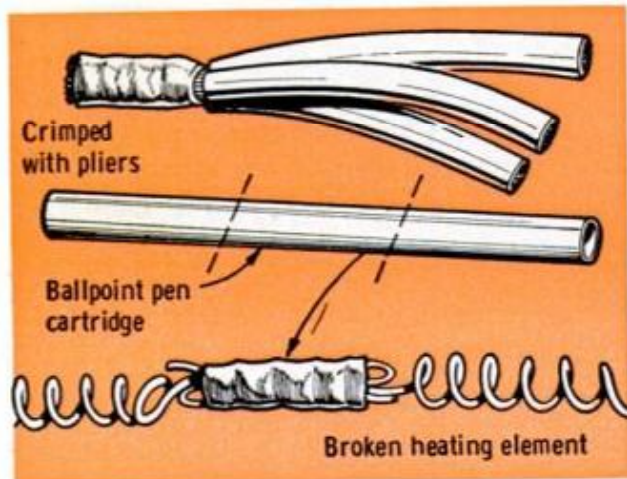
Quick-change display boards

If your hobby collection is too big for a single display, try this novel mounting idea and show off a bit at a time. Sort the collection into an equal number of parts and mount each group on burlap-covered panels of the same size. Build a simple frame to accept the panels and install lengths of aluminum sliding-door track at the top and bottom of the frame. Thus, you can lift out one display board and replace it with another when you choose.—*Charles LaRobardier*



Splicing sleeves from ballpoints

Keep those empty ballpoint pen cartridges and you'll have a ready supply of splicing sleeves suitable for electrical wires of most gauges. Just cut a cartridge into six to eight equal sections (a fine-tooth hacksaw blade produces relatively clean cuts). Insert the wires to be joined, crimp the sleeve and you have a tight, secure connection. The idea also works great for splicing broken heating elements found in toasters, hot plates and other electrical appliances.—*Joseph Braunstein*



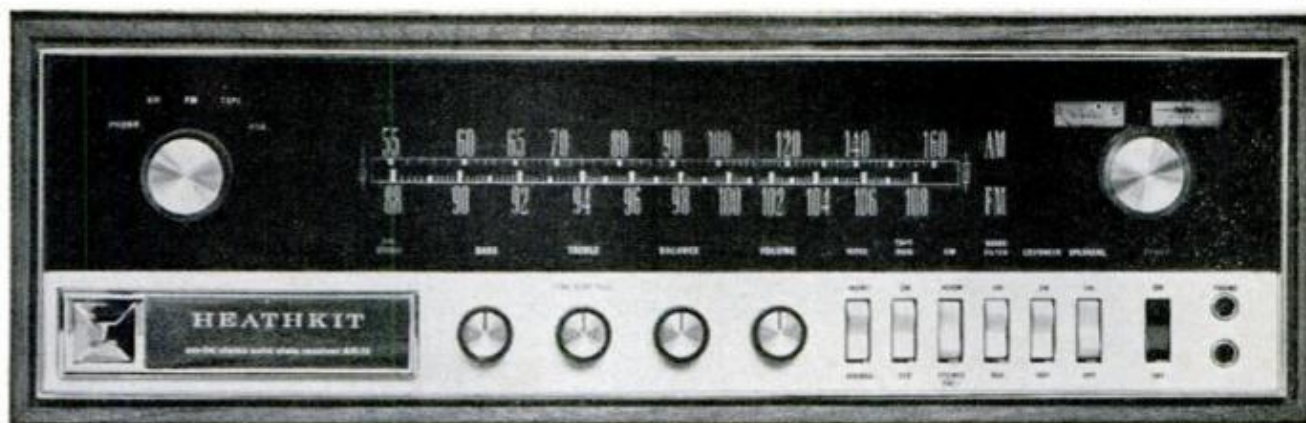
NEXT MONTH IN SHOP AND CRAFTS

YOU, TOO, CAN BUILD A FIREPLACE. Packaged steel units make it a cinch. Each step of an actual installation made by our Home and Shop editor, is shown in a two-part construction article beginning in the December issue. A sneak peek at the completed fireplace is given in the special section on leisure living in this issue.

RIGHT WAY TO RUN A SNOW BLOWER. There's a lot more to efficiently operating your new snow blower than you'll ever find in the owner's manual. Next month's informative article describes a number of tips enabling you to cut maneuvering time to a minimum. You'll certainly want to save it for a carefree White Christmas.

WORLD'S MOST COMPACT WORKSHOP. After visiting Bill Crane (surely a dean of inventors), *PM's* editors were so impressed by his novel in-a-door workshop that they arranged to borrow his unique idea for your use. Presented in color, the adaptation of the in-a-door concept will prove a boon to homeowners and apartment dwellers who'd like a complete hobby-type workshop in a single closet.

NEW MINI-TRAINS BUILT LIKE A WATCH. Latest introduction to the hobby field, "N"-gauge model trains are small enough to fit in a vest pocket, yet really pull a load. The eight-wheel-drive locomotives are a wonder of precision and just as detailed as their big brothers in the HO family. A full page in color shows the intricate parts of a completely disassembled locomotive in their actual size.



The Heathkit AR-15: Slick New, Feature-Packed Receiver

Heath designed in the performance-plus FET and IC circuits and a host of convenience, safety and styling features, but it's your job to put the parts together to make this sophisticated AM-FM stereo kit

By BILL HARTFORD, Electronics Editor

Photos by Bob Mills

IT'S NOT ENOUGH just to say that Heathkit's top-of-the-line AR-15 is an audio Rolls Royce; it is actually quieter than that paragon of automobiles! That doesn't mean its 75 watts per channel isn't up to duplicating the roar of engines with a fidelity that would make you dive for safety, but it does mean it has the operational quietness that is just as important to high-fidelity performance as booming bass and tinkling treble.

Some of the quiet is built-in—as in any high-quality equipment—and some is added on in the way of extra convenience features. A “squelch” control, located behind the door on the front panel, is just such a convenience feature. It can be adjusted to make for quiet “driving” between stations. Interstation noise is probably one of the most annoying sounds on any set. Often all you can do is crank down volume before changing stations.

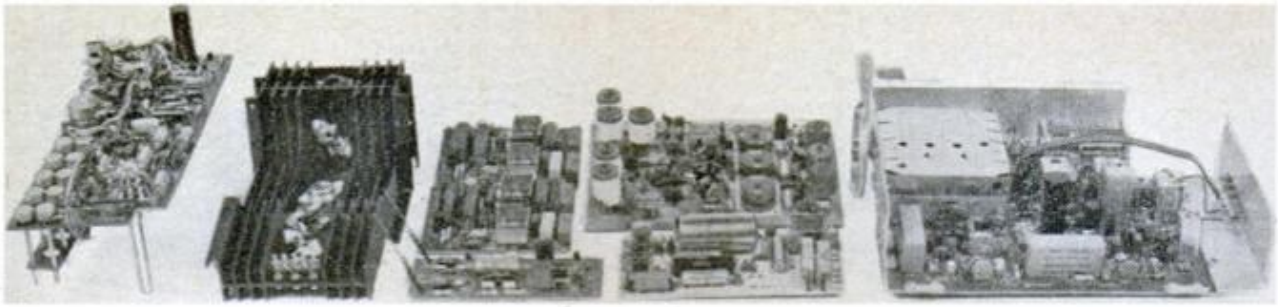
Next to the squelch control is a “stereo threshold” control that keeps noisy hash from ever reaching your ear. It can be adjusted for any point to switch FM stereo reception automatically to mono-

phonic reception when the received signal gets too weak or noisy.

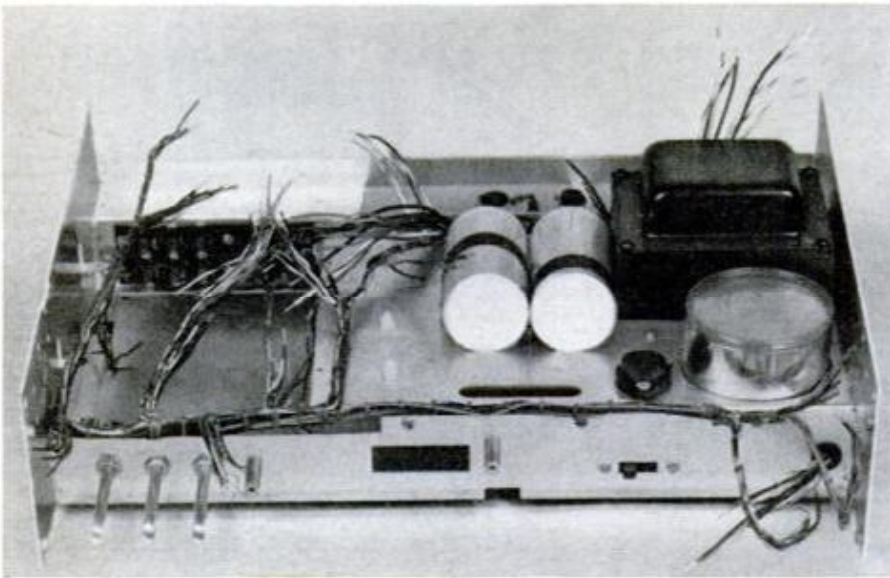
One of the built-in noise-killing features of the AR-15 is the application of crystal filters, rather than conventional transformers, in the intermediate frequency (IF) circuits of the FM tuner. These filters are “steep-sided”—they provide a sharp cutoff when tuning onto or off a station. In short, they eliminate the annoying “rush” or noisy distortion you get when you move your tuning indicator just to the left or right of a station on the dial of a transformer-IF tuner or receiver.

Subcarrier filter circuits further eliminate noise that might be present in stereo signals. The power supply is more than adequate, operates cool and helps contribute to low hum and noise.

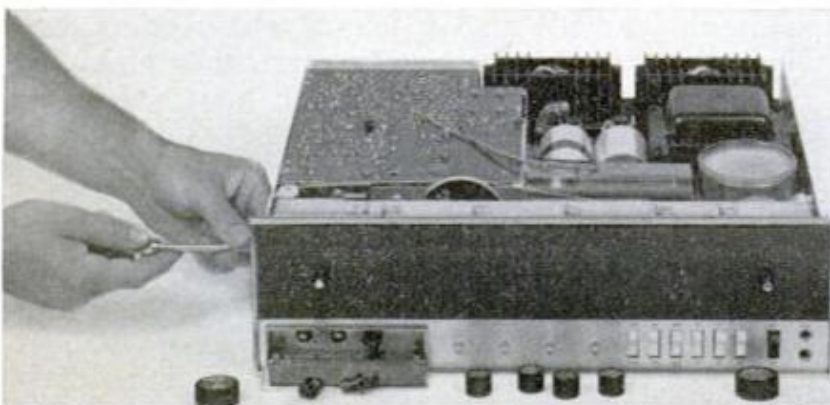
So much for what you *don't* get from the AR-15. What you do get is superb sound—AM, FM, and amplifier performance that's right up to, if not better than, what are actually conservative published specifications. Field-effect transistors (FETs) and integrated circuits (ICs),



FIRST STEP in building the AR-15 kit is to prepare seven circuit boards (a phono preamp, power supply, two power amplifiers, control preamp, multiple circuit and AM-FM tuner and IF circuit) and four heat sinks which mount the output transistors. Next step is chassis



SECOND STEP is securing sheet metal parts together to form the chassis. Large capacitors, transformer and all circuit boards and heat sinks, shown above, are then mounted on the chassis. Interconnecting wiring between chassis components and circuit boards is accomplished by means of two cable harnesses which are shown in place here. They are completely prepared (cut to length, stripped and bound) by Heath. The long phase, squelch and threshold control shafts (left front chassis) indicate depth of front panel



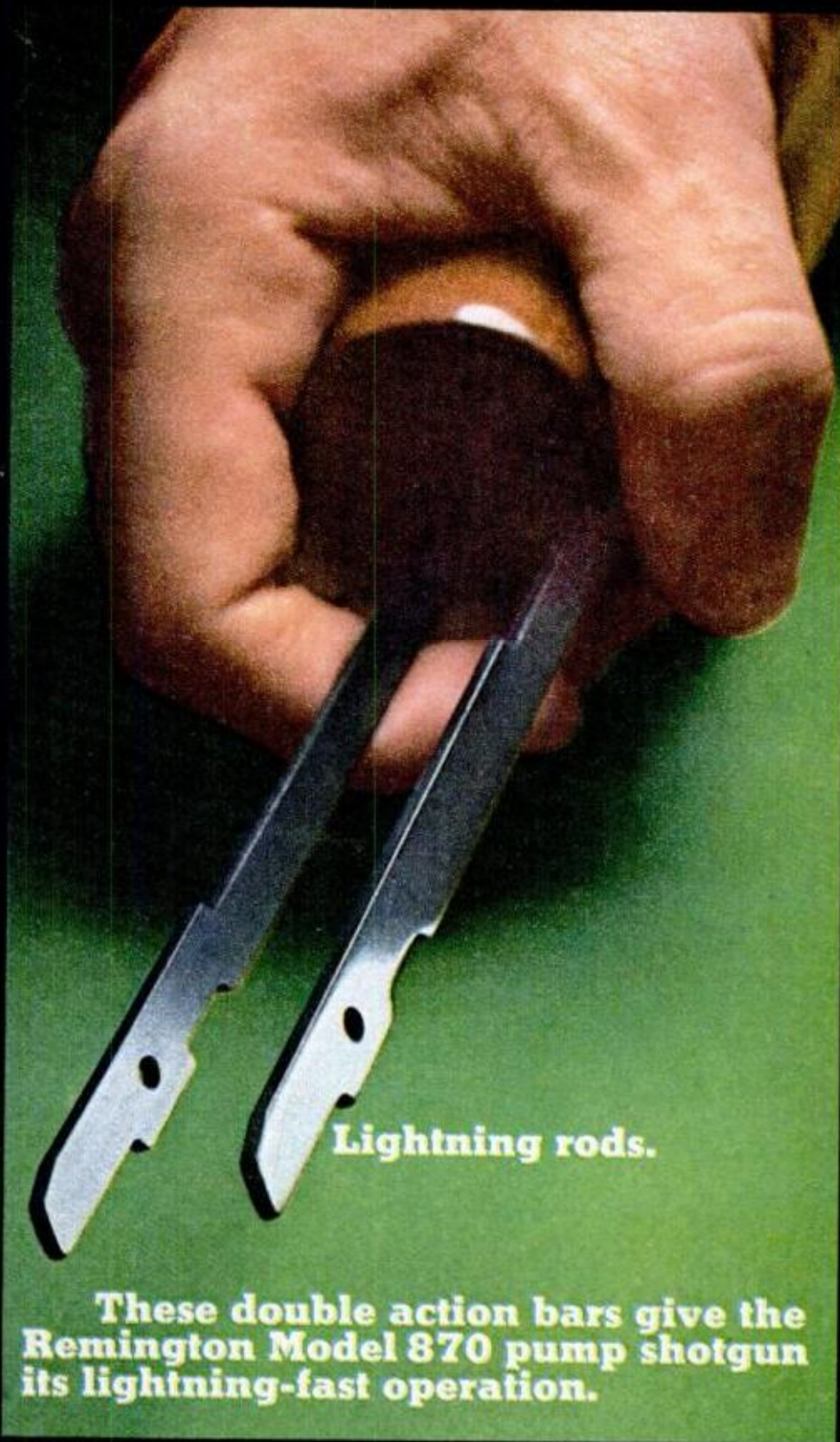
FRONT PANEL ASSEMBLY entails installation of several light reflectors (a total of nine pilot and indicator lamps), dial cord and pulley, dial window and meters and dial pointer rail. A tinted window covers the entire dial-face assembly, rendering it invisible until the receiver is turned on. All the rocker switches on the front panel are mounted on their own bracket, which is secured to the rear of the front-panel plate. Signal meter doubles as an ohmmeter and a voltmeter for all of the final checkouts and adjustments.

two of the latest developments in solid-state technology, contribute to performance by improving FM tuner operation, and IF amplification and limiting, respectively.

In addition to basic performance, the

receiver allows for the utmost in manipulating the audio signal to suit personal taste, to compensate for the nonlinear characteristics of the human ear, and for the type of reception desired. Among the

(Please turn to page 209)



At least once every minute this season, some hunter will be using chain lightning to connect with his bird.

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STOP-ACTION STUTTER STROBE

(Continued from page 175)

you wish to shoot—produces a spectacular series of closely spaced images that dance across the picture as if they were actually moving. The result is almost like shooting action pictures with a still camera.

The Cronoscope can be used with any camera that has provision for time exposures. An outlet on the front accepts several types of tripper cords for firing the flash. Connected to a camera by means of a standard shutter cord, the light serves as a regular strobe, giving a single flash every time the shutter release is pressed. Unlike many electronic flashguns that require a recycle time of several seconds, the Cronoscope can be fired repeatedly as fast as you can trip the release with no waiting between flashes.

For multiple-exposure effects, such as the swinging hammer and bouncing ball shown here, the speedlight is not connected to the camera at all. In fact, your camera doesn't even have to have a flash connection so long as it has a "Bulb" or "Time" setting. You simply open the shutter in a darkened room, start the light flashing, then close the shutter after a second or two. For this, there's an extension cord with a pushbutton switch on the end that lets you fire the light from several feet away. The light can also be fired by means of a button on the case.

The Cronoscope is designed to sell for \$64.50, making it competitive with other moderate-cost electronic flash units. Its light output compares favorably with that of other small strobes. The present version operates off 115-volt a.c., but an accessory battery pack is planned.

Varying the flash rate

By turning a knob, you can adjust the light's firing rate from 10 to 30 flashes per second, depending on the number of images you want. The faster the rate, the more images you get in the same amount of time and the more closely spaced they are. In general, the more images you have, the smoother the sequence and the more dramatic the picture. However, too closely spaced images may start to overlap and become confusing. To determine the best firing rate, make several trial exposures at different settings. A Polaroid camera, if one is available, is handy for making quick tests and will tell you immediately what firing rate is best for any particular type of action.

You can also vary the flash duration—the length of time that each pulse of light lasts. This is adjustable from 1/40,000th of a second to 1/500,000th—the latter being

fast enough to freeze a rifle bullet in flight. The shorter the flash, the less light you get, but the more action you stop. Here, again, some experimentation is necessary to determine the best duration for a particular shot. The 1/500,000th-second setting is needed to stop high-speed motion like a bursting light bulb or balloon.

It's a good idea to use as fast a film as you can since this lets you stop down for maximum sharpness. In tests made by PM using high-speed Tri-X film, rated at ASA 400, it was found that nearly all shots could be made at f/8—small enough to give you a good depth of field.

A solid black background provides the most dramatic results on multiple-exposure shots. It's important, however, to place it a good distance behind the action—10 to 12 feet—so it won't pick up dark shadows and hot spots of light. It's also wise to tilt the background at an angle to the camera so it can't bounce reflections back into the lens.

Make the room completely dark before you shoot and close the shutter as quickly as you can after the action is completed in order to keep stray light from fogging the picture. For the photos shown here, the shutter was opened for two to three seconds—no longer.

Catching an explosion

For split-second action that would be difficult to catch by manually firing the light, the Cronoscope can be actuated by special sound or light-triggering devices available as accessories. For the shots of the bursting balloon and bulb, a small microphone was plugged into the light instead of the regular tripper cord. The shutter was opened and the microphone picked up the sounds of the explosion, triggering the light at the same instant.

The mike can be placed anywhere from several inches to several feet from the action. Varying the distance that the sound has to travel changes the point at which the light fires so you can adjust the mike to catch the action at the most exciting stage. The mike was placed about a foot away for the balloon shot and two feet away for the light bulb because it was found that the bulb took slightly longer to burst and thus needed a little extra delay.

The Cronoscope flash tube is a plug-in type that's easily replaced. Two styles of tubes are available. A bare bulb comes with the unit and is suitable for general-purpose shooting. For more directional lighting, a tube with a parabolic reflector is available as an accessory. The Cronoscope is made by Wein Products, Inc., Box 34647, Palms, Calif. 90034. ★ ★ ★

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GM

THE MAN FROM MORAN

(Continued from page 139)

and Hennessey being Al Hatfield, the engineer (who lives "down where the horses are," he reminds you, when speaking of his engines), and Henry Ronneberg, the deckhand.

This crew is on duty 48 hours straight, then off for two days while a second crew takes over. You can't have an expensive piece of machinery like a tug idle. The night before, Sanschagrín had been up till 3:00 a.m. moving an oil tanker from a Bayonne, N.J., refinery to Brooklyn, a simple job, but there had been difficulties and delays. The working day is from 8:00 a.m. to 4:00 p.m., and anything before or after those hours rates overtime pay.

Sanschagrín lives in Lattingtown, Long Island, a New York suburb, with his wife and two of his four children (two are married). Offhandedly, but with understandable pride, he admits that he built his own 10-room, 3-bathroom, split-level house himself—mostly with his own hands!

From his job with Moran, Sanschagrín earns about \$12,000 a year, but he gets almost as much again from the ships he handles through a special pilots' pool. A big liner pays \$35, a small freighter \$10, for example, but all the payments made to all pilots go into a pool which is divided up at the end of the month. Depending on his length of service, a man has a quarter share, a half share, or a full share—and as a rule Sanschagrín's share brings him from \$800 to \$1000 a month.

Father also a captain

His father, a Canadian, was also a tugboat captain, chiefly on the Erie Canal. Sanschagrín got his start on the Erie and the Great Lakes where, he recalls, he started at \$85 for a full 31-day month of 12-hour days. Long before the days of diesels or unions, he spent a good part of his time shoveling the coal which kept the tug operating. Aside from a grade school education in New York City's P.S. 29, Sanschagrín has had no formal training, but he is frequently called in as a consultant on harbor design.

Much of Sanschagrín's work in the middle of an average working day is moving tankers or barges from one berth to another. Big ships are fueled from tankers which must be brought alongside—and pulled out a few hours later. Snagging a big awkward tanker or a flock of barges through a tight harbor traffic situation seems impossible until you see Sanschagrín do it. He admits that tankers are the most dangerous and difficult ships

to handle. Fully loaded they are tremendously heavy, and to handle them a tug must be lashed tightly to them, which sometimes makes a tug captain feel he's being taken over by his tow. Although he was not aboard at the time, he recalls the disastrous run-in the *Patricia Moran* had with a tanker a few years ago in the Kill Van Kull, a narrow passage between Staten Island and New Jersey. One bright, sunny morning a tanker came booming along and crashed into the *Patricia* so that she sank almost immediately with the loss of four lives. After 14 days she was fished up and reconditioned, and has been in service ever since. Not long ago she towed a section of floating dry dock to Vietnam, for she is one of the most powerful and modern tugs afloat.

Sanschagrín has never been on one of these long sea trips; he prefers harbor work.

Never takes a job lightly

For all his experience, Sanschagrín finds he can never take his job lightly. "You might think," he tells you, "that after years of docking the world's greatest ships such as the *Queens*, the *Michelangelo*, and sometimes aircraft carriers, that everything would be automatic.

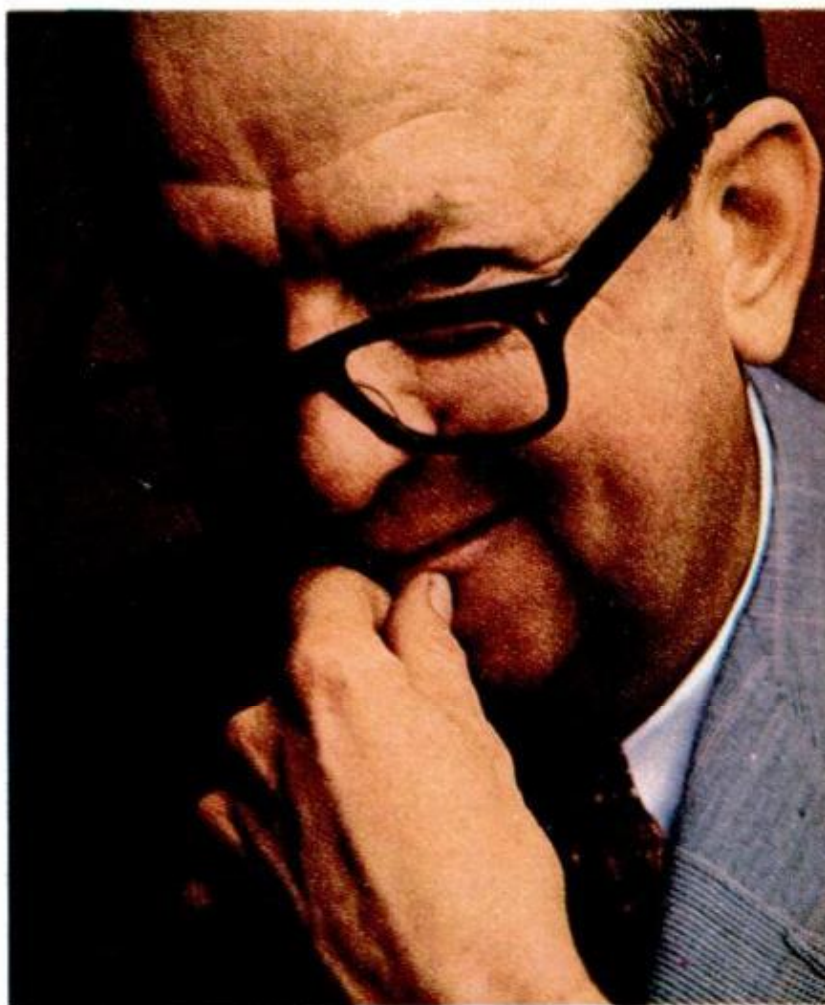
"But you can never forget that the least miscalculation will send an 80,000-ton ship crashing into a pier with disastrous results. Each docking, even of the same ship, is a challenge to your memory, experience and judgment. Seldom are the wind, the pull and strength of the tide, and the currents the same. Is this ship 700, 800 or 1000 feet long? What are her draft and special maneuvering characteristics? You must constantly watch the ship's angle as she approaches her berth. Your orders to the ship's helmsman and the engine room must synchronize with your walkie-talkie orders to the tugs you can't see. Your decisions must be instantaneous and accurate!

A few crunches

"No, I've never had a bad crash, but a couple of times a sudden gust of wind sent us crunching against the end of a pier, fortunately with very minor results to any of us.

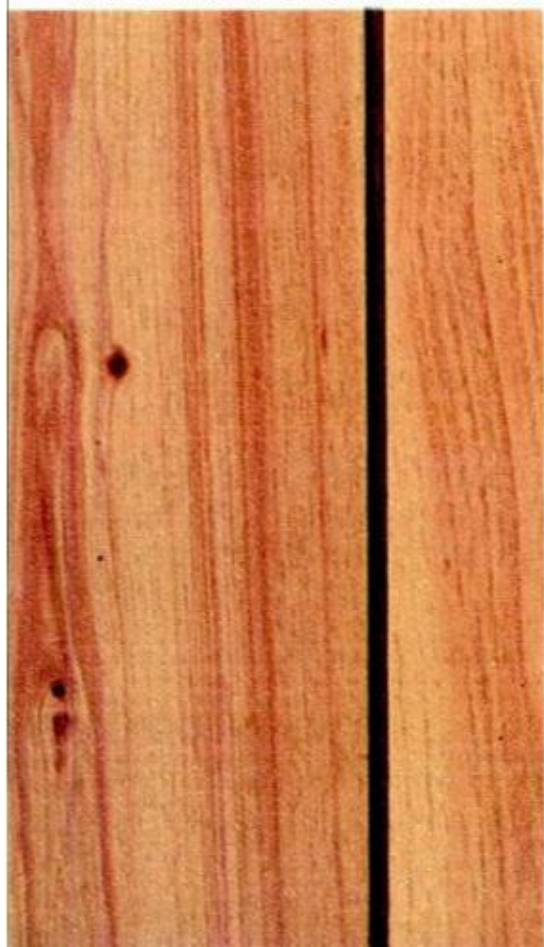
"There are small, special things you have to remember, too. You must remember that the owners of the *Michelangelo*, for instance, are very fussy about their white paint job, and insist that tugs working around her throw a white canvas over their bows so as not to leave marks. They expect a sort of surgical cleanliness." ★★★

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MEADVILLE, PA.

GOOD CARS YOU CAN'T BUY

(Continued from page 111)

Among the more desirable English cars is the Daimler 2.5 Liter. This is actually a Jaguar product, because Jaguar bought out Daimler a few years ago. The Daimler is one of the cheaper cars in the Jaguar range, and it is similar in appearance to the Jaguar sports sedans. The power unit is a fine little V8, which Jaguar inherited from Daimler, and it gives 142 hp from its 155.5 cu. in. The car could be sold in America for approximately \$4500, but to market it here would involve introducing an engine not sold on Jaguar, with the considerable parts and service problem that implies.

Luxury from England

In the luxury class from England, there is the AC Convertible, powered by American Ford's 428-cu.-in. V8, and two Chrysler-powered cars—the Bristol 409 and the Jensen FF. In the American market these three would all be in the \$12,000 to \$15,000 range. The AC is built by the same company that builds the Cobras, and the Jensen is interesting because it uses four-wheel drive and has a Maxaret antilock device in its braking system, similar to those used in aircraft.

Like General Motors, Ford has decided to sell some of its foreign-built cars here and keep the others in the closet. Basically, Ford's policy is to concentrate on its snappy English-built Cortina. This leaves out the complete German Taunus range with its interesting V4 and V6 engines. These cars are well styled with considerable American influence. Engine sizes range from 91.4 cu. in. to 122 cu. in., so that they would handle American conditions with ease. The same can be said for the Corsair, Zephyr and Zodiac produced by English Ford. The Corsair and Zephyr are powered by V4s, with a V6 optional for the Zephyr. The Zodiac, with 136 hp from a 182.7-cu.-in. V6 is an excellent car with disc brakes all around. Prices in America would range from less than \$2000 for the cheapest Taunus, to over \$4000 for the most expensive Zodiac.

France's Simca Co., which is now 77 percent owned by Chrysler, is gradually building up sales in America, but imports only the rear-engined 1000 series powered by little 57.6-cu.-in. engines. However, Simca also builds 1301 and 1501 series powered by 78.7 cu. in. and 90-cu.-in. engines, respectively, which are mounted in front and drive the rear wheels. These cars have done well in France and could probably sell here in the \$2300 to \$2800 price range.

Renault, France's biggest carmaker, offers Americans the Dauphine, and the 10 which can also be obtained in Caravelle form. Missing from the scene are Renault's smaller and larger models, the 4 and 16. The 4 is a practical little estate car. The 30 hp from its 51.6-cu.-in. engine might be marginal on the highway, although the 4 would make a good second car. It sells for \$1345 at the factory. Add \$400, and it might be a little overpriced in America.

The 104-inch-wheelbase Renault 16 could sell in America at about \$2500 and would be excellent for American conditions. Its 90.5-cu.-in. engine puts out 63 hp, and its body is designed to make maximum use of available space, which is made easier by a front-wheel-drive layout. It has a four-wheel independent suspension.

These are just a few of the good cars you can't buy in the competitive old United States. We have tried to concentrate on cars you might want to buy if they were available and which would be competitively priced as well as suited to American needs. We have omitted extremely expensive cars and exotic, few-of-a-kind models.

Beware if you buy one

Of course there's nothing to stop you from going to Europe, or anywhere else, and buying the local product and bringing it home. But beware: If you get picked up driving a Brazilian Willys-Overland, a Yue Loong from Taiwan, an East German Trabant, or a Polish Syrena, the Highway Patrol will give you a hard time. Most cars not designed for sale in the United States do not comply with our safety regulations. Neither the Karmann Ghia 1600 nor the VW notchback are equipped for the American market.

Every country has its own rules as far as headlights, color of lenses, type of safety glass and many other small details are concerned. Apart from differing among themselves, the European countries all differ widely with America on these requirements. Also, assuming that you were able to make the necessary modifications to meet your state regulations, you might experience considerable delay in getting parts and sheet metal in case of trouble.

I wouldn't be surprised if there are a few essential parts for Karmann Ghia 1600s stashed away behind locked doors at Volkswagen HQ at Englewood Cliffs, N.J., because VW doesn't want anyone saying he can't get parts. Whether General Motors and Ford would be as sympathetic to sneaky Vauxhall and Taunus buyers is a matter for conjecture. ★ ★ ★

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THE HEATHKIT AR-15

(Continued from page 200)

rocker switches, for example, are FM and loudness switches. The FM switch can be set in the "norm" position or can be set to "stereo only," which lets you sweep across the FM dial receiving only programs being broadcast in stereo. The loudness switch, when placed in the "on" position, is designed to cause a calculated boost in bass for listening at low-volume levels—when the receiver is providing quiet background music, for example. This boost compensates for the poor bass response of the ear at low levels.

The other rocker switches control mode (mono-stereo), tape monitor, noise filter (FM stereo reception), speakers (on-off) and power. The power switch also controls one switched a.c. receptacle on the rear of the chassis.

A pull switch is incorporated in the treble control which overrides the effect of treble and bass settings to give flat amplifier response. Another pull-type switch is the "phase" control, which allows you to obtain maximum stereo separation for each stereo station tuned.

Ten slotted shafts that adjust the level of the input signals (aux, tape, AM-FM, phono and tape monitor) to the left and right channels are also accessible behind the hinged door on the front panel. Four indicators visible on the dial face keep tabs on the receiver's operation. A "high-temperature" lamp goes on and a thermal circuit breaker shuts down the power amplifiers if the output transistors get too hot from insufficient ventilation or any malfunction. A "stereo" lamp indicates stereo reception; and two meters indicate signal strength and FM tuning. The signal meter also indicates relative voltage and resistance for initial testing and adjustment of the receiver.

Unless you have more time than most of us, set aside about a dozen evenings and a Saturday or two over a period of a month to build the AR-15. It's an over-50-hour project which most electronics buffs would not recommend for the novice. But that depends on the novice. If he's a careful worker, has a good soldering savvy and is, above all, a patient builder, he will astound the most experienced of his more mechanically and electronics-oriented friends.

At \$329.95, with an extra \$19.95 for a walnut enclosure, the AR-15 is not cheap, but it's an excellent, *sound* investment. And since Heath has just announced that the AR-15 is now available fully assembled (the ARW-15) for \$499.50, you're saving \$169.55. ★★★

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STALLING TROUBLES

(Continued from page 147)

will supply enough fuel to start a cold engine can falter when it warms up and keep sufficient fuel from reaching the carburetor. Causes include a cracked diaphragm, a weak diaphragm return spring or a bad pump valve. How to check the pump and treat a defective one was the subject of last month's *Saturday Mechanic*.

Engine stalls on getaway from stop

Fouled or improperly gapped plugs. If you're lucky enough to have access to a sparkplug scope, you will save yourself the job of removing each plug and examining it visually. Otherwise, plugs must be pulled and checked for gas-fouling, oil-fouling, over-heating and proper gap.

A fouled or improperly gapped sparkplug can't ignite the fuel-air mixture or, at best, will produce inadequate ignition. Naturally, an engine that is not firing on all six or eight cylinders is prone to stalling. If a plug is fouled, it usually signifies a malfunction in the engine, fuel system or ignition system to be traced and fixed.

Defective vacuum advance. A defective vacuum advance can cause stalling when a load is put on your engine. A quick field check of vacuum advance operation can often be made by removing the distributor cap and rotor and disconnecting the carburetor-to-distributor vacuum line at the distributor. Pull the distributor breaker plate against cam rotation and hold a wet finger over the vacuum inlet. The plate should not move when you let go. If it does, the diaphragm is leaking, and the unit should be replaced.

In some cases, you can't pull the distributor breaker plate against cam rotation. To check this type, you will have to use a timing light or distributor-scope.

Distributor primary internally grounded. This is one of those sneaky troubles you don't think of. It can mislead you into looking for the cause of stalling every place but the right one. True, it doesn't happen often, but don't overlook the possibility. Open up the distributor and inspect the insulated primary lead for wear. Make sure it's not grounded in any way.

Clogged fuel line. It's obvious that a partial obstruction of fuel flow because of a clogged filter will cause your engine to starve out when you accelerate. But how do you know that that's the trouble? Better check and, if necessary, replace the fuel filter and the input filter screen in the carburetor inlet, if there is one.

Defective accelerator pump and low

(Please turn to page 212)

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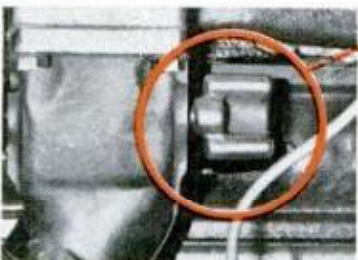
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STALLING TROUBLES

(Continued from page 210)

float level. Acceleration places a sudden momentary demand on the fuel-output requirement of the carburetor. A bad accelerator pump circuit or a low float level condition in the carburetor bowl doesn't allow for sufficient fuel to reach the cylinders to meet acceleration demands.

Adequate fuel supply is easy enough to check. Just remove the carburetor air cleaner and operate the throttle valve by hand. A stream of raw fuel should squirt from the discharge nozzles into the venturi every time.

Breakdown inside engine. Naturally, low compression can contribute to stalling, so take a compression test. Not so obvious is the fact that a faulty cooling system thermostat could also help cause stalling by delaying engine warm-up.

Take the thermostat out of the car and suspend it in a container of water. Insert a thermometer in the water and heat the water. Watch to see at what temperature the thermostat opens fully. This figure should be compared with the temperature rating stamped into the housing. ★★★

HOW THE GARDEN GREW

(Continued from page 143)

steel. This "skin" is made of 2000 slabs of concrete. Some—the curved cove panels—are tan. The others, flat castings weighing nearly 12 tons apiece, are peppered with three quarter-inch brown pebbles. Hansel and Gretel would have gone for them.

In startling contrast, a glass-sheathed "bridge" nearly a city block wide and three stories high links the Center with the office building. This is the *Mall*, a luxurious approach to the lobby for those who enter the complex from the east. Spanning a taxi ramp to the railroad's now sunken concourse, it's a cheerful rallying point for sports-bound parties. The same cheer carries into the color schemes throughout the Center. Gone are the dull gray catacombs of the former Garden.

Finally, there's that vital ingredient: *Safety*. If there can be a fireproof building, this is it. Even the steelwork has been sprayed with asbestos. The wide corridors, commodious escalators, elevators and, if necessary, the two-lane freight ramp, provide every possible facility for quick evacuation. Entrances for firemen are equally plentiful. Spaced 50 feet apart at each floor level are emergency doors tucked into the recessed coves. In a lighter vein, ladies can ride the electric stairs without fear. There are no high heel grabbers in the treads. ★★★

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EYE-OPENERS ABOUT SLEEP

(Continued from page 107)

parently turned to alcohol and drugs.

Aside from easing mental stress, REM also speeds recovery from sheer physical fatigue. Only during REM periods can the muscles completely relax. As long as muscles remain taut, their blood vessels are squeezed. Under REM relaxation, the vessels open up and the racing heart flushes the muscles with plenty of blood, washing out the poisonous waste (lactic acid) produced by hard work. Again the implication was: more REM—better rest.

A sleep machine?

At this point, far-out optimists were hoping out loud that by increasing the proportion of REM states in sleep, we could make sleep more efficient. Russian scientists even talked of reducing the daily need for sleep from seven to nine hours to somewhere between two and three. They were already counting up the years of productive time this would add to the average life-span.

From Russia also came reports that their physiologists had constructed a "sleep machine" able to induce sleep by applying electric pulses to the brain similar to those normally given off by the brain during sleep. Immediately, hope sprang up that such a sleep machine might be programmed to provide the right amount of REM for a person deficient in this type of sleep. Later on, when these methods were checked out at the Downstate Medical Center in Brooklyn, it was found that electro-sleep was really no proper sleep at all but a type of anesthesia.

The hitch is that so far nobody has found a way to induce REM artificially. Ordinary sleeping pills (barbiturates) won't do it. On the contrary, they reduce the proportion of REM during a night's sleep. So does alcohol. "These drugs do not really produce sleep," comments Dr. Frederick Snyder, a sleep researcher at the National Institute of Mental Health. "They produce a form of anesthesia—unconsciousness—which is biologically different from sleep. To some degree, they poison the central nervous system." So far, the only drug showing any promise of lengthening REM periods is LSD.

Not everyone agrees that more REM would be a good thing. Even if it were possible to increase the REM portion of sleep, warns Dr. Snyder, it would put added strain on heart and brain, which work furiously during the REM state.

Doctors have long known that many fatal heart attacks, strokes, or internal

(Please turn to page 216)

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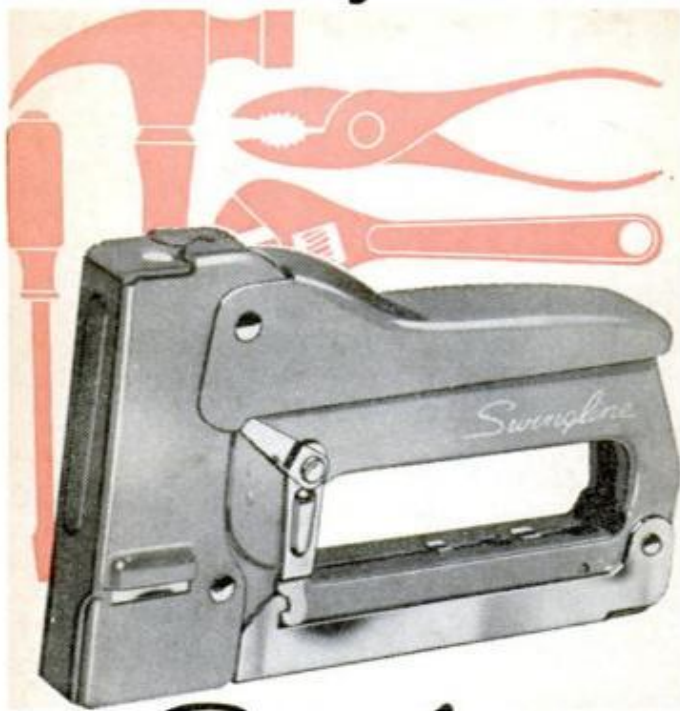
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EYE-OPENERS ABOUT SLEEP

(Continued from page 214)

hemorrhages occur in the small hours of the morning. Now they know why. This is the period of maximum REM activity and duration. In its fantastic dream life, the body blows itself up with inner overwork.

This new insight may bring about changes in the usual therapy for heart patients and treatment of strokes, ulcers, or vascular diseases. At present, such conditions are treated with plenty of "restful sleep." But since we now know that sleep isn't consistently restful for the circulatory system, new routines may be developed. In those ailments, deliberate REM suppression might prevent sudden death.

On the other hand, doctors would have to watch out for the rebound effect. If the dream-starved patient later on tries to make up his loss with extra REM, he might be even more likely to kill himself in his sleep.

To gain more knowledge, the study of human sleep is supplemented with animal experiments. Dogs, cats, goats, even possums exhibit lively REM activity on their EEGs and show all signs of dreaming.

The possum is particularly dreamy and spends as much time REM-ing as he does waking. This puts quite a dent into Freud's frustration theory of dreams. "What are emotional pressures of civilization on a possum?" asks a psychiatrist.

Animals have problems, too

The roots of dreaming evidently go much deeper than Freud suspected. Mental illness may not be a human prerogative. Prof. Michel Jouvet at the University of Lyons in France put cats on slanted stones surrounded by water. As long as the cats slept in the non-REM phase—as monitored on the EEG recorder—they had enough muscle tone to cling to the stone. When muscles relaxed at the onset of REM, the cats toppled into the water and woke up. After a few days of this, the cats began to show definite symptoms of emotional disturbance, including nervous over-reaction to all stimuli, gluttony and what Jouvet calls "indiscriminate hypersexuality." This indicates that REM does not depend on higher thinking behavior. The roots of REM seem to lie at a far more basic level.

To confirm this finding, Jouvet cut into the brainstem of a cat. He discovered that its lower region sends out electric pulses that apparently cause the REM state. With tiny electrodes placed directly into the cat's brain, he mapped the pathway of these pulses and observed that the signals travel mostly along the visual nerve tracts.

Very likely, this accounts for the images one "sees" in dreams.

Stimulation from the same source may also act on the autonomic nervous system which governs the heart, blood vessels, glands, stomach and so on. This would explain the involuntary and unconscious upheaval of those organs in REM sleep.

Recently, two Italian researchers, Moruzzi and Pompeiano, were able to show how this mechanism relaxes the skeletal muscles while at the same time exciting the inner organs. They discovered that the signals from the hind brain turn on a gland within the skull. The hormone oozing out—known as REM-juice among researchers—keeps the stimulation pulses from reaching the motor nerves that control the skeletal muscles which move our limbs. That's why these muscles go completely limp and the body does not outwardly participate in its dreams.

Acting out dreams

The two researchers then removed the REM-juice gland in one of their cats. Immediately, the separation between outward and inward activity broke down. With control over its muscles, the cat acted out its wild dreams. As one observer reported: "The animal (in its sleep) performs bodily movements of rage, fear and pursuit . . . so fierce as to make the experimenter recoil." Without REM-juice, one might say the dream comes true.

Doctors have long known that a connection exists between mental illness, dreams and sleep disturbances. Insomnia, excessive sleeping, sleepwalking and other sleep abnormalities are often the first signs of emotional disorders. By exploring the different phases of sleep—particularly the REM condition—psychiatrists may gain a better understanding of the apparent link between sleep and mental disorders.

At 7:00 a.m. the buzzer went off again. "Sleep well?" Pessah asked sardonically.

After unplugging myself—dangling my wires like a nightcap—I staggered into the lab in my pajamas. "You sure messed up a lot of paper," growled Pessah, showing me my sleep score: nearly 2000 feet of recording strip with 16 traces side by side.

"Those wild jiggles are your REMs," he said. Adding them up, I found that I had spent a total of 80 minutes that night in wild agitation. Just what I was doing I'll never know.

So far, sleep research has produced more questions than answers. But that is necessarily true in any new field of science. The important thing is that we have at last begun to penetrate into a hidden region of our mental and physical being—into the dark third of life. ★★★

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JOHNCOCK TESTS JAVELIN

(Continued from page 130)

much sweat. Actually, the car had more left, but the track has only one short straight, the rest of it being pretty much one long bend to the left. On standing start acceleration runs, I averaged 0 to 60 in a little over nine seconds. The bigger engine will boost these times considerably, I'm sure.

Now let's talk about styling.

In profile, the Javelin presents a neat, trim version of the long-hood, short-deck theme characteristic of most car design these days. I like the car's sweeping back and uncluttered hind quarters, a nice combination, I think, of both the fastback and notchback ideas.

Up front, the hood slopes forward from just below a highly raked windshield to a simple and quite functional "air scoop" grille.

From any angle, in my opinion, AMC has done a nice job on the Javelin's exterior.

For example, one feature that I really like are the recessed door handles. They open easily, are out of the way, and look like they "belong," as opposed to looking tacked-on.

Roomy for its type

Inside, things are just as handsome. I particularly liked the overall roominess, something you wouldn't normally expect to get much of in a car of this type. The seats are comfortable, especially with the headrests, and I like the idea of using a woven plastic fabric in the seat backs and bottoms (a real boon on a hot day). Visibility all-round is fine.

I also like AMC's new inside door lock idea. The locks are recessed in the armrests, eliminating door buttons and the need to twist around to unlock a door. Also, it keeps things out of the reach of youngsters.

I liked the design of the steering wheel. It's deep-dished and racy-looking and its three spokes are situated just the way I like 'em, giving me what I feel is maximum steering control. I found the foot controls easy to reach and I thought the clutch and brake pedals had just the right amount of tension. The accelerator pedal isn't too light to the touch, yet you don't have to stomp on it, either. I found it easy to get the feel of.

Headroom is good over both front and rear seats. And there's a pretty fair amount of legroom for the rear passengers, too. Again, this is something you don't expect to find in a car of this type.

(Please turn to page 220)



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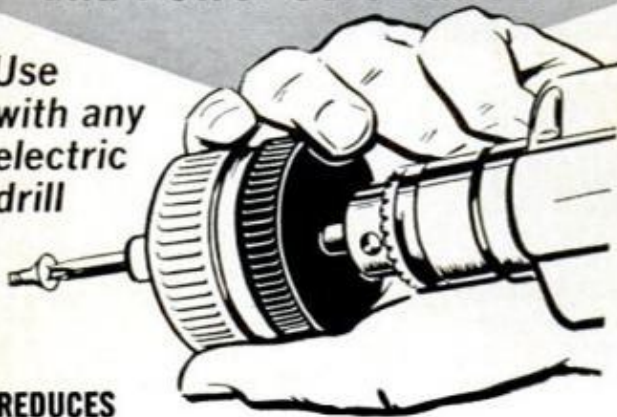
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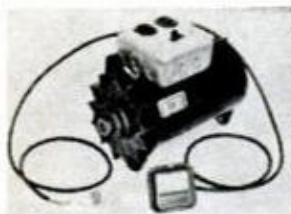
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JOHNCOCK TESTS JAVELIN

(Continued from page 218)

If I've got any quibble with the interior, it's the dash. The instruments are deeply recessed in a thick plastic molding overlaid with heavy padding. They're easy to read and the recessed idea cuts down on potential glare off the windshield. But the layout is dull! This may sound funny, but for some reason I found it monotonous. Anyway, I'd like to see the Javelin's dash made more interesting.

One final note: During the high-speed runs I had all the windows closed, depending on the front grille air intakes for ventilation. They work, but I sure wanted to crank down a window. At least I wanted to open a vent. The Javelin has no vents, and while this might look swell from a styling point of view, it can be rough on a driver and his passengers. AMC says its fresh-air ventilation system, standard on all Javelins, is of the "flow-through" type. It needs improving.

In all, I think I gave the Javelin about as thorough a workout as possible. I guess the best summary of how I feel about it is that I wanted to take it home. It's a neat little car. ★★★

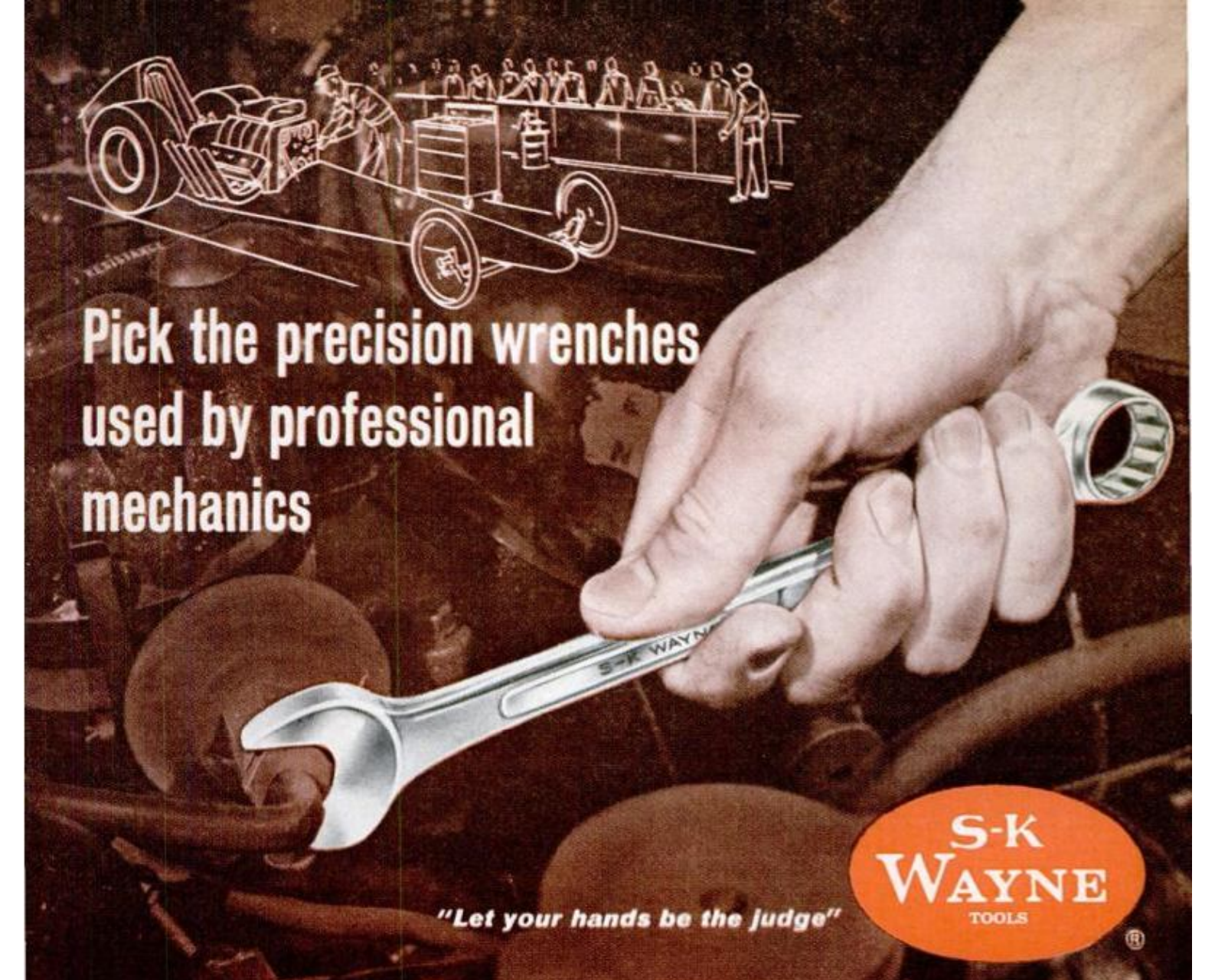
COLOR FOR \$200?

(Continued from page 127)

than just color TV. In addition to a big-screen chassis, the multi-media centers feature AM/FM and FM stereo radios, record changers and stereo amplifiers. All the electronics is mortised-and-tenoned into furniture that ranges from the basic and functional in design and construction to fine craftsmanship in rich woods.

Models in every conceivable style with price tags for some very inconceivable budgets have expanded this year's selection. Way out in design and price is a 21st Century design: Andrea's new Theatre in the Round—a \$2000 eye-catcher.

Color doesn't come much higher than that, but it does price a lot lower, putting it in line with more and more budgets. The accompanying buyer's guide chart should give you an indication of a color set in line with yours. The screen sizes offered by each manufacturer are given in both the viewable diagonal measurement and the total square-inch area since the current trend is toward specifying screen size in area. The fine-tuning aids are indicated for the screen sizes in which they are available. They are not necessarily included on the most inexpensive sets of a particular size. ★★★



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SUNKEN TIME BOMBS

(Continued from page 100)

through the sunny haze. This is the big whistler buoy that separates the busy eastbound and westbound shipping lanes running from New York.

By its black and white fins, I recognize it as the buoy we'd seen from the air—five miles northeast of the wreck.

Stu and Bob are awake as we begin the tough part of our search. Though we're nearing *Coimbra's* grave, we can easily miss her by a few feet. We start relying on loran—navigational signals aimed from shore.

It's 11:30 a.m. I climb the swaying fish tower and secure myself in the crow's nest—30 feet above the deck. We should be near the wreck now. But I see no oil, no trace.

Our sonar's on. It shows the depth holding steady at 180 feet. The *Coimbra* should be here.

But there's no sign.

At 11:44 I scan to starboard. Off our bow, I see a "calm," a flat spot on the sea. It lies in a great half-moon curve, heading northwest, then swinging southwest toward Jersey.

Shimmers like flame

Then in the sun, we see a strange tint on the water. It shimmers just like the blue flame of propane gas. Stu shouts: "Look at that oil." Stu has dived on *Coimbra* before, but has never seen this big a slick.

We drop a buoy, stop our engines, and drop anchor.

Dressed in black wet suits and carrying cameras, Stu and Bob tumble over the side with a huge splash.

"If we don't surface in 30 minutes," Stu says, "call Air-Sea Rescue for the decompression chamber at New London."

Then he's gone. The time is 1:17 p.m. Because of the depth, they'll have 10 minutes on the bottom.

Sonar shows we're directly over the wreck. A great shape—40 feet tall—lies on the ocean floor 180 feet below.

I check my watch. It's 1:45 p.m. They've been down 28 minutes. Two minutes to go. I find myself pacing anxiously.

Then, without warning, they break the surface. Bob waves. Stu is groggy from narcosis—nitrogen in the blood resulting from deep dives. But he calls: "We found her. She must be 400 feet long and is badly twisted. Her stern lies on its port side; her bow is completely upside down. When she was hit amidships she split in half. Looks like six of her main cargo tanks were split wide open, too."

Then as Stu climbs aboard he gives us bad news: In the dark murky Atlantic it was impossible to see—or photograph—an escaping stream of oil.

And yet the oil is there! That much we know. From the plane a week earlier Stu and I thought that crude oil was bubbling from *Coimbra*. But it's obvious now that the incredibly light blue film all around us is not crude. What type of oil was *Coimbra* carrying?

A week later, from the Naval History Archives in Washington, we find the answer. In the official report of the sinking: "*Coimbra* was British registry," it says, "Carrying lube oil . . ."

This helps explain, too, why Stu and Bob saw no gummy stream. Small drops of lube oil are all but invisible underwater. Unlike crude oil, which thickens like tar at 40 degrees (the bottom temperature), lube oil stays thin enough to escape through pinholes.

Steel is probably pinholed

And from steel experts we learn that this may be exactly what's happening. Like other wrecks, *Coimbra's* steel is probably being pinholed by corrosion.

Slow leakage through pinholes can empty one of a tanker's many cargo tanks. The ocean can generally destroy small oil leaks like the *Coimbra* slick. But even so, these leaks can change the whole weight distribution of a sunken tanker, according to Paul D. Field, a retired Bethlehem Steel corrosion expert. As buoyant oil or air escapes from leaking tanks, it's replaced by heavier saltwater. This weight change could create a bending movement sufficient to fracture other tanks, suddenly releasing thousands of gallons of trapped oil.

Though steel tanks deteriorate slowly, .005 of an inch a year, pitting occurs at a rate three to five times faster—.015 to .025 of an inch.

We had been disappointed in *Coimbra*. We'd seen oil but couldn't find the leak. But now we know she's typical.

Engineering plans, sent us by Lloyds of London, show *Coimbra* with 16 main cargo tanks—each able to hold 150,000 gallons of light lube oil. Although she was torpedoed, all her tanks weren't ruptured. And, it's the same story with the other wrecks.

So each blossoming blob of oil marks time until a full tank bursts open, belching a huge oil slick.

Only 2500 gallons of oil are needed to pollute the ocean surface for four square miles. This is little compared to the capacity of just one cargo tank.

But what will happen when hundreds of tanks in other sunken ships let go? ★★

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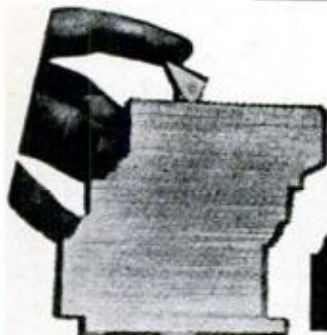
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WINTERIZING A STERN DRIVE

(Continued from page 167)

new gaskets. Torque to the manufacturer's requirements, which are usually 20 to 25 ft. lb.

Take out the battery, clean and re-charge it. But don't put it back into the boat. Store it in a relatively warm area for the winter, such as in the basement. Get it up off the floor, though. And don't overlook cleaning and lubricating battery supports, containers and cables.

Remove the oil filler cap. Clean it in kerosene and re-oil.

Overhead-valve engine

If you have an overhead-valve engine, remove the valve rocker-arm cover and wipe out the inside. Now, give the valve mechanism a liberal coating with crankcase oil or storage seal. Do the same to the insides of the covers, then reinstall the covers, using new gaskets so you'll get a proper seal.

Finally, clean the outside of the engine and spray it with rust and corrosion preventive, or wipe it down with a lightly oiled cloth. You can cover the engine if you wish, but keep the cover loose to allow air to circulate around it. This prevents condensation.

Phase 2: lower unit

Now for phase 2: winterizing the lower unit.

Remove the flushing plug and allow all water to drain. This is important, since trapped water can freeze and expand, cracking the gear housing and water-pump housing. Make sure water-drain holes in the gear housing are open.

Check and refill the upper gear chamber and lower gear housing with the gear lube recommended by the manufacturer. You'll have to refer to the unit's lubrication chart. You'll also need the chart for lubricating steering parts, the gimbal housing's upper and lower pivot pins, and the tilt pins on the sides of the gimbal ring.

Remove the propeller, apply a multi-the prop shaft and reinstall the prop on its shaft.

purpose grease or waterproof lubricant to

Finally, wipe the exterior of the unit and spray it with a rust preventive. Also spray the underside of the unit in the area around the reverse locks.

There is one other point that needs stressing. If your engine was last run in salt water, before you even start the winterization procedure you should flush the cooling system with fresh water, allowing this to circulate for at least five minutes.

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BAJA AND BACK

(Continued from page 120)

ploy—I didn't take much splashing mud.

If ever an engine had an excuse to overheat, mine did when I left the muddy road bordering the *Bahia* and started pulling the steep hills just before Comondu. The front of the cylinders and the exhaust pipes were covered with a good two inches of baked mud which I should have broken away. But even with all this insulation the engine kept its cool. And the chrome didn't even turn blue on the pipes!

In 16 falls (by actual count) of one kind or another, I didn't suffer any broken control levers and only the gearshift lever bent. It bent every time the bike went down on its left side. This lever is made of soft but tough aluminum and when it bent I simply straightened it out.

The center stand on this bike has a projection on the left side, ostensibly to make it easier to bring the stand down. But any time the bike goes down hard on the left side, this projection bends the left leg of the center stand in toward the wheel; which fouls the chain when in the up position. A few sharp thwacks with a rock—Mexico's universal tool—was all it took to restore it to its original configuration. Anyone riding a CL-160 with this center stand might give serious thought to a little hack-saw manicing of this appendage.

The CL-160 has a high exhaust system terminating in a very efficient muffler. A lot of people like a loud exhaust system, but I'm definitely not one of them. I much prefer the burbling notes of the CL-160's exhaust. It has the sweet sound of a severely overrevved BMW!

Blessed the exhaust shield

Happily the exhaust system is also well-shielded—a feature I had cause to bless when I spent five minutes or so lying in the middle of a sandy road with the bike pinning my left leg after hitting a buried rock at speed. Although only the shield and a pair of heavy jeans protected me from the exhaust pipe, I didn't even wind up with a slight reddening of the skin. And the engine had been running wide open when I "got" off!

The bike restarted at first kick—when I restarted after getting out from under and making sure I was still "working."

This, incidentally, is one of the most important attributes of a motorcycle. Some bikes don't like to start when they're hot, others when they're cold. Now and then you encounter one that dislikes commencing hot or cold. A pox on such.

The CL-160 always started with either

(Please turn to page 228)



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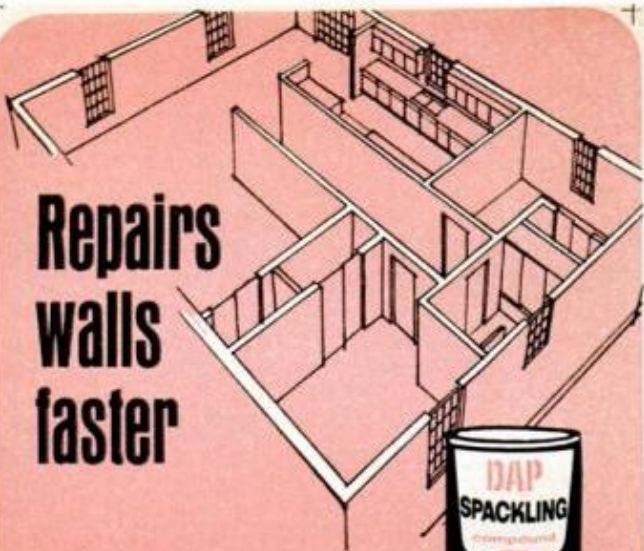
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BAJA AND BACK

(Continued from page 226)

the first or second kick—usually the first. Even when it had been on its side for 10 minutes or so, or out all night in wet or freezing weather, the story was the same. Fired right off.

The handling was fine on or off the pavement. Although a friction steering damper is provided on this motorcycle, I never used it—and never felt the need. My only criticism is probably unjust. I'd like some more steering lock, but let's face it, the CL-160 is not sold as a trials iron.

Another thing I like was the way the adjustments "held." No need here to be fiddling constantly with the machinery. On the whole trip the only adjustment that was necessary was the rear chain.

Unusual gas 'pumps'

As long as I kept the rpm above 3000, the bike ran perfectly on "Mexican regular," siphoned out of drums and measured with everything from buckets to plastic detergent bottles. It is a supreme recommendation for the filter system that neither carb required cleaning.

Mechanically, the trip was what I would consider trouble-free as far as Baja runs go. I caught a rock in the chain and broke the master link at just the right place to dump both machine and yours truly into a mass of *donnikers*—smooth rocks of varying sizes that line the road and actually form an eerie roadbed that gives you the impression of being on another planet. In the same mishap, the luggage carrier that was bolted to the seat mounts and the rear fender twisted the rear fender, actually tearing the metal. This necessitated an on-the-spot amputation of the rack and fender. Another mechanical mishap occurred when I carelessly allowed a sweater to fall into the rear wheel, again breaking a master link. Otherwise, I wore out a throttle cable with hours of full-on, full-off throttle twisting and went through two sparkplugs.

After finishing the Baja round trip the weather looked so good that I decided to ride the bike back to San Francisco. The good weather didn't last, but I still pushed on, through driving rain, sandstorms and full-fledged blizzards in the Cajon and Tehachapi Passes. I faced the wind every inch of the way and rode with wide-open throttle, but the engine never faltered.

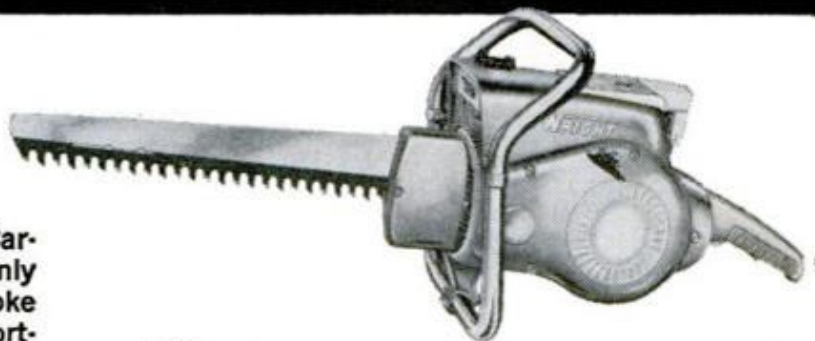
I might be bragging, but I'd say that a test like this is easily the equivalent of five years of normal use by the average noncompetitive rider. The CL-160 came through with flying colors—but I was drooping a bit!

★★★

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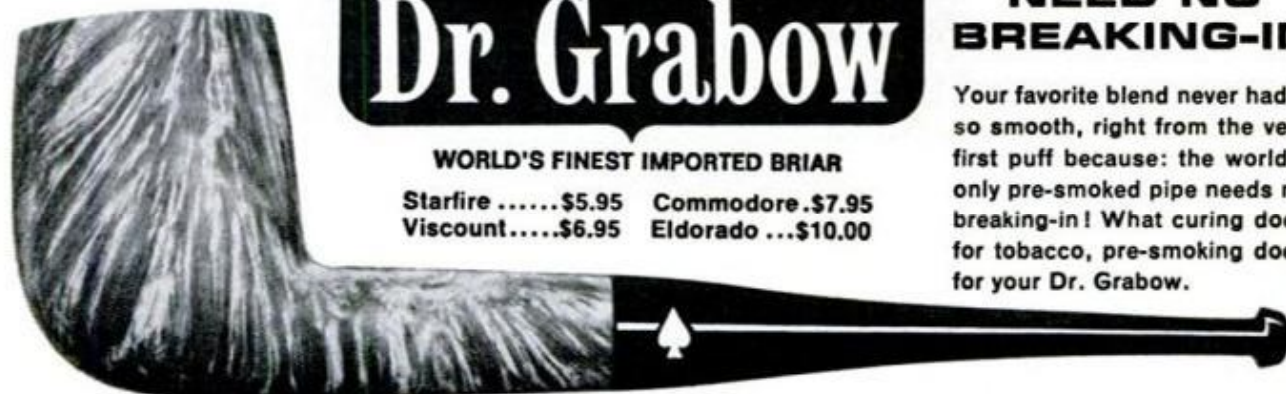
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'TIGER SHARKS' STRIKE

(Continued from page 134)

few inches of daylight below the skirts. The skirts allow the skimmer to clear obstacles five or six feet high, and they smooth out the ride over waves.

Steering is by means of twin rudders in the pusher prop's slipstream, aided by skirt-lifting rods in the hull. These serve somewhat like a plane's ailerons, enabling the craft to bank for tight turns.

The 40 officers and men of PACV Div. 107, under the command of Lt. Kenneth H. Luenser, took training at Bell's skimmer base in Buffalo on Lake Erie, and at the Navy's Fleet Amphibious Base at Coronado Beach, Calif., before going to Vietnam with their craft in May last year.

On Nov. 20, a Sunday, the three skimmers began "Operation Quai Vat"—named after the Vietnamese term for "monster." Grinning mouths, full of shark's teeth, had been painted on the bows of the ACVs.

The Pak-Vs set out each day for targets assigned on a map by a Special Forces intelligence officer.

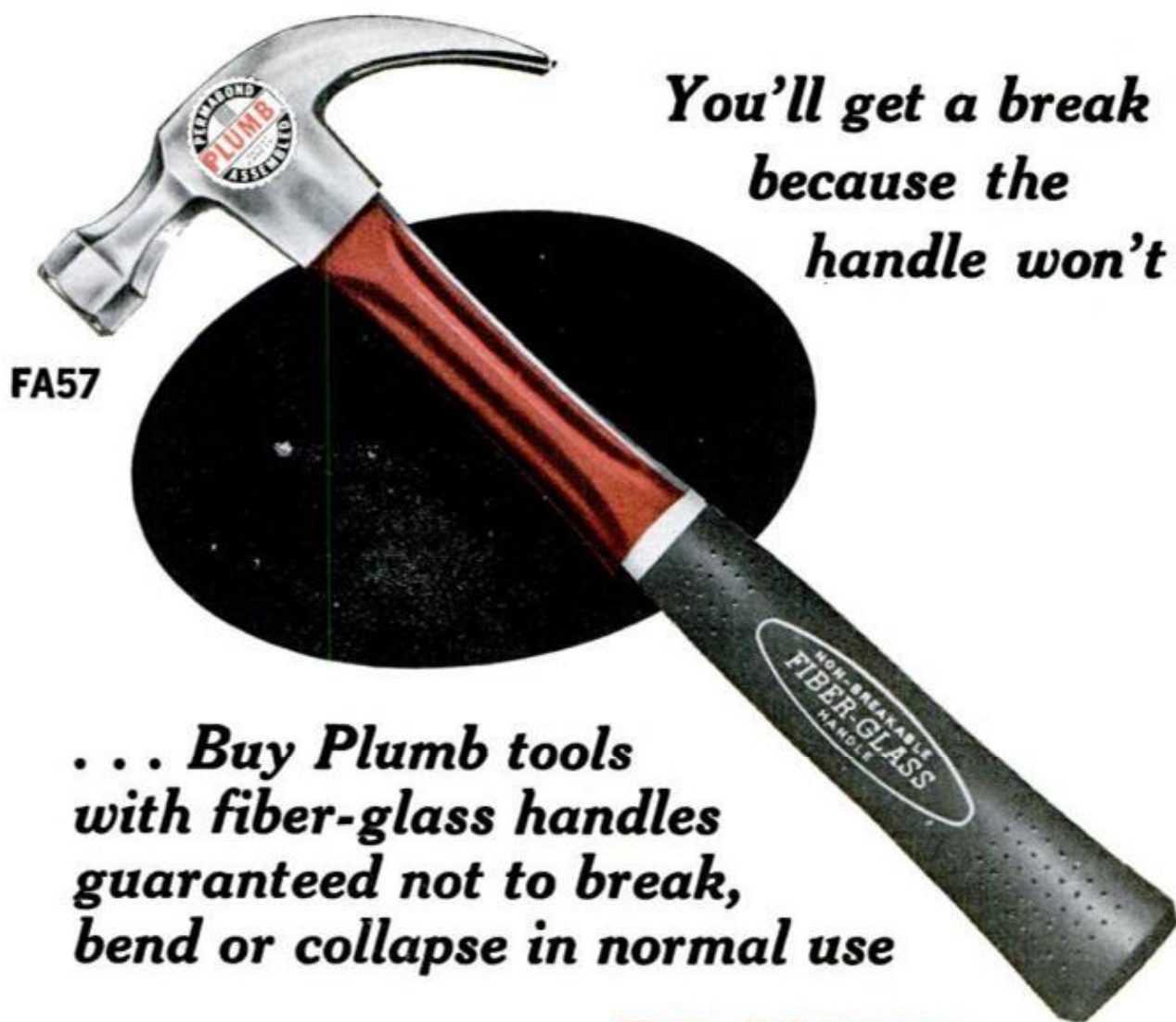
One or two officers and four men typically made up the crew of a Pak-V. There was space in the cabin for four more—"We tried to reserve that space for prisoners," said Vincent. Outriders were also carried on top of the plenum chamber—Special Forces and Vietnamese soldiers picked up at Moc Hoa or along the way.

The three Pak-Vs would work together as a fleet. Most of the time they also had helicopters working with them, scouting ahead and directing the skimmers toward suspicious areas. Sometimes the craft would be engulfed in vegetation taller than their 16-foot radar masts, and they would be dependent on the copters to track them in the elephant grass. They had to go around wooded areas, but the mud sailors discovered they could drive right through groves of saplings a couple of inches in diameter and 20 feet tall.

"It was swamp and I don't think those trees were really solidly rooted," says Vincent. "Our main concern, when we were going through trees, was to protect our eyes. There were branches flying all around, and the windows were open for the machine gunners. It got pretty wild sometimes, plowing through those trees at 45 knots."

The Pak-Vs were also used as battering rams to knock over the huts. The most dramatic action came in an attack on a fortified village on Nov. 22. The Pak-Vs were working as part of a combined force including swamp boats and the un-

(Please turn to page 232)



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New from Sprayit at the hardware show last month was this pressure-flow painting outfit that lets you change from roller to sprayer in seconds. Roller frame screws out, spray head screws in. Fingertip control regulates flow of paint to roller or spray, which feeds direct from gallon can that clamps in place. Comes with 15-ft. paint-supply hose, 42-in. extension handle,

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Frozen heart valves taken from cadavers and calves may replace plastic valves in open heart surgery.

Dr. John W. Kirkland of the University of Alabama Medical Center has successfully transplanted frozen valves to 50 patients. He reported recently that frozen heart valves from humans and calves are now available to specialists.

The advantage of the frozen valves over plastic ones is that they virtually eliminate problems of blood clotting which occur after heart surgery in 10 to 40 percent of cases. The human body does not launch an immunological attack against the frozen valves.

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'TIGER SHARKS' STRIKE

(Continued from page 230)

armed troop-carrying helicopters called "slicks." This is Lt. Luenser's report:

"We were making a sweep and we came into one area that had a lot of houses and bunkers in it. We put off the Vietnamese troops on board. They found a few rifles and hand grenades, but the area was very heavily booby-trapped. I called the troops back on board because I was afraid we were going to get someone hurt pretty seriously. We left the area and I called an air strike in on it.

"About that time one of the helos reported sighting a large concentration of sampans. We asked for a vector and proceeded to that area at high speed.

"As we proceeded, the slicks were bringing in ground troops and landing them. We caught some of the Vietcong running across an open field toward their village. The ground was wet, muddy, maybe ankle-deep in water. We did some shooting up of people right there in the field, but a few got to the village.

"The village was surrounded by sort of a wall and we were receiving some fire from it. So we turned and the Pak-Vs made two high-speed runs, shooting into the village with our twin-.50s.

"We fired approximately 2000 rounds per craft that day, the majority of it in this one engagement. We were getting fire back from a window in this fortification—my gunner estimated it to be .30-cal. machine-gun fire. He fired into the blast of the muzzle flash and silenced it.

Split it down the middle

"A Special Forces captain in the air boats, closer in, said our gunner apparently split this machine gun right down the middle. He told me that what caught his eye was the steel flying around and the man shooting it being upended."

During Operation Quai Vat, the Pak-Vs were officially credited with 23 Vietcons killed in action. They destroyed 71 Sampans, 71 land structures and a printing press used for Communist propaganda. A total of 194 bunkers were discovered and checked out. The Pak-Vs captured 11 Vietcong soldiers, a quantity of arms and ammunition, six outboard motors and 60 pounds of documents.

Amazingly, no one in the Pak-V unit was even injured during the entire period in Vietnam. This was probably due to the high speed and maneuverability of the cushioncraft, which made them elusive targets despite their size.

Of course the ACVs were hit by enemy

(Please turn to page 234)

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'TIGER SHARKS' STRIKE

(Continued from page 232)

fire many times, and plenty of holes in their plenum chambers and rubber skirts had to be patched. Although an air-cushion vehicle rides on compressed air, it's pretty hard to get a "flat." The powerful lift fan keeps pumping air into the cushion to make up for even major leaks. The Bell skimmers can still go with a five-foot hole in the plenum chamber.

The Plain of Reeds operation showed that emergency repairs could be made under combat conditions. Mike Vincent told of the time the steering controls on the craft he was commanding failed.

"We got hung up in some trees," he said. "I rigged a couple of ropes to the rudders. I wanted the turret gunner to do the steering, but he said, 'Hell, Mr. Vincent, I gotta operate the gun.' So I pulled on the ropes myself. The pilot told me when to give her right or left rudder.

"I still have the blisters on my hands—but we were able to go along at about 30 knots and get back to base."

What does the trial of the skimmers in Vietnam prove?

Hovering just off the ground—"flying" without really flying—air-cushion vehicles are in many ways somewhere between aircraft and land or water craft.

Able to carry fuel for up to eight hours of operation, an ACV can stay on station longer than a helicopter. Maintenance is considerably simpler than for an aircraft.

Like aircraft, the ACVs can travel at high speed over terrain impassable to land or water craft, as well as over dry land and water. They are limited to reasonably flat terrain, however, since the air cushion provides no traction.

PACVs could conceivably become the "tanks" of the war in Vietnam—floating fortresses—able to maneuver at high speed over terrain where no conventional armored vehicle can travel. Unaware of the capabilities of the cushioncraft, the Vietcong didn't know how to cope with them. Whether they have learned from their setbacks remains to be seen.

The Navy's future plans for the Pak-Vs are still secret. The three craft of Div. 107 were brought back and were being refurbished and modified somewhat at Coronado Beach. It seems likely that they will have a future in Vietnam.

Another indication may be that Bell Aerosystems has tooled up at its Buffalo plant for production of 65 skimmers. The first 20—larger and with more armament—were scheduled to roll off the line in October, and the monsoon rains will be over again in Vietnam this month. ★★

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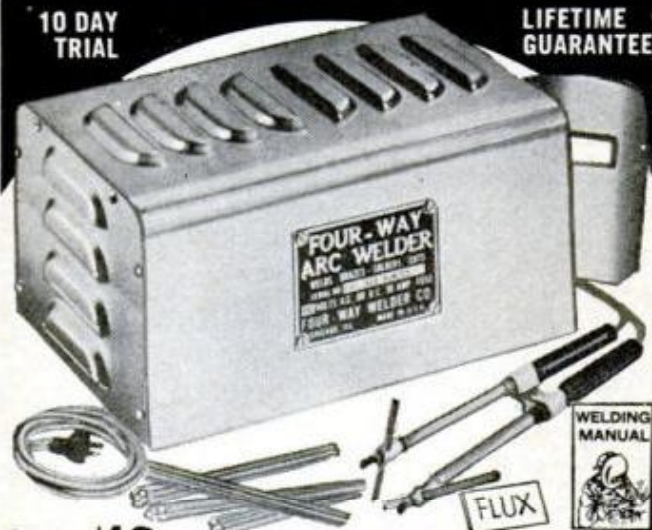
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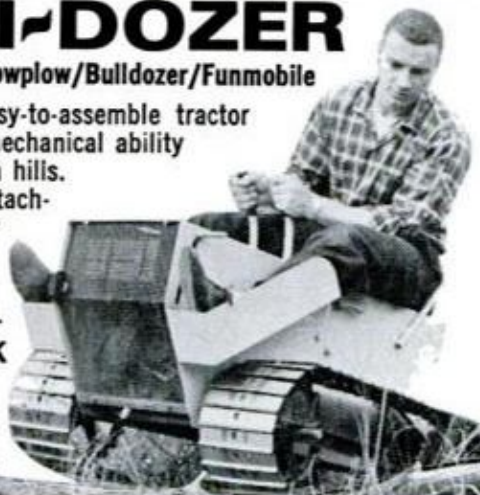
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Very soon you'll start seeing products bearing Popular Mechanics "Product Feature" Mark appearing on dealers shelves. This is a brand new service to our readers and will help you recognize the products that have appeared in the advertising pages of your magazine.

So, whenever you have to choose between products, mark our words.

**OUR WORDS MARK THE
PRODUCTS YOU WILL RECOGNIZE.
MARK THE PRODUCTS
THAT BEAR THIS MARK.**



SMOG-CONTROL DEVICES

(Continued from page 159)

in the air/fuel mixture by recycling a portion of the exhaust gases back into the intake manifold.

The system is shown in Fig. 7. Atlantic-Richfield states that NOR reduces nitric oxide emissions by better than 75 percent and has been completely successful.

Smog-control devices are going to be expensive in initial cost and in maintenance costs. Performance will be reduced, and you're likely to have some heating problems. The legislation of a nationwide "cure" for a Los Angeles affliction may seem drastic, but this could be the first step in ensuring that we don't smother ourselves.

E. A. Schuck, of the University of California air-pollution research center at Riverside, says we must actually stop the burning of all fossil fuels—gas, coal, oil and gasoline—within the next 25 years if civilization is to survive. He says that Earth is like a spaceship with a limited amount of oxygen, and that the burning of these fuels is gradually replacing the oxygen with carbon dioxide. If this is true, your new \$50 antismog device could be an important investment in the health of future generations—even if you do live in Madawaska, Me. ★ ★ ★

STARCRAFT'S SUPER SPORT-V

(Continued from page 162)

jerkiness, still smooth as country cream.

At speed, I had the impression of riding right on the surface, as though the bottom were perfectly flat and coated with Teflon. Yet it felt safe and stable throughout all the nimble-footed maneuvers.

As for noise, the SS-V seemed just about as quiet as most fiberglass boats of comparable size. Even in wake jumps—which it took quite softly—there was none of the resonant pounding normally associated with aluminum fishing boats.

The same lack of inertia that makes the boat so responsive also makes this a very weight-sensitive hull. Trim is drastically affected by load distribution, so you have to pay a little attention to locating passengers and gear properly. Not that it's unsafe if not trimmed exactly right but poor trim will cut into that fun handling.

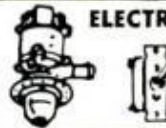
To sum it up, this is a well-built, good-looking utility sport boat that combines big-family cockpit space with the fun-to-drive feel of a high-speed runabout. If you've got lots of preconceptions about aluminum boats, this is just the model to shake you out of them. ★ ★ ★

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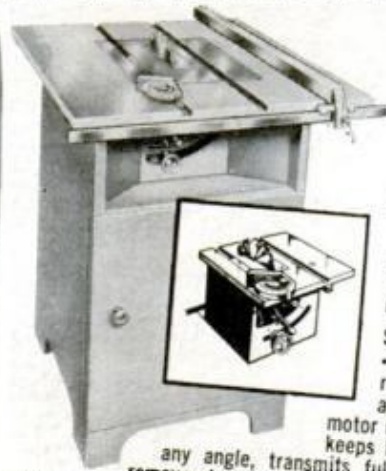
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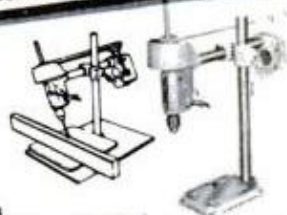
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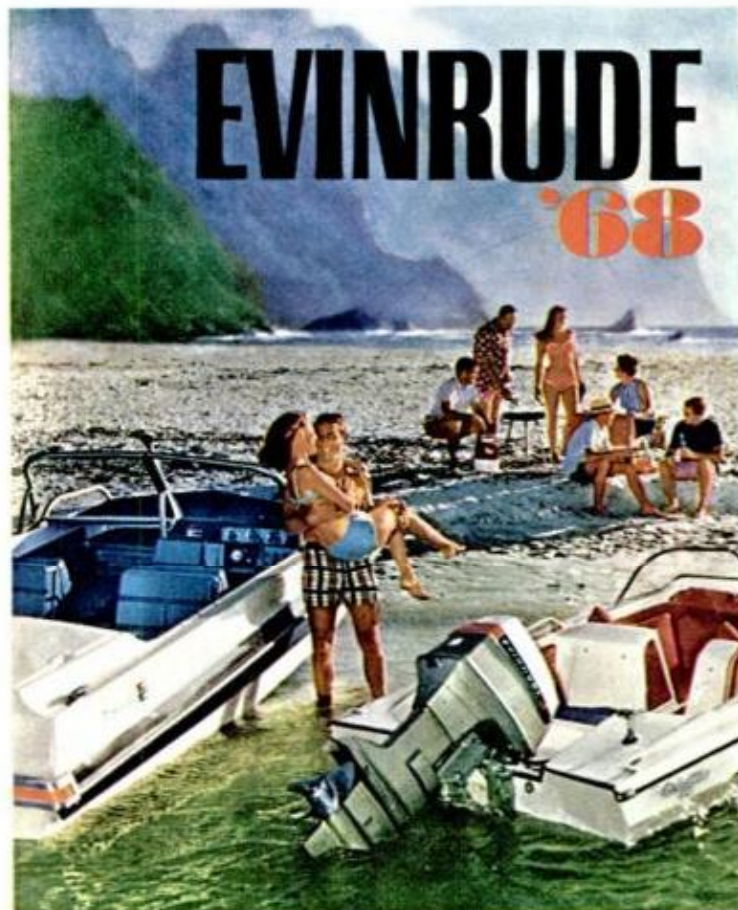
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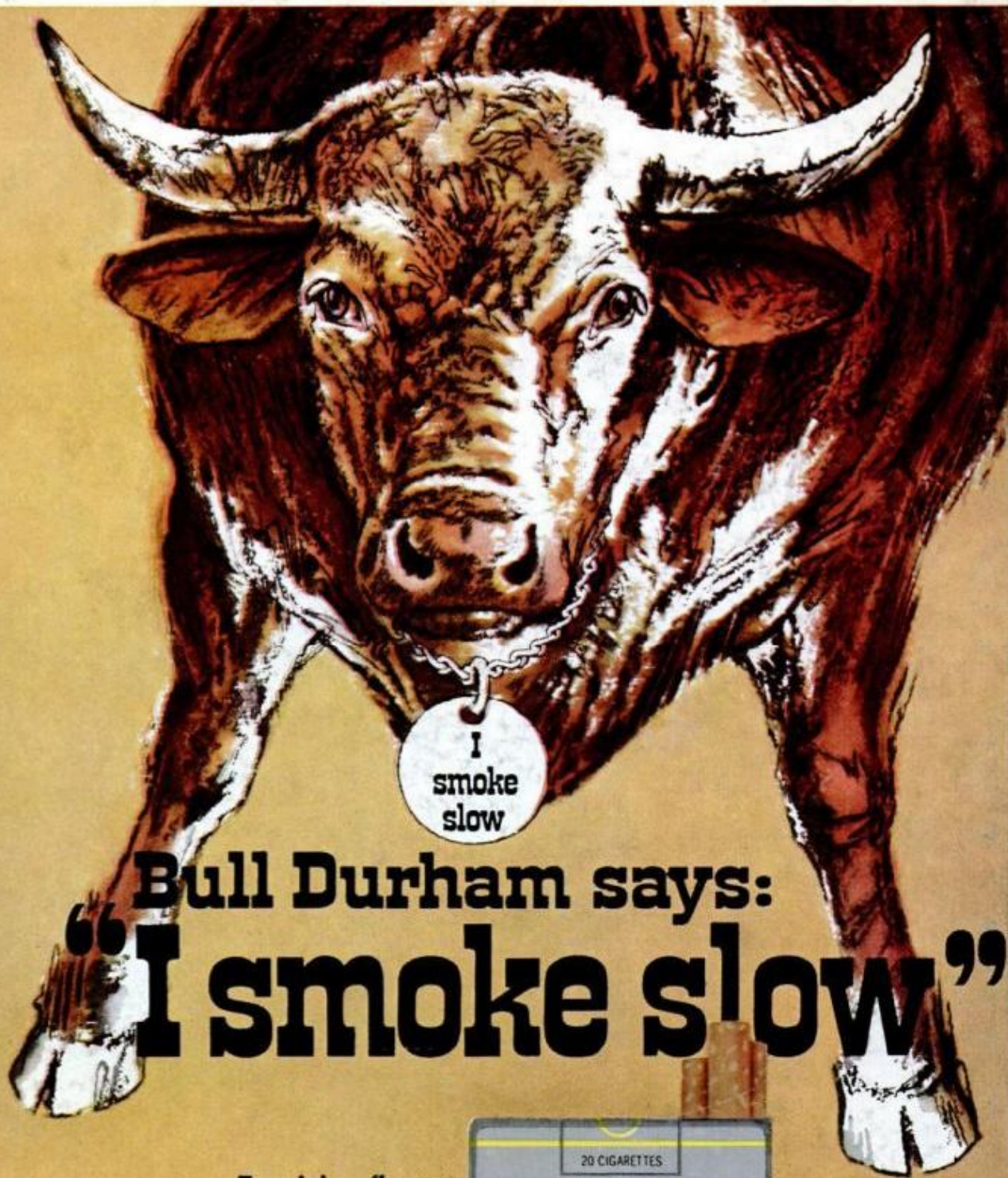
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