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POPULAR MECHANICS

MAR. 1968
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With the Turn of a Knob

**PUT A ROLL BAR
IN YOUR CAR!** Page 77

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How to Sell an Invention to Detroit

Driving Honda's New Little Car

Dan Gurney Tests the AMX

Saturday Mechanic:
Power Brakes

Drivin' With Dan

Auto Clinic

*THE
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First of the SSTs

Giant Color Cutaway
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THINGS TO MAKE

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Weekend Projects

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NEXT MONTH IN POPULAR MECHANICS

Are Cars Really Getting Better? Ten years of Union/Pure Oil Performance Trials indicate the U.S. car has changed—but not much, reports Bill Kilpatrick, auto editor.

The Train That Gives the Jets the Jitters. Ride up front with Editor Bob Crossley in the 132-mph New Tokaido Line luxury express between Tokyo and Osaka.

Owners Report on the Buick Special. They've driven their Buicks thousands of miles; listen in while the owners sound off.

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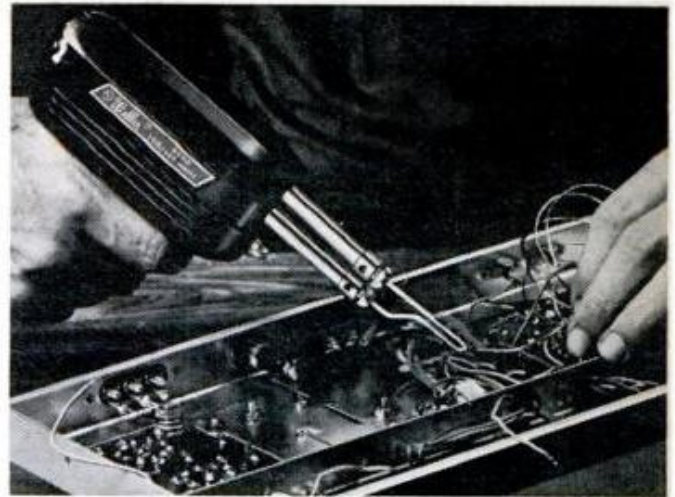
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MARCH 1968



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LETTERS

TO THE EDITOR

New auto insurance?

Daniel P. Moynihan is obviously a big government advocate (*Let's Have a New Auto Insurance Policy*, page 104, Jan. PM), and his arguments are weak.

The concepts of tort liability are obsolete only in the minds of collectivists who lump together all the problems of mankind into singular semantics. Mr. Moynihan's example of the 14th car ramming No. 13 because car No. 1 suddenly braked is absurd. Car No. 14 (the driver thereof), like all other cars in the line, is responsible in his operation to be prepared for any such emergency and is legally liable for the damage—and properly so.

Putting insurance into the hands of the Federal government as a cure assumes a degree of orderliness and honesty of the administration which is laughable in the light of our experience with other government administrations.

LANHAM, MD.

KARL E. BRANDT

The article forces me to defend today's

auto insurance policy on the grounds that it is doing, and well, the job that is required of it. It provides protection to my client for his legal liability arising out of the use of an automobile.

The fact that it does not, at the same time, protect adequately the accident victim, is a fault of the present system of determining liability, not the insurance policy. Change the legal yardstick by which my client will be measured and you'll automatically have new insurance policies. Pressure for change should be directed toward lawmakers, not insurance companies.

The proposed "innocent victim" idea is not new. A motorist can buy this protection now from any one of a hundred companies. It comes in two contracts: collision insurance and accident insurance. Both are great ideas; both insure the victim; and both have been around for years.

ERIE, PA.

MARSHALL G. LINDSAY

New angle on shutter test

I've tried for months to check my focal-plane shutter with the system shown in *Simple Test for Shutter Speed* (page 168, Sept. PM). Your test does not work.

Your diagram actually shows how to measure the time it takes the curtain to

(Please turn to page 8)



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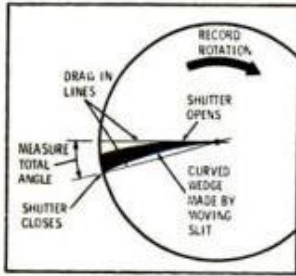
(Continued from page 6)

move across the film plane. What I really want to know is the time it takes the slit in the curtain to cross one point of the film plane (or to cross the edge of the phonograph record in the diagram).

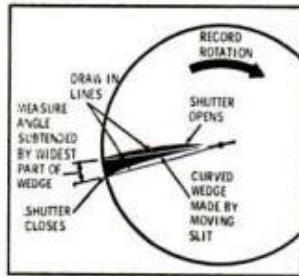
CHAPPAQUA, N.Y. RICHARD D. WOLFF

You're right. Our original drawing (left) should have looked like the one at right.

WRONG



RIGHT



It's still the way to go

When I took the National Drivers Test, I answered "true" to the statement, "In deep snow you should put weights in the trunk of your car," because that was one of the tips in *20 Ways to Go in Snow* (page 87, Jan. '67 PM). The NDT says this is very

dangerous because the front wheels are lifted and lose steering traction.

WESTPORT, CONN.

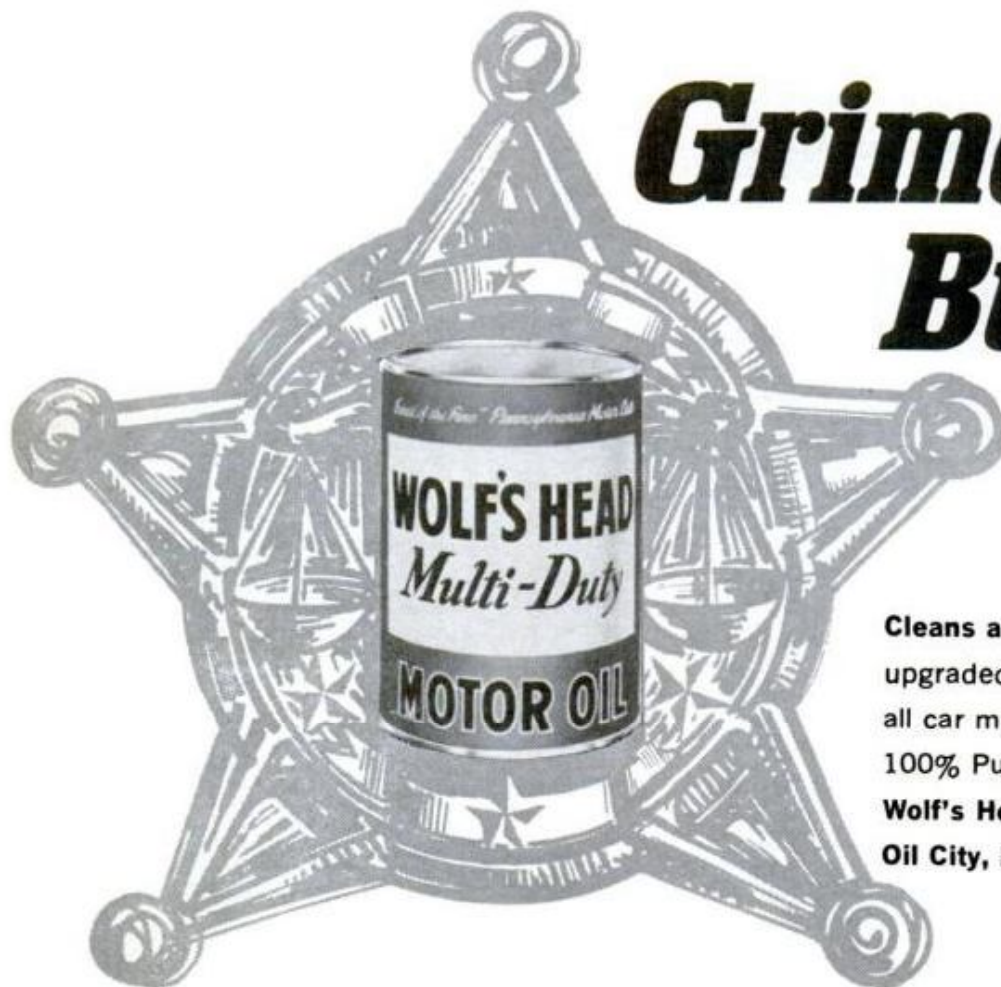
STEVE HERMENZE

Author Ed Fales responds: "The National Drivers Test represents some good opinions, but is by no means definitive. If the testers told you that you should not weight the back of your car in order to buck through heavy snow they are simply wrong. All snow driving is dangerous. But the fact is: It is far more dangerous to move through deep snow without weighting the rear. This causes most deep-snow spinouts.

"Of course, it would be absurd to weight a car aft, then rush out and drive 60 mph with a light front end. Deep-snow maneuvering is never done over 10 to 25 mph (otherwise it isn't deep snow!).

"No sensible snow driver puts all his weight behind the rear wheels, or even all of it in his trunk. As PM said, the idea is to weight the trunk and get some extra weight behind the axle—certainly not all—for blasting through unbroken snow.

"Repeated, careful tests have shown that a car without weight aft is highly dangerous because it spins, runs off the road, or stalls. With proper rear-weighting, cars have kept going in storms that had most traffic tied up." ★★★



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Tom McCahill

TOM McCAHILL

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Science Worldwide BY JOHN F. PEARSON

Drink tea for your arteries. Tests on rabbits by University of California researchers show that adding tea to the animals' diet substantially lowers the amount of fat deposited on artery walls. This fat—cholesterol—is associated with atherosclerosis, or hardening of the arteries. It has long been established that the Chinese, heavy tea drinkers, have much lower levels of cholesterol than do Europeans and Americans.

Deepest drill hole ever made is approaching its planned depth of 20,670 feet, according to a report in a Russian newspaper. Engineers in charge of the petroleum-seeking probe say the last few feet are proving tough. Drilling temperatures approach 400° F. Layers of quartz-porphyrite rock rapidly wear out both drill bits and pipe—and merely raising the drill from such depths to replace a bit takes 14 hours.

Heat given off by students in classrooms and by lights, electric motors and the cafeteria kitchen is used to keep dormitories at comfortable temperatures at the new Johnstown, Pa., campus of the University of Pittsburgh. During the day, excess heat is drawn into airconditioning units where it heats water in pipes. The water's temperature is raised through compression and the heat is transferred to a second water circuit that warms the dorms.

Ground-up newspapers and molasses make a nutritious cattle feed, according to dairy scientists at Pennsylvania State University. In a 56-day experiment, heifers fed on the unusual mixture gained weight and appeared as healthy as a "control" group that ate a standard feed supplement. The novel diet could help alleviate the expected food deficit in an increasingly populated world, say the Penn State researchers.

Gravity will be a plus factor at the 1968 Olympic Games in Mexico City, making it easier to set records than at the '64 Olympics in Tokyo. That's the opinion of Dr. Richard H. Rapp, associate professor of geodetic science at Ohio State, who explains that the pull of gravity is less at the equator than at the Earth's poles. He notes that Mexico City is at 19.405° latitude, while Tokyo is at 35.71°, much closer to the North Pole. "These figures mean that it will take less effort in Mexico City to set the same marks achieved in Tokyo," he contends. Perhaps this will offset the "thin" air of 7800-foot-high Mexico City, a factor some experts believe will adversely affect performance.

A 300-mph train suspended above the ground by magnetic forces is proposed by two scientists at Brookhaven National Laboratory, Upton, N. Y. The train would carry superconducting loops that would act on wire tracks to create a magnetic repulsion between train and track. The train could be driven by turboprop engines or magnetic propulsion. Small auxiliary wheels would support the train at station stops. Once the train started moving, the current flowing in the superconducting loops would induce a current in the wire tracks—and the resulting repulsion between the two would lift the train off the ground.

Earwax of American Indians offers new evidence that they originated in Asia. Researchers at the University of California examined the earwax of 483 American Indians. Those of pure blood invariably had dry earwax—typical of Mongols. (Cerumen, or earwax, is either sticky or dry—and a child inherits wax type just as he does eye color.) Indians who had some white blood tended to have wax of the sticky variety.

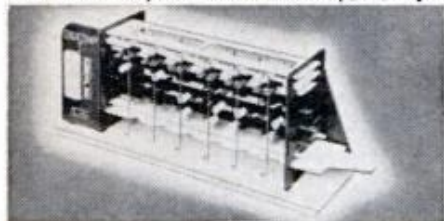
When our Apollo astronauts reach the moon, one of their tasks will involve a laser experiment to measure the distance between Earth and the moon. The distance is now known to within a few hundred yards. Laser beams bounced off the Earth from the moon should refine that measurement to within five feet. Instrumentation for the experiment is now being developed at an Air Force research lab. ★★★



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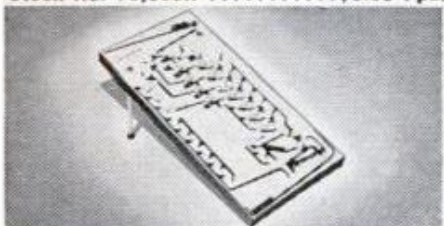
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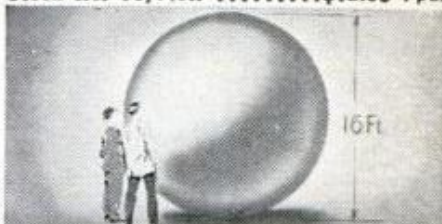
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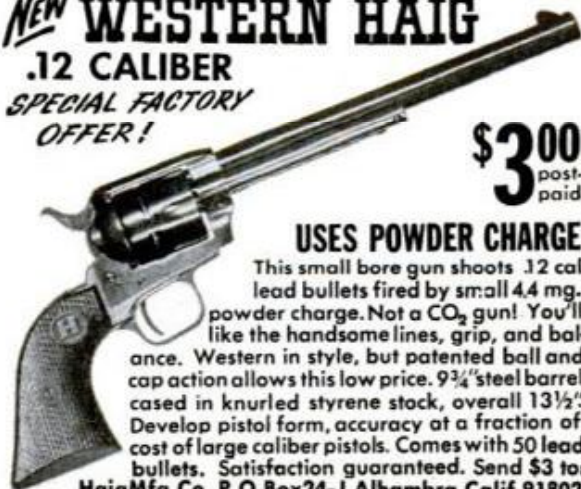
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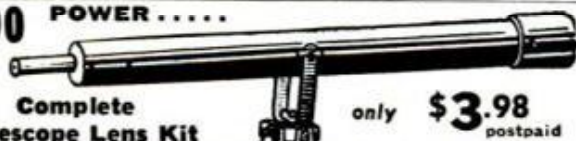
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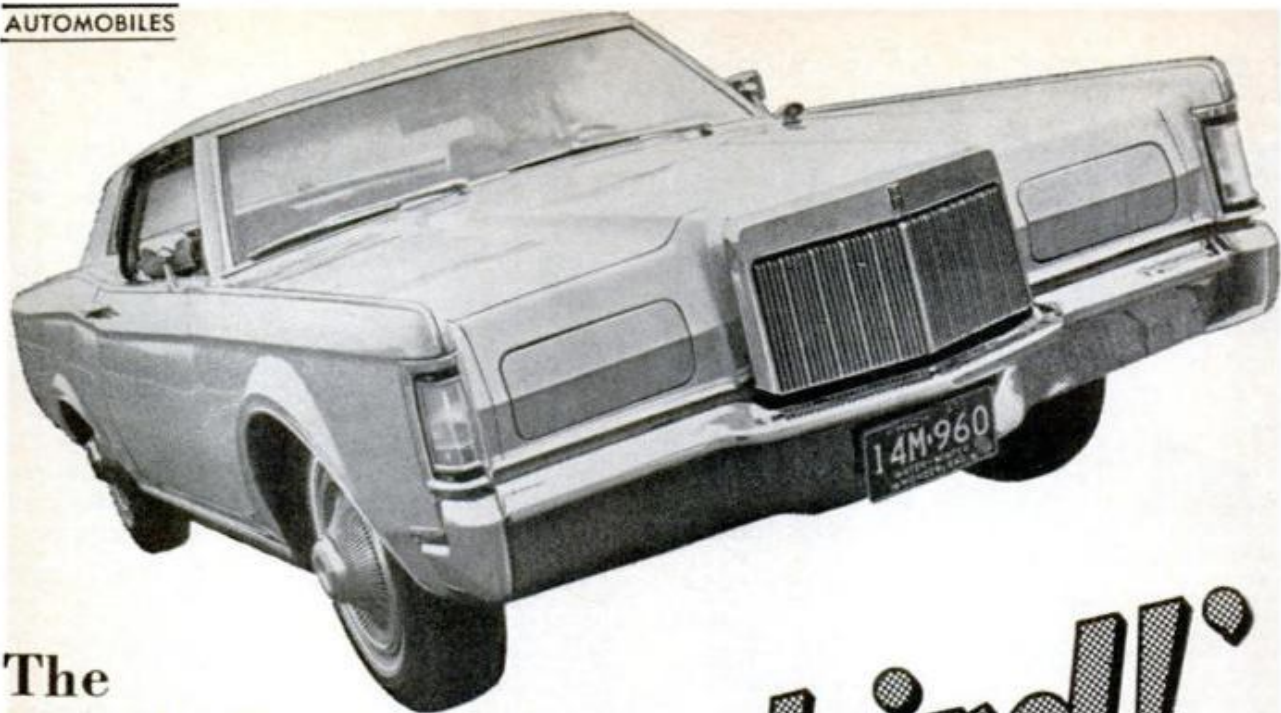
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The
Lincoln Continental
Mark III

'It's Superbird!'

A lot borrowed and not much new
sums up this newest U.S. prestige car

By **BILL KILPATRICK**, Auto Editor

Photos by Jeannie Weaver

THE ABSOLUTE END of innocence: If you have or get the idea the U.S. auto industry always puts its best technical and artistic foot forward when it introduces a new car, forget it. With woefully few exceptions, what Detroit does (and well, too) is design its products to plug competitive gaps in the marketplace. A car conceived and produced for its own sake is a rarity. Such a rarity, sad to say, is *not* the new Continental Mark III which has just been introduced by Ford's Lincoln-Mercury Division.

I may be dead wrong, but I doubt that the car in its present form would have been brought out had not Cadillac successfully marketed the high-ticket Eldorado (proving what I guess must be some terribly significant fact about the American psyche). Certainly the Ford corporate idea could not have been to let the troops do the very best they knew how—to make a really outstanding automobile. Other-

wise, the Mark III would have been so much better.

In the Mustang and its spin-off, the Cougar, FoMoCo proved that it could take bold steps and innovate with the best. It can and does build outstanding cars (the '68 Torino GT, to mention one). But in the Mark III, the day was carried by the resident cuff-shooters and blurb-writers, a breed I'm convinced lives at the "Y" and forms its tastes from the pages of *Playboy*.

What FoMoCo did, essentially, was take what I think of as being an already overdone car—the Thunderbird—and overdo it some more. The Mark III boils down to a fatter, heavier, even more plush T-bird.

There's a new 365-hp, 460-cu.-in. V8 engine that Ford says was designed with antipollution regulations in mind. There's a new miniaturized voltage regulator, some new beefing-up along the underbody, and a fuel tank mounted forward of

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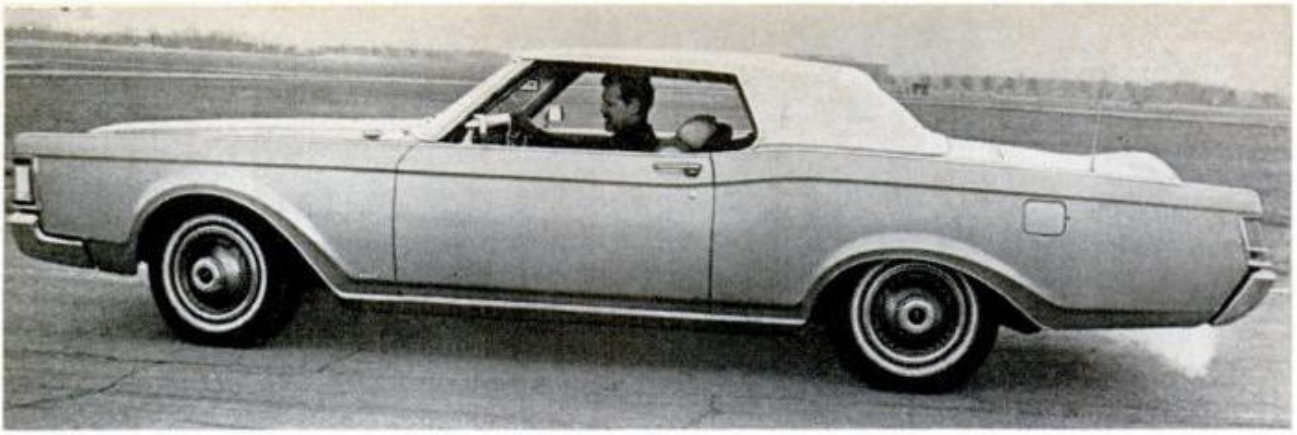
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MARK III WHEELBASE is 117 in., length 216, width 79, height 52.9, front/rear tread 62, weight 4738 lbs.

the luggage area. And that's about it; the rest of the car is stuff you've seen before.

Exterior styling features the Continental's traditional "simulated" (their word, not mine) spare-tire carrier (the spare itself is a mashie-shot forward of the "carrier") and what to me is an overwrought grille. Headlights are concealed, giving the car a nose-on appearance of a Far Eastern Little Orphan Annie, complete with her eyes—as Walt Kelly would say—"blonked out."

Something for all

Interior styling features a theme perhaps best described as being a cross between a jet cockpit, a stately home of England and Las Vegas *moderne*. There's something for everybody, particularly the button-happy. Power this and power that abound throughout.

The car is not one with which prudent drivers would want to be in nitty-gritty situations.

Steering is mushy in the center range and it requires brute force at either end of the rack. The power brakes haul down just fine, but the line you travel is in the lap of the gods; in three rather low-speed, semi-panic stops, I wobbled over far too much pavement.

The thing that makes me most nervous about the Mark III is that in the main it will be bought by older, secure, well-established types used to having their own way and, thus, people not apt to drive this barge with the skill and concentration it requires.

Available only as a two-door coupe, the Mark III will sell loaded for just a trifle under \$10,000. That's a lot for a super T-bird.

TRADITIONAL "simulated" spare-tire carrier is a styling feature of Mark III. Gimmick is pretty, but useless



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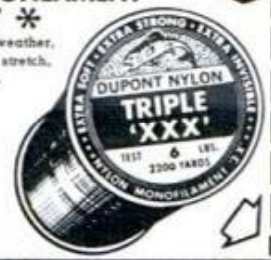
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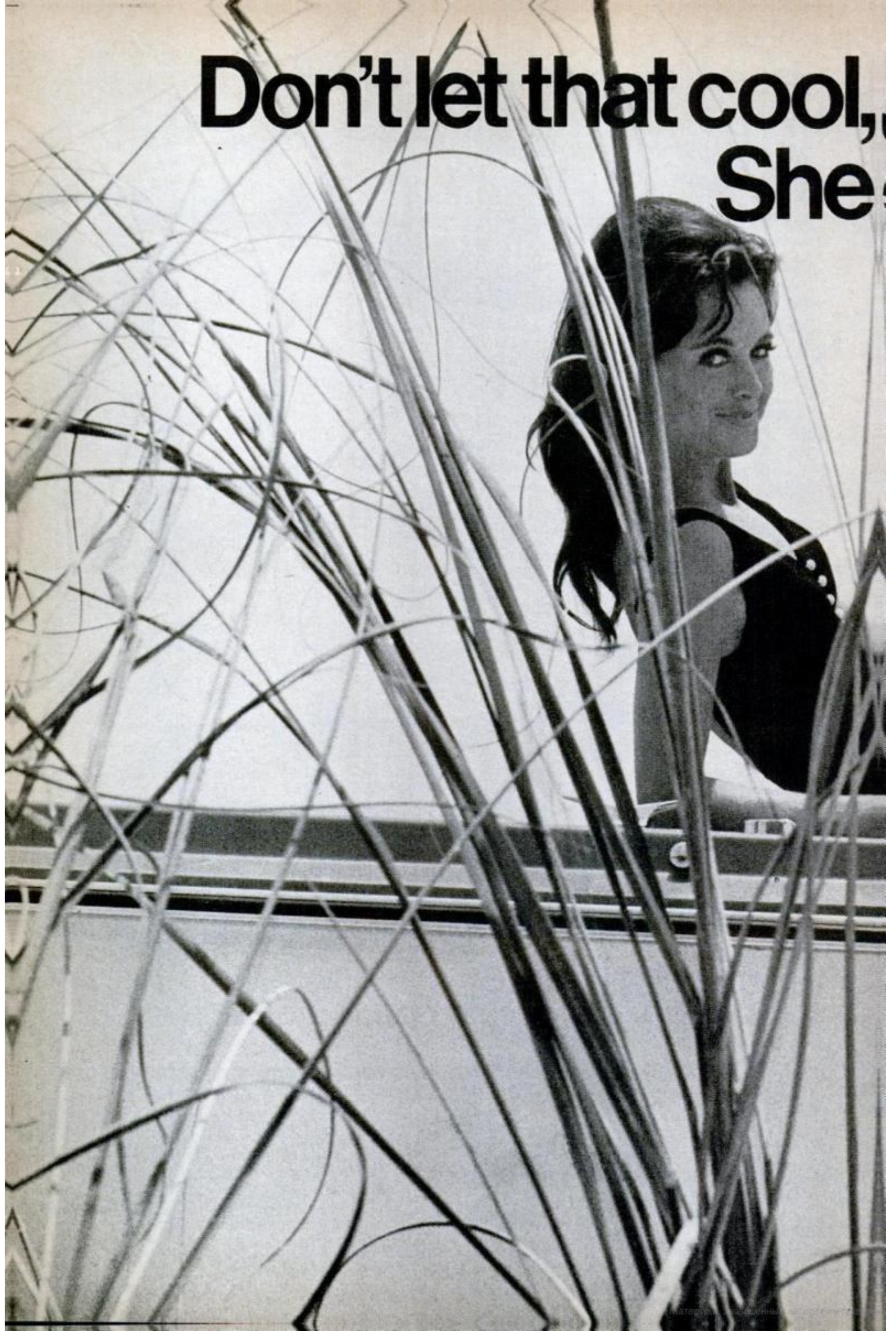
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DETROIT

LISTENING POST

BY BOB IRVIN

FORD OFFICIALS NOW DENY the company is working on a small car to compete with the Volkswagen. "If they aren't, they ought to be," says one competitor. Rumors persist that Detroit is still eyeing this market seriously, particularly since sales of small import cars have now passed the 700,000-a-year mark.

"COLD POWER" is the aim of an Indianapolis teen-ager who wants to drive a car with dry ice. Robert Deardorff, 18, calls his invention "an air engine." Dry ice is added to a pressure vessel containing water and, as the resulting carbon dioxide gas pressure builds up, it's fed into the cylinders to drive the engine. Government air-pollution experts should approve because the exhaust seems as clear and pure as clean ocean air.

INERTIA REELS—said to be the only practical means by which seat belts can be used—may be installed on American cars in another year or two. This is the prediction of Dr. William Haddon Jr., man in charge of the U.S. auto safety program. Inertia reels roll up belts when not in use, allow freedom of movement to people wearing belts, but lock the belts tight in case of sudden movement. They're common on many European cars.

SKEPTICISM greeted American Motors' bullish announcement about an electric car. But AMC officials insist they're serious and will have an experimental electric Rambler on the test track this year. The electric power package being developed by AMC's partner in the project, Gulton Industries, will be installed first in an American sedan, later in the auto firm's minicar, dubbed the Amitron. Competitors doubt AMC's claim the car could be in production in five years. A Chrysler vice-president says it could take that long—maybe even 10 years—just to develop a practical battery.

A PLASTIC BODY was once considered for the AMX, but American Motors decided against it for two reasons. First AMC found it would be more economical to build the AMX out of basic Javelin components rather than tool for a plastic body, and second, AMC, which builds only unitized cars, felt there were too many unknowns in combining this type of underbody with a plastic upper structure. Dan Gurney has just tested the car for *PM*. Read *The New AMX*, page 40.

A MINIMUM RUN of two to three years for its new Continental Mark III is being planned by Ford, although it obviously hopes the car will become a permanent fixture in the auto marketplace. At any rate, the car isn't being sold on a model-year basis and, thus, not even minor styling changes are planned for the next couple of years. Maybe the company figures that at those prices (close to \$9000) there shouldn't be any planned obsolescence. Incidentally, Ford figures the average Mark III buyer will be a 50-year-old man with a \$25,000 annual income. For a closer look at this luxury liner, see *It's Superbird!* by Bill Kilpatrick, *PM* auto editor, page 20.

WHAT'S THE DESIGN LIFE OF AN AUTOMOBILE? And does the new-car warranty cover it? Detroit's going to be asked for answers to these and other questions this year when Congress holds hearings on bills to establish federal controls over new-car guarantees. The bills and the hearings were prompted by thousands of complaints in recent years from irate car buyers. Top auto officials have already announced opposition to the bills, so the hearings could be stormy.

IMPORT SALES OF BRITISH CARS are expected to increase this year because there are now some good bargains, thanks to the devaluation of the British pound. "This

(Please turn to page 28)



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DETROIT LISTENING POST

(Continued from page 26)

will offset the cost of putting in the safety and antismog devices required on all cars," said a BMC official. Since the British pound is now worth less than before, British car prices here have gone down accordingly.

RETALIATORY MEASURES may be sought by Detroit against Japanese import cars. This is the word from some inside sources, who say U.S. automakers are miffed at the prospect of seeing more than 100,000 Toyota and Datsun cars being sold here, while only a few thousand American cars can be sold in Japan because of high tariffs.

A NEW 351-CU.-IN. V8 will be added to the Ford lineup in 1969. It will fit between the 302 and 428-inch V8s Ford brought out last year. The 390 will be carried over.

MERCURY WILL OFFER two wheelbases for 1969 models—121 and 124 inches, just like Pontiac's Catalina and Bonneville. Merc also will have a new convertible package next year.

TWO YEARS' NOTICE to meet new safety standards is being given automakers, a concession to the manufacturers' plea that they need 24 months or more to make major design changes. The first four standards for 1970 have already been proposed, and two of them might require some design changes, especially for foreign carmakers. One calls for glovebox doors to be designed so they won't pop open in accidents; the other prohibits pop-out windshields. Both were on a "shopping list" of 47 suggested standards the safety agency published late last year.

HELICOPTER LANDING PADS are being set up at several Detroit-area hospitals for what may be the nation's first private airborne ambulance service. "You will see these being set up all over the country in another year or so because it's the only way to quickly help many traffic-accident victims," says Walter Gutowski, president of Superior Ambulance Co. His firm has obtained the use of a helicopter which recently made its first "run" transferring a badly burned man to the University of Michigan Hospital in nearby Ann Arbor. Some police departments elsewhere already are using helicopters to transport accident victims and federal safety officials are trying to obtain the use of more than 1000 military choppers for the same purpose. ★★★

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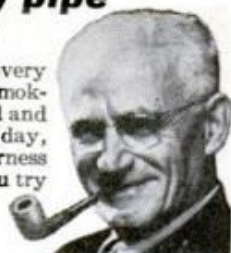
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This all grew out of research which showed that engineers could change electrical signals into flame vibrations which, in turn, could fill a room with controlled sounds, even music or speech.

AIRPORT NOISE, meanwhile, is also getting some attention.

In Los Angeles, homes near the huge Los Angeles International Airport are being soundproofed to find out how much of the noise, principally from the huge transcontinental and intercontinental jet airliners, can be kept out.

Precise measurements of noise levels before and after installation of the soundproofing materials are being made.

Some of the homes are already owned by the Los Angeles Dept. of Airports. They were purchased over a period of time in an effort to establish a "clean zone" along the line of the airport's major runways. Other private residences, however, will also be used. Some of the owners have volunteered the use of their homes for the tests.

There are no guidelines on how much soundproofing might be required, but the department hopes to gather enough data on which to establish such norms.

If successful, the tests might eliminate the need to soundproof the jets themselves.

JET BLASTS, another unwanted by-product of jet engines, may be minimized by a new, adjustable blast fence installed on parking ramps. The fence would move up behind the engines during warm-up, then move down flush with the ramp after the plane leaves to provide a smooth taxi surface. The blast would be funneled off via underground tunnels. ★★★

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What do you think of radial tires? Is braking with the left foot a good idea with an automatic transmission? Why does Lotus favor Jim Clark over Graham Hill? Dan Gurney answers these and other provocative questions



DAN AND FRIEND Ritchie Ginther (left) talk things over following a tire test at Indianapolis. Ginther, retired as a driver, continues his racing interests

Q. *I like Fords, but someone in my family sells Plymouths. Which do you think is a better racing car? Is Richard Petty's Plymouth a GTX model?—Jack Tallevast, Laurens, S.C.*

A. I'm a Ford man, too, but as to which is a better race car . . . well, that's what racing is all about. It's a constantly changing picture, and if you picked a winner one week, you might be wrong the next. My understanding is that Richard Petty's car last year was a GTX, but that this year his car is referred to as a "Road Runner" model.

Q. *Assuming a car has an automatic transmission, do you have any pro or con theories on left-foot braking? I've been left-foot braking since 1963 and I feel I have better control.—Fred Linchmann, Cincinnati.*

A. I'm in favor of left-foot braking with an automatic. At first it may seem awkward if, for a long time, you've been using the right foot only. But in a few months, the left foot will learn. Almost all USAC race drivers use

the left-foot system because, with your foot already at the pedal, reaction times are quicker.

Q. *I would like to know when you began racing, and why.—Glenn Trenowski, Lansing, Ill.*

A. Officially, Sept. 1955. I've always enjoyed racing something or other . . . you know, roller skates, bicycles, scooters, dodge-ems, go-karts, motorcycles, cars and so on. Why? I love it, that's why. To me, from many different angles, it's the greatest thing in the world.

Q. *I would like to learn how to design and build Formula 1 cars. Would it be possible to get my training with you?—Barry Goodwin, Kamloops, B.C.*

A. Boy, that's a tough one to answer. One thing I know for sure—we can't support a training program at this time. To start, I'd suggest at least a college education in the basic physics and engineering involved in automotive design and mechanics. Then, if you're still interested, you may be in a position to talk practice training with a professional racing organization.

Q. *Could you tell me if British Eagle fans living in the U.K. are eligible to join the Eagle Club? If so, is there already a club headquarters in Britain?—Roger Laycock, Coventry, United Kingdom.*

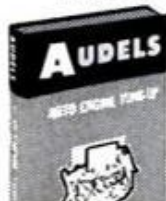
A. Certainly British fans are eligible to join the Eagle Club. There's no headquarters in the U.K. at the moment, but you can send your request to the Eagle Club, Box 2283, Santa Ana, Calif. 92707, U.S.A. We're happy to send application forms to fans anywhere in the world. We already have members in

(Please turn to page 38)

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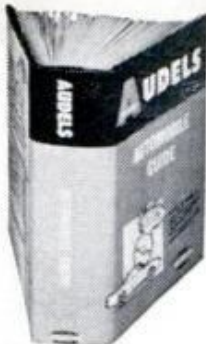
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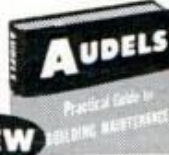
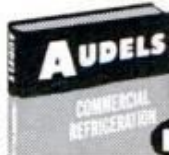
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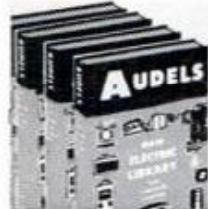
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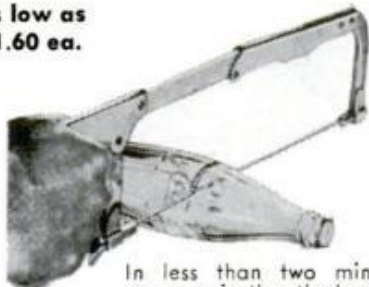
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DRIVIN' WITH DAN

(Continued from page 32)

such diverse locales as India, Africa and Japan.

Q. Where can I get information on dragsters?—Bob Jones, Valencia, Pa.

A. Your best bet is to write to the National Hot Rod Assn., 3418 West First St., Los Angeles, Calif.

Q. Are you acquainted with Formula Vee racing? What is your opinion of it?—Dan Grome, Cincinnati.

A. My acquaintance with Formula Vee racing is superficial, at best, but I like it. It seems to provide racing opportunities for talented and ingenious men forced to operate on limited budgets. This type of racing offers plenty of scope for development and experimentation.

Q. What do you think of the Javelin? Do you think American Motors can compete against the other manufacturers in drag and track racing?—David Morgan, Montezuma, Kans.

A. I recently drove the American Motors AMX (see page 42) and it seemed a darn good car. It offers lots of fun and plenty of response. The Javelin looks like it should merit respect, also. As for racing, the potential is there, but success depends a great deal upon how the various programs, if any, are carried out.

Q. Which do you consider a better high performance car, the Shelby GT-500 or the Dana Camaro?—Mike Mahalek, Milwaukee.

A. I haven't tried either one, but I suspect Chevy lovers will pick one, Ford enthusiasts the other. I doubt if anyone could settle on a solid answer for long. It wouldn't be nearly as much fun being, say, a Ford enthusiast if there weren't others who think just as much of competitive makes.

Q. I have found radial-ply tires superior in every way and under all conditions to conventional tires. Do you have any comment?—R. Mountford, Brisbane, Australia.

A. Although I certainly haven't tried all the tires now on the market, the best one I've encountered so far is a new one incorporat-

ing fiberglass cords and the radial design.

Q. How do you explain Colin Chapman, of Lotus, playing favorites by giving Jimmy Clark better cars than he gives Graham Hill? Also, please compare the absolute maximum speeds of the Formula 1 Ferrari, Eagle and Lotus.—Patrick Lafgreen, Akron.

A. Jimmy is No. 1, but it doesn't always work out that he has the best car. Sometimes the mechanics themselves don't know which car is best until they reach the racetrack. Usually, the No. 1 driver gets first attention. As for maximum speed, last year at Spa, Belgium, which was early in the season, the Ferrari did about 190 mph down the fastest straight, the Lotus 193, and the Eagle between 190-195. The cars change from race to race, but I think they could top 200 mph in all-out attempts.

Q. Is go-kart driving a good way to learn race-car driving?—David Wilmoth, Fresno, Calif.

A. Yes. I think so. Just about any form of motorized competition is worthwhile. You are bound to learn all sorts of important things that can be applied to race-car driving.

Q. Will Ford of England enter a car in Le Mans next year using its Cosworth V8? Why don't you enter one using your Gurney-Weslake V12?—Tommy Smith, Athens, Tex.

A. We think that they might. We have no plans to do so with our V12, but we have considered selling some to other outfits who might use them at Le Mans.

Q. What do you think of the new rule at Le Mans limiting prototype car engines to 183 cu. in.? Isn't this pretty puny? What will it do to the race?—Joe F. Scott, Wichita, Kans.

A. There's a lot of concern over the three-liter engine limit at Le Mans, but it's not so much that it is puny. It's more that it means starting all over again for those that have been relying on larger engines.

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 48).


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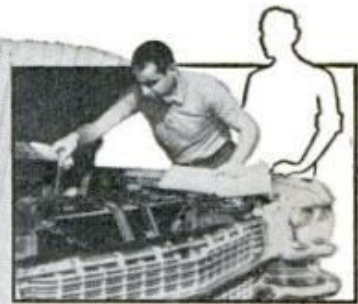
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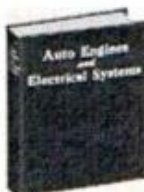
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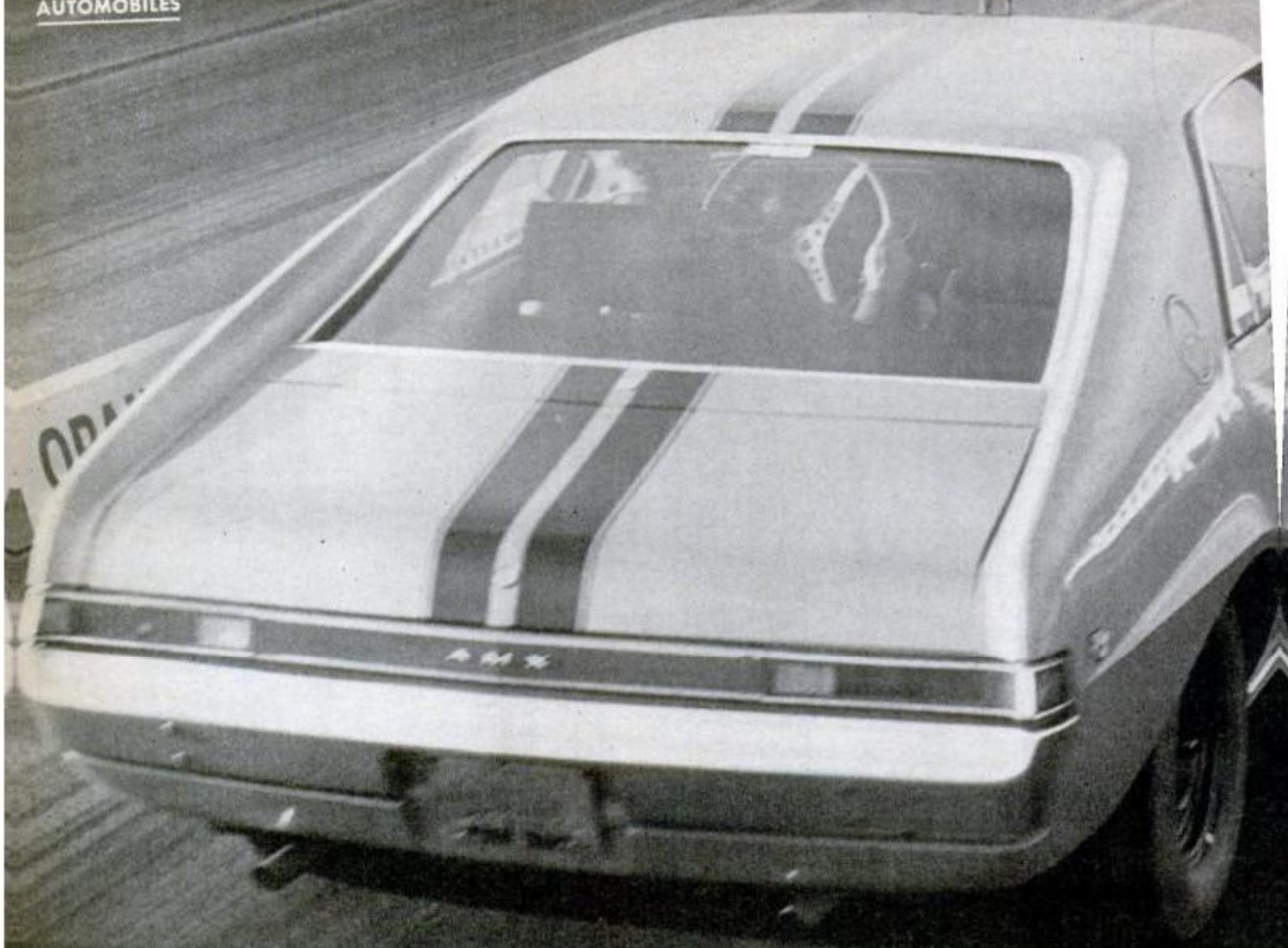
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Dan Gurney Tests The New AMX

American Motors' new two-passenger sports coupe lives up to its nimble, racy appearance—it's a 'real mover'

By DAN GURNEY

IT SOUNDED interesting from the beginning—an all-new American Motors two-passenger sports coupe called the AMX. But you hear a lot in the motor-racing business and learn quickly that seeing is believing. This is to report that seeing and driving the AMX was enough to make a believer out of me. American Motors is on the move with this neat little scamp.

I have always been partial to the theory of small, light, nimble cars. I feel that they are safer, more fun, and, with the right touches, as comfortable as any car need be. The AMX carries this philosophy to an outstanding point, and I'll be sur-

prised if the public reaction to it isn't enthusiastic. I know I enjoyed the AMX thoroughly.

The first one I saw was parked at Orange County Raceway, a drag strip and test facility in Southern California. I remember commenting to myself on how small and racy it looked, and although "racy" may not have the same complimentary interpretation to everyone, I imagine those who appreciate this sort of thing will receive a similarly pleasing first impression.

Once buckled in, I took a few trips around the available short course and down the strip itself. Immediately the power and performance of the AMX became apparent. All the test cars on hand were equipped with the new, optional four-barrel, 390-cu.-in. V8, American's biggest engine ever, and it turns on in a big way in these little 3000-pound beauties. Running 95-mph quarters in the 14-second bracket was no trouble at all.

Although the power is great, you don't pay penalties of noise and roughness. The engine and drive train is smooth. I liked the automatic transmission, although the four-speed manual seemed a little quicker.

The braking, I felt, was as impressive as the power, which is the way it should be but so seldom is. My test car had the heavy-duty suspension package with 112-inch diameter Bendix disc brakes up front and 10-inch drums in the rear. This is an optional package with the AMX, and I would strongly recommend it. I ran

(Please turn to page 197)

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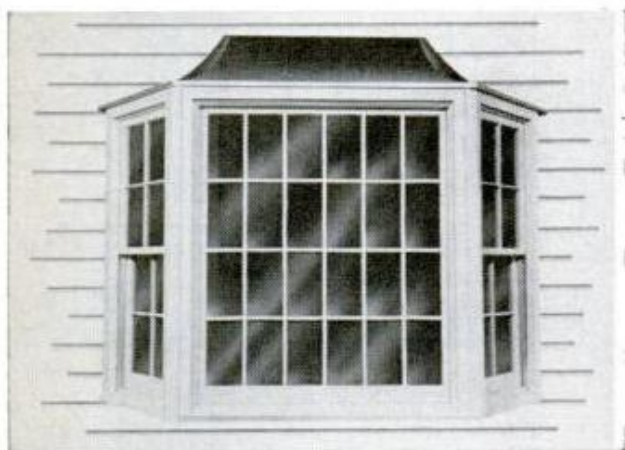
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New Materials You Should Know About



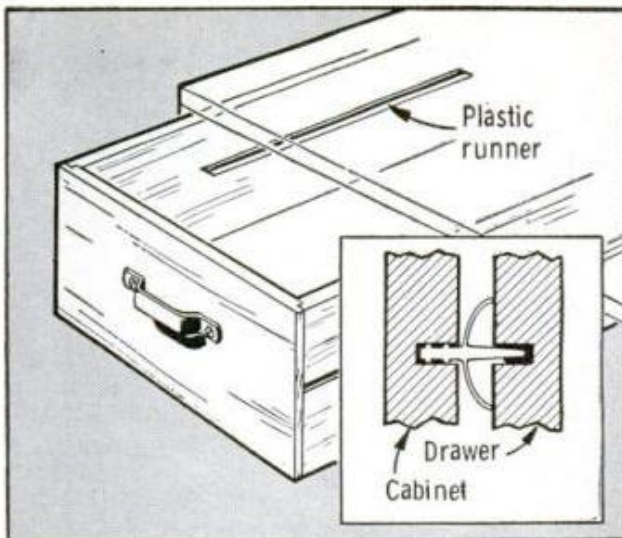
Lightweight exposed beams

Made entirely of polyurethane, new 2x6 and 4x6 natural-looking, exposed beams are so light that a 16-ft. long 4x6 weighs only 8 lbs. With realistic wood-grain patterns and coloring, the beams are available in walnut, oak and mahogany. Installation can be made with mastic adhesive or by tacking the U-channel beams over 2x2 ceiling strips. Priced at \$1.99 per foot, the beams are manufactured by Am-Finn Sauna, Inc., Lite-Beam Div., Haddon Ave. and Line St., Camden, N.J. 08103.



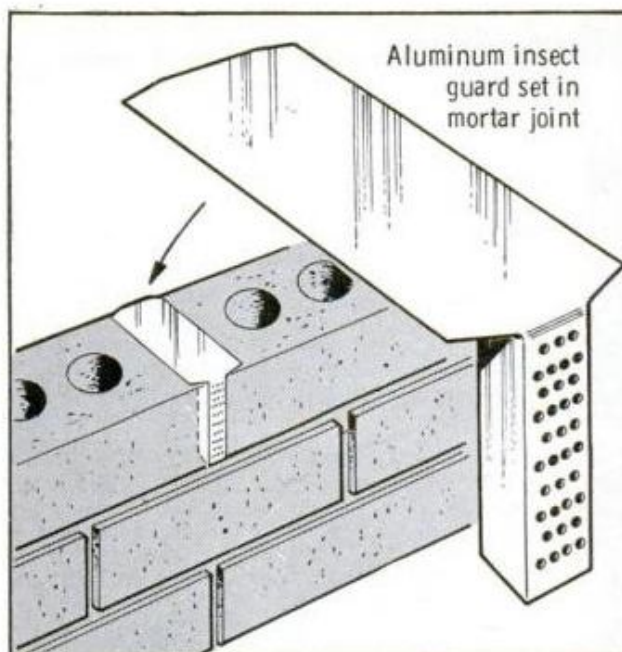
Preassembled bay windows

Ready for installation, the windows are assembled and weatherstripped at the factory and also incorporate insulating glass to eliminate the need for storm windows. Available in stock sizes, they also can be ordered with roof. The units are fabricated by Ponderosa Pine Woodwork, 39 S. LaSalle St., Chicago.



Easy-fitting drawer glides

The installation of drawers of most any size is a cinch with these silent one-piece glides manufactured by Alta Industries. All you do to install them is cut a pair of matching saw kerfs in the drawer and cabinet, then tap the plastic glides into the kerfs in the cabinet sides. Pressure flanges take up side play to make the drawers fit snugly. The price is \$3 for three pairs. Alta Industries is located at 3015 N.W. Industrial Rd., Portland, Ore.



Insect guard and ventilator

Designed to prevent rodents, bugs and other undesirables from entering a house through a weep hole, this aluminum guard nevertheless allows excess moisture to escape. Available are guards for old and new (shown) installations. Made by Alford Mfg. Co., Inc., 3112 Houston Ave., Houston, Tex.



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-CO
CHICAGO, ILLINOIS 60626

SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Part-time jerk

When I put my 1964 Oldsmobile into super drive ("S" on the transmission quadrant) going down a hill, I get a surge or jerk between 15-30 mph. This doesn't happen in other ranges. One mechanic wants to replace the carburetor, but I'd like your opinion before I give him the go-ahead.—Clayton Van Dyke, Middleburg, N. Y.

This problem has nothing to do with your carburetor or, in fact, with the engine. It's a normal function of the transmission, caused by the governor fluctuating in super drive. As the governor opens and closes, it sends surges through the oil control system, and that's what you're feeling. Disregard this and save yourself money.

Genteel squire

We own a 1966 Ford Country Squire. I've noted that the simulated wood of older models of the same car deteriorates more rapidly than the painted body. What can I put on the surface to protect it?—Frank J. Breslin, Jr., Los Angeles.

It's true that the simulated wood of Country Squires prior to 1964 models decomposed. However, that's been fixed, and you won't usually find the problem with later-model Squires. Ford changed the material and coated it with clear enamel to give the simulated wood the same finish as the rest of the car. Regard this area as a standard paint finish. When you wax the car, use the same wax on the simulated wood.

A valve flows in Brooklyn

Recently, I had cause to replace the oil filter valve assembly on my 1966 Chevrolet Belair. A problem arose as to the positioning of the part. There are two choices—with the orange valve next to the block or the opposite way. I've been to every Chevy dealer in Brooklyn. No one knows. Can you tell me the purpose of this part and the correct position for it?—Fred Davis, Brooklyn.

The valve's a bypass which allows oil to keep flowing if the oil filter clogs. You can install it either way.

Shoddy shoes

After putting 23,000 miles on a 1966 Ford LTD, I found the top front portion of both rear-wheel brake linings to be two-thirds worn out, but the bottom portions were just like new. I had the drums turned, and new shoes and wheel cylinders installed. After another 1500 miles, a recheck of the linings showed that the same thing was happening. This time, we also observed that the holes in the brake shoes were about 1/8-inch larger than the bolts. It came from the factory this way. What can cause this unusual wearing of the linings, and what can I do to correct it?—E. Sanner, Akron, Ohio.

Usually, I'd say that linings would wear this way if the shoes weren't arced to fit the drum upon installation. Even new shoes installed at the factory could do this if arcing isn't done. In your case, though, I think you started with defective brake shoes. Those larger holes, I'll bet, are causing the linings to rub against the drums, resulting in the uneven wear.

Plunkitis

What's that front-end noise I get in my 1966 Comet Caliente on an uneven road? It sounds as if the car's hitting the bottom of the shocks or the bumpers. New shock absorbers haven't helped. The rubber bumpers show no signs of any contact. What do you say?—James F. Cooper, Garrettsville, Ohio.

I think it's ball joint "plunk," caused by movement of the ball in the joint. That doesn't mean your ball joints are shot. They probably aren't. You can stop the noise! How? First, pack the joints with grease. If that doesn't get rid of all noise, install a set of heavy-duty shocks. Also make sure the upper shock bolts are tight.

Wired for sound

Recently, I found a problem in my 1966 Plymouth that might help Auto Clinic readers. The problem arose with the carbon-core wire for the high-voltage leads in the ignition system. This wire has one leg of a U-shaped piece of metallic wire inserted in the core at the end to make

(Please turn to page 74)



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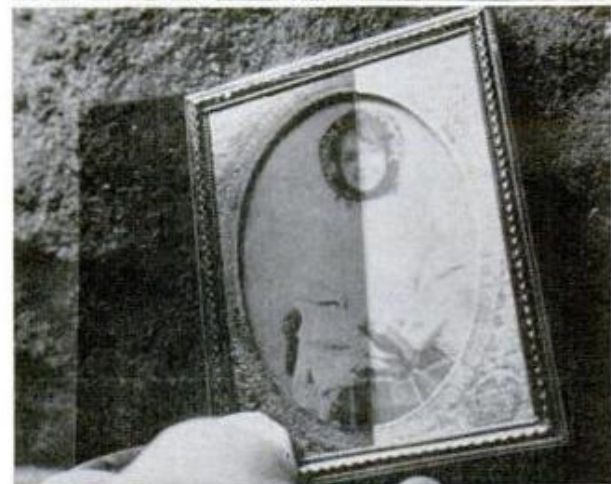
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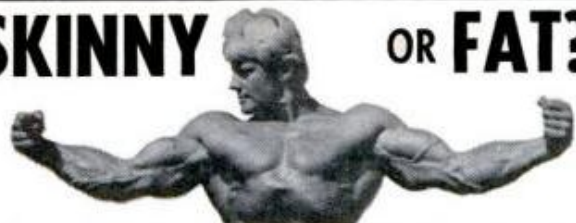
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Polaroid 'tintypes'

An enterprising photographer has worked out a system for making "tintypes" from Polaroid prints, and his studio has become one of the attractions of the New York Flea Market. Posing his subjects in one of the three dozen old-time costumes collected by his wife, John Dornes takes the photo (top), then sprays it with a fixative lacquer (center). The picture is then mounted in a frame and covered with a neutral-density filter (bottom), which gives it the appearance of a tintype. His biggest problem is finding old-time costumes large enough for present-day people.

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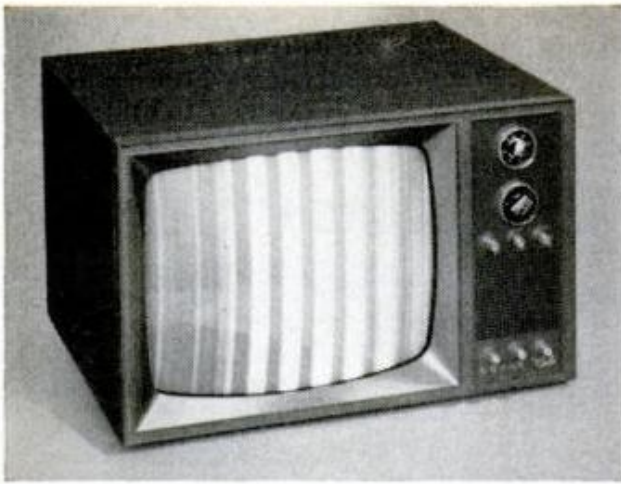
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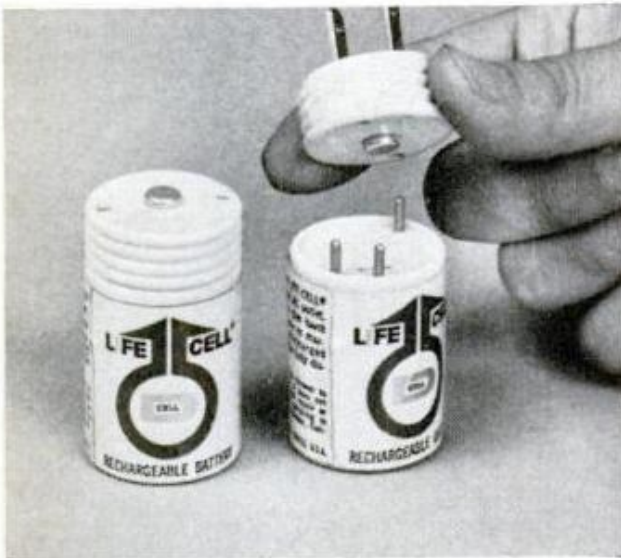
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COLOR TV KIT, designed for National Radio Institute's TV home-study course, is available separately from NRI's Conar Instruments Div. The 18-inch Model 600 is \$366. Kit has built-in crosshatch generator for servicing; bars on screen here are from color-generator kit.



AM-FM stereo tuner in distinctive upright cabinet is approximately 9 in. high, 9 in. deep, 4½ in. wide. The Olson Electronics tuner features stereo indicator light, tuning meter and AFC. Solid-state circuitry has 12 transistors and 18 diodes. Slide-rule tuning dial is set behind brushed-aluminum panel. Model RA-856 is priced at \$90.



RECHARGEABLE BATTERIES of standard D-cell size can be recharged by plugging them into a wall outlet. Life-Cell from Waldom Electronics has removable top: Pull it off, turn it over, replace it on cell and plug it in. It'll recharge 100 to 200 times. Price: \$8.45 pair.

NEW in ELECTRONICS



FM STEREO RECEIVER KIT from EICO combines 70-watt stereo amplifier and FM tuner on one chassis. Third in solid-state "Cortina" line, receiver is easy to assemble with RF, IF and multiplex sections preassembled and aligned. Kit with cabinet is \$160; wired, \$240.

ANTENNA replacement for automobile radios improves AM reception. Coil at bottom of Electenna fits over stub of the broken antenna. Coil acts to tune antenna to deliver higher signal voltage to radio's input. Price is \$7. Coil alone (\$5) is available for use with existing antenna. Antenna is cut 1½ in. above base and coil is inserted.



CB TRANSCEIVER is a 2-watt, 3-channel portable from Sears, Roebuck & Co. The solid-state walkie-talkie (Sears No. 6471) is called the "thin-line" model; its width is 2 in. The two-way CB radio features a call-alert, battery-strength meter, plus carrying case and earphone. Price of the unit is \$80.

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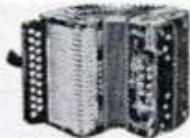
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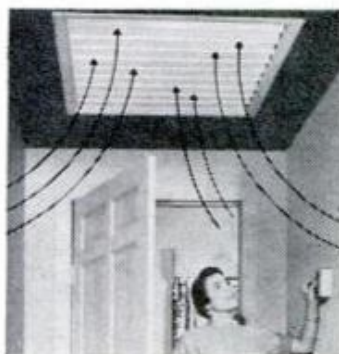
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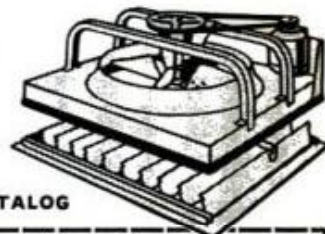


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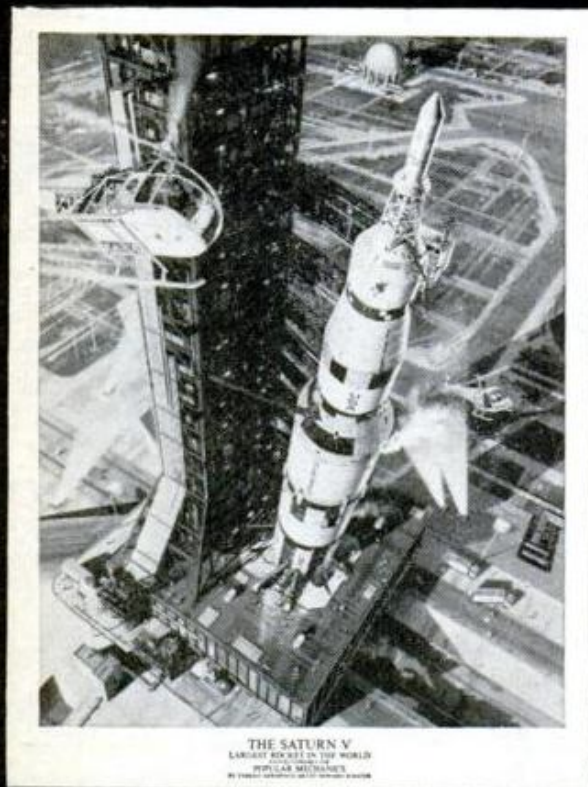
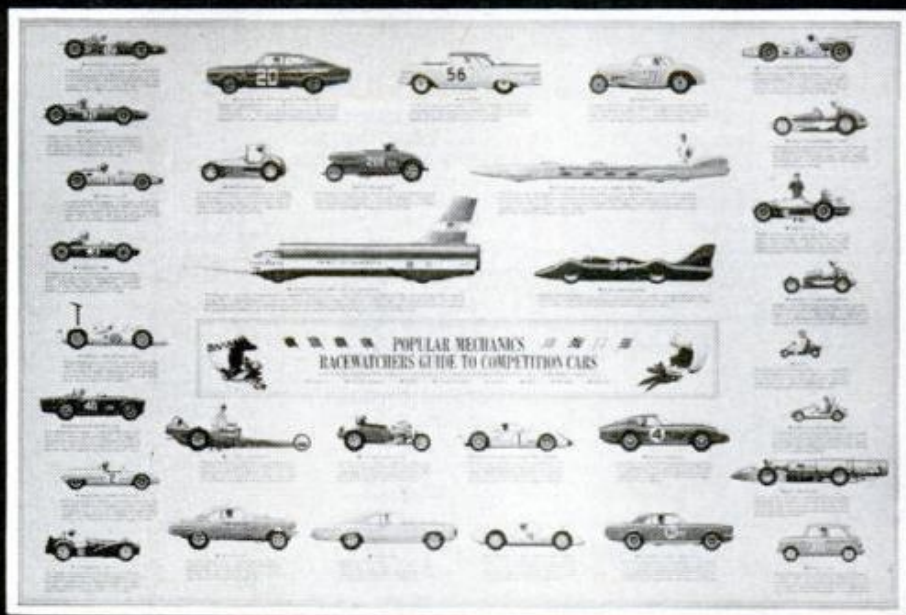
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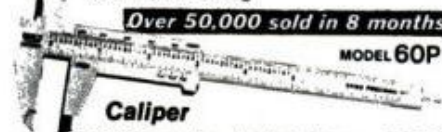
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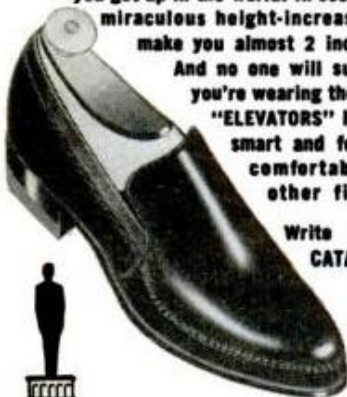
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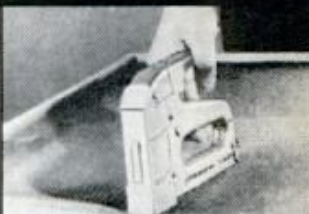
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MISCELLANEOUS

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WINEMAKERS—Free catalog and recipes. Kraus, Box 451-L, Nevada, Missouri 64772.

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WINEMAKING—Year around beginners kit \$2.98. Catalog, Recipes 25¢. Winemakers Guild, P.O. Box 193, Elm Grove, Wisc. 53122.

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DENTURE Wearers: Distressed? Free important information now helping thousands! Marshall, Box 1221-PM, Dania, Florida 33004.

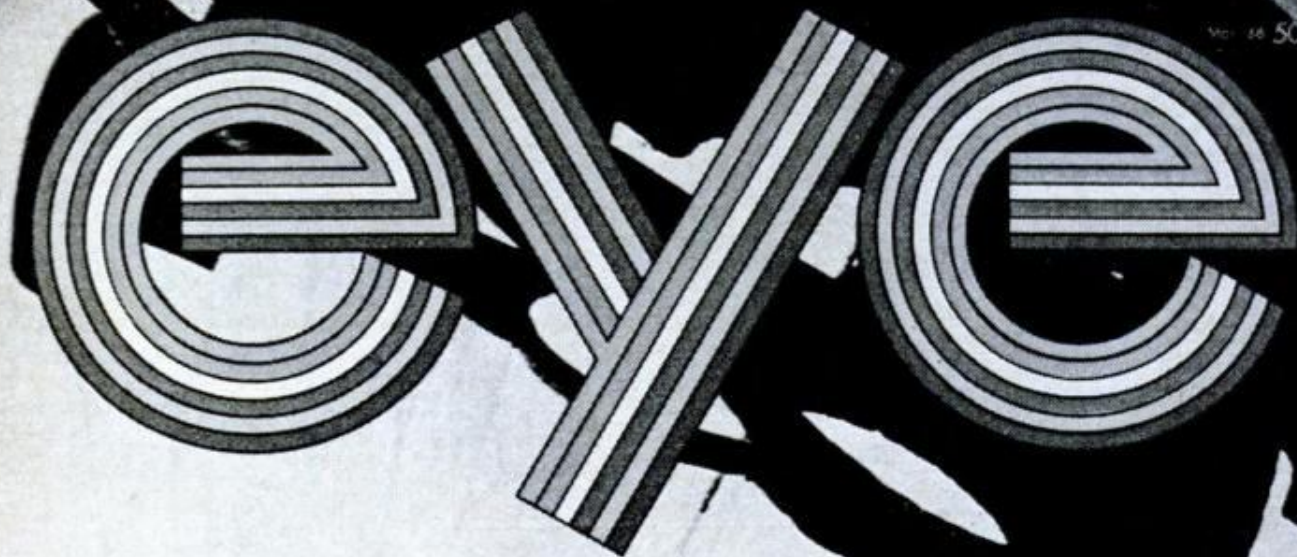
WINEMAKER'S Yeast—Recipes—Catalogue—25¢. Nichols Hops, 1190 North, Albany, Oregon 97321.

BEER Brewing instructions! No still needed! \$1. Beer, 50 Atlantic, Metuchen, New Jersey, 08840.

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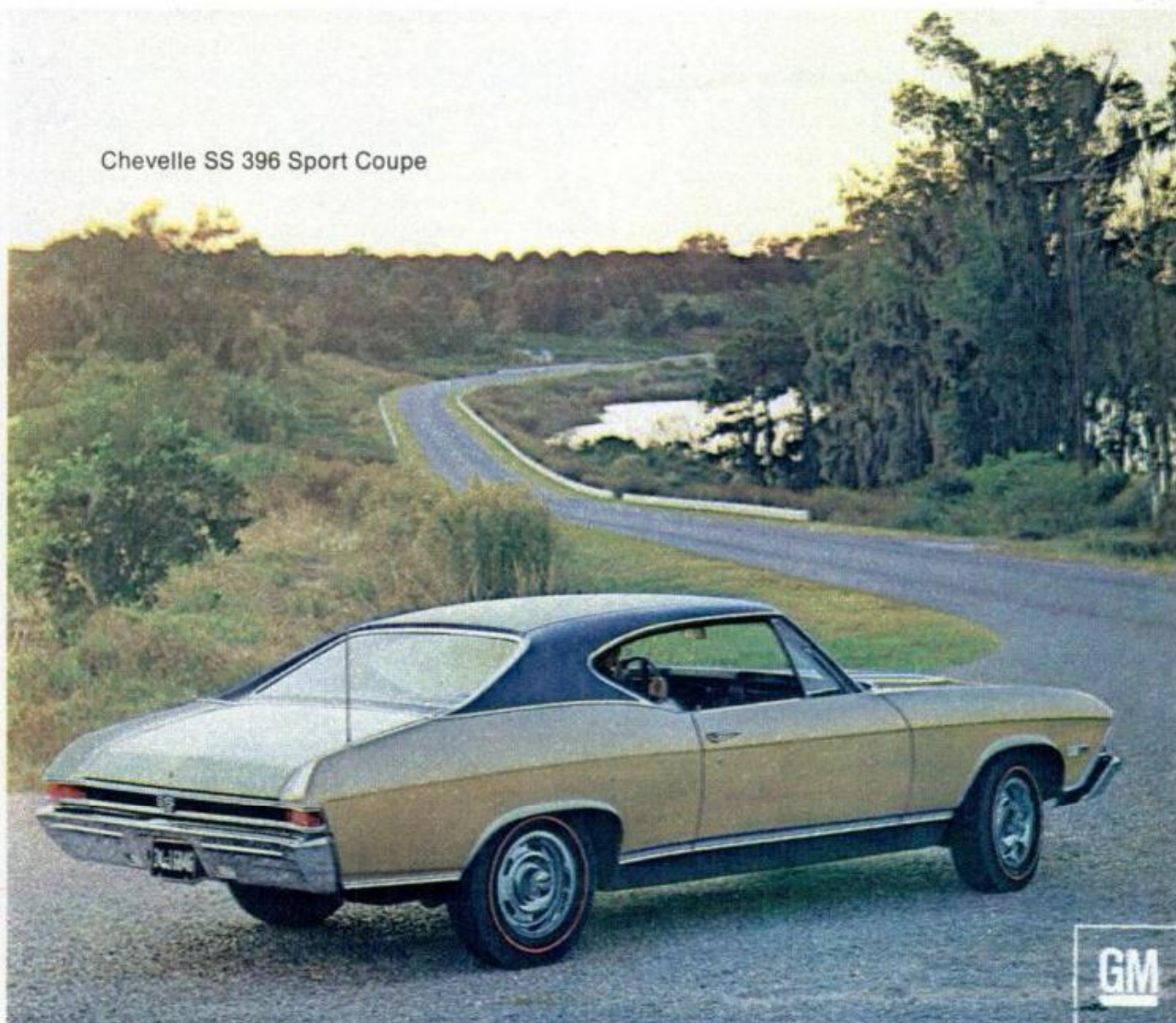
It's domed. It's striped. It's got bulges on its bulges. It's SS 396, boss of the Quick-Size Chevelles. But don't let all the niceties fool you. Underneath, it's got everything you need for your kind of driving. 396 cubic inches, beefed-up shocks and springs, wide oval treads, the whole thing. With credentials like that, you could get along nicely without the glittering goodies. You *could*, but why play it down when you're living it up?

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MARK OF EXCELLENCE

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

That condensation problem

I have a new house with metal casement windows that are wet from November to May. What is this condensation? Where does the water come from? Is there any cure for it?—D.R., Ala.

Ever notice the beads of moisture that gather almost instantly on the outside of tumblers containing those tall, cold beverages you enjoy during the warm, muggy days of summer? If you did, you were looking right at the cause of your winter-time problem. When the air is warm and heavy with moisture and the surfaces of the tumbler are colder than air, the moisture in the air condenses on the colder surfaces.

During the winter season, your furnace humidifier creates warm, moist air, while the window panes and metal frames remain at a lower temperature than the room air. Thus, moisture in the air condenses on the cold panes and frames.

The remedy isn't so simple in modern homes, but you'll find that storm sash are a help (if not always a cure) in reducing the formation of condensate. Simply opening doors and windows for a short time to replace the warm, moist air in the rooms with cool, dry air will often work wonders in minimizing this bothersome problem of condensation.

Cherry to walnut

I have an old chest which I'm sure is made of cherry wood. I'd like to refinish it in walnut to match other pieces. Can this be done successfully?—T.P., Ohio.

It depends on the condition of the wood and whether you have succeeded in removing *all* the original finish. If this has been done and if the wood is still in good condition, then, yes, you can produce a fairly good walnut finish on cherry.

If you do the work yourself, use a walnut pigmented stain. Just brush it on, allow it to stand until it begins to "flat," then wipe off lightly until you get the shade of walnut desired. Allow the wiped stain to dry at least 48 hours. If it dries a bit too light, apply a second coat of stain, wipe off and let it dry. If this is satisfactory, sand or steel-wool (use 8/0 sand-

paper or 4/0 steel wool) very lightly and follow with a sealer. Sand this lightly and follow with top coats of a pale varnish or lacquer.

The greenest grass

I see some lawns that are always a deep, rich green, while others, are a lighter, paler green. Are these different types of grasses?—N.A., Ill.

There is a variation in the color of various common lawn grasses but there is also a marked difference in the plant characteristics, particularly in the normal length and breadth of the blades. I'd suspect that the variation in color you have observed is more likely due to the same or similar grasses growing on fertilized and unfertilized soils.

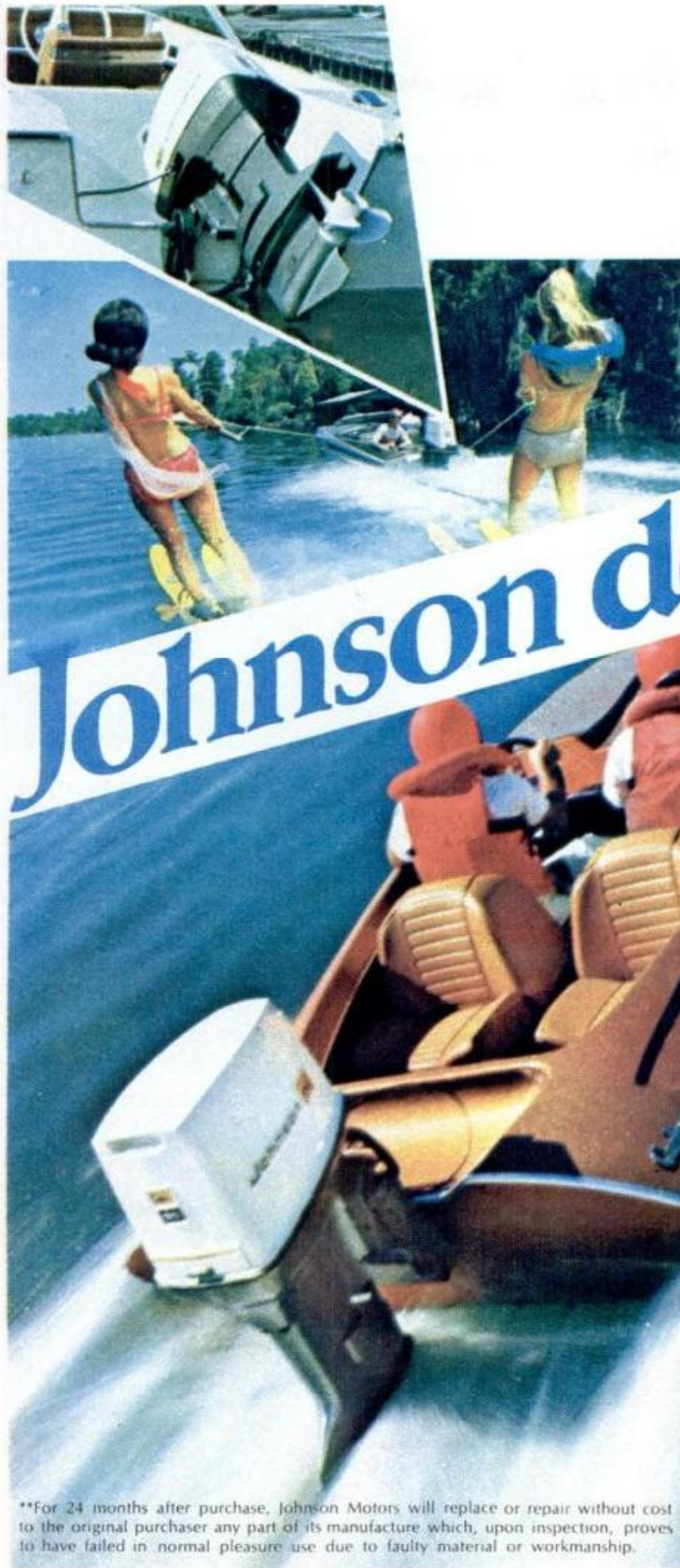
Grasses that are growing on soils enriched by regular applications of fertilizers relatively high in available nitrogen are generally of the "deep, rich green" you describe. Regular applications of nitrogenous fertilizers are necessary to promote vigorous growth of all common lawn grasses.

Locating furring strips

I want to locate several furring strips under insulated planking in order to anchor screws which are to hold a wall cabinet. I tried tapping with a hammer but was not successful. Is there any other way you know of to locate the strips with some certainty?—A.D., Me.

If the planks are nailed to the strips—and generally they are—a permanent magnet will usually "draw" when it passes a nail. Of course, you have to use a fairly strong magnet as otherwise you cannot "sense" the nail. Start at any convenient point on the wall and move the magnet slowly over the surface, keeping it in very light contact with the wall. It's likely you will have to cover a considerable area before locating a nail. When you do, mark the point very lightly with a soft lead pencil; you can erase the mark after it has served its purpose. Then move the magnet horizontally about 16 in., locate the nails in the next stud and mark this location. Continue in this manner until you've located as many studs as necessary.

Another method is to drive an ordinary pin through the planks until you strike a strip. If you use care to tap the pin straight, you won't deface the planks. A light pressure over the hole with a fingertip will close it so that it is not noticeable, even on close examination. ★★



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**For 24 months after purchase, Johnson Motors will replace or repair without cost to the original purchaser any part of its manufacture which, upon inspection, proves to have failed in normal pleasure use due to faulty material or workmanship.



1 We're the truck people from General Motors. We just cut apart the best-looking pickup we ever built to prove that its beauty is more than skin deep. Under that skin are the greatest truck features ever assembled in a pickup.

2 Every GMC cab has two roofs and two cab walls. This double protection does a great job in shutting out noise, vibration and weather. It also makes the cab last longer. You'd think all pickups would be built this way. Strangely enough, ours is one of the few that is.

3 Unlike other truck-makers, we gave you four headlights instead of two. We also made the rear window bigger. And designed a sleek hood to keep road splash from gumming up the windows. The point here is visibility. We gave you plenty.

4 Burly leaf springs at the back of our pickup really support your cargo. Independent suspension and coil springs up front cushion the ride, yet deliver tremendous stability on corners. Load roll is at a minimum. Comfort is at its maximum.

5 We offer more engines than anyone else in the business. Our new V8's deliver

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acceleration you never thought a truck could give. Our inline-sixes really trim the fat out of gas and repair costs. And the exclusive GMC V6's are so tough many owners go 150,000 miles (and more) before major overhauls. There are seven GMC engines to choose from. With horsepower to 310.

6 Pushbutton seat belts, passenger-guard door locks, backup lights, plenty of safety items.

7 Interiors are color-keyed to the outside. And you can get bucket seats, carpeting, a center console, all the comforts.

8 The cargo box has two walls of steel. Should your load dent the inside, the outside won't show it.

9 This dual master cylinder brake system goes on all our light-duty trucks. We think that confidence should be standard on every pickup we make.

10 There is one area where pickups are pretty much alike. The price. We know it's tough to believe after you've seen the quality of a GMC. A point your GMC Truck dealer is most eager to prove.

pickup just to prove a point.

The Truck and Coach Division of General Motors

GMC

What a difference a name makes

AUTO CLINIC

(Continued from page 48)

good contact with clips. These clips connect the lead to the sparkplug and to the distributor cap.

I found that one of these clips was missing, and the carbon core had deteriorated to a point where the spark had to arc the gap. This caused the cylinder to misfire during acceleration. Replacement of the wire solved my problem.—Frank R. Hof, Charleston Heights, S. C.

Thanks for the tip, Frank. Your fix throws light on a real sneaky one.

Vicious VW vibration

Between 30 and 45 mph, when I hit a bump or pothole with my 1966 VW 1300, the steering wheel vibrates so badly I can't hold it. Mechanics say the front end, wheel bearings and steering adjustments are okay. Tire rotation hasn't helped. Please advise.—Edward Siena, New York.

Usually, the difficulty is insufficient positive caster. If you're sure that's okay, I'd like to draw your attention to four bolts that hold the front end to the body. If they're loose or missing, this can cause the trouble. I'm assuming that shock absorbers and steering damper are okay.

Transmission lost its cool

Those people who disputed your statement that automatic transmission fluid in the Chevrolet should be changed every 12,000 miles (see *Auto Clinic*, page 20, July '67 PM) owe you an apology.

My father drove from Chicago to Florida in his 1964 Chevy. While there, his transmission failed and it cost him about \$100 to get it fixed. He wrote Chevy and complained, and the company reimbursed him. It seems, the company said that the engineers did not provide for enough cooling of the transmission. As a result, lacquer builds up on the transmission filter screen. These deposits soon retard fluid flow sufficiently to burn out the clutches.

Since the manual states that the transmission fluid is good for the life of the car, it seems to me that any Chevy owner who encounters the trouble should get in touch with the company. Just thought some

readers might be interested.—Ted Blomquist, Carbondale, Ill.

I'm sure they are. Thanks, Ted.

On the right trail

Is there anything I can do to get rid of a terrible rear-end vibration at and over 45 mph in my 1965 Rambler? We tried every which way of balancing, but nothing helps.—H. A. Wohlers, Lafox, Ill.

This is a recognized problem with the Rambler. Get a Rambler shop to install a trailing link kit, which is a shock-absorber affair mounted from the frame to the rear. It will absorb the vibration which is causing the seemingly unbalanced condition.

Service Tips

● **Ford reminds us** that the heat distribution pattern within an engine block can cause a small, but significant degree of warping. At times it can create a sealing problem at the intake manifold to cylinder head gasket. You'll get vacuum loss and a rough-running engine. To prevent leaks next time you install a new intake manifold gasket, do this:

1. Install the new gasket, tightening the intake manifold-attaching bolts to the specified torque.

2. Start the engine and run it until normal operating temperature is reached. This will take about 10 minutes.

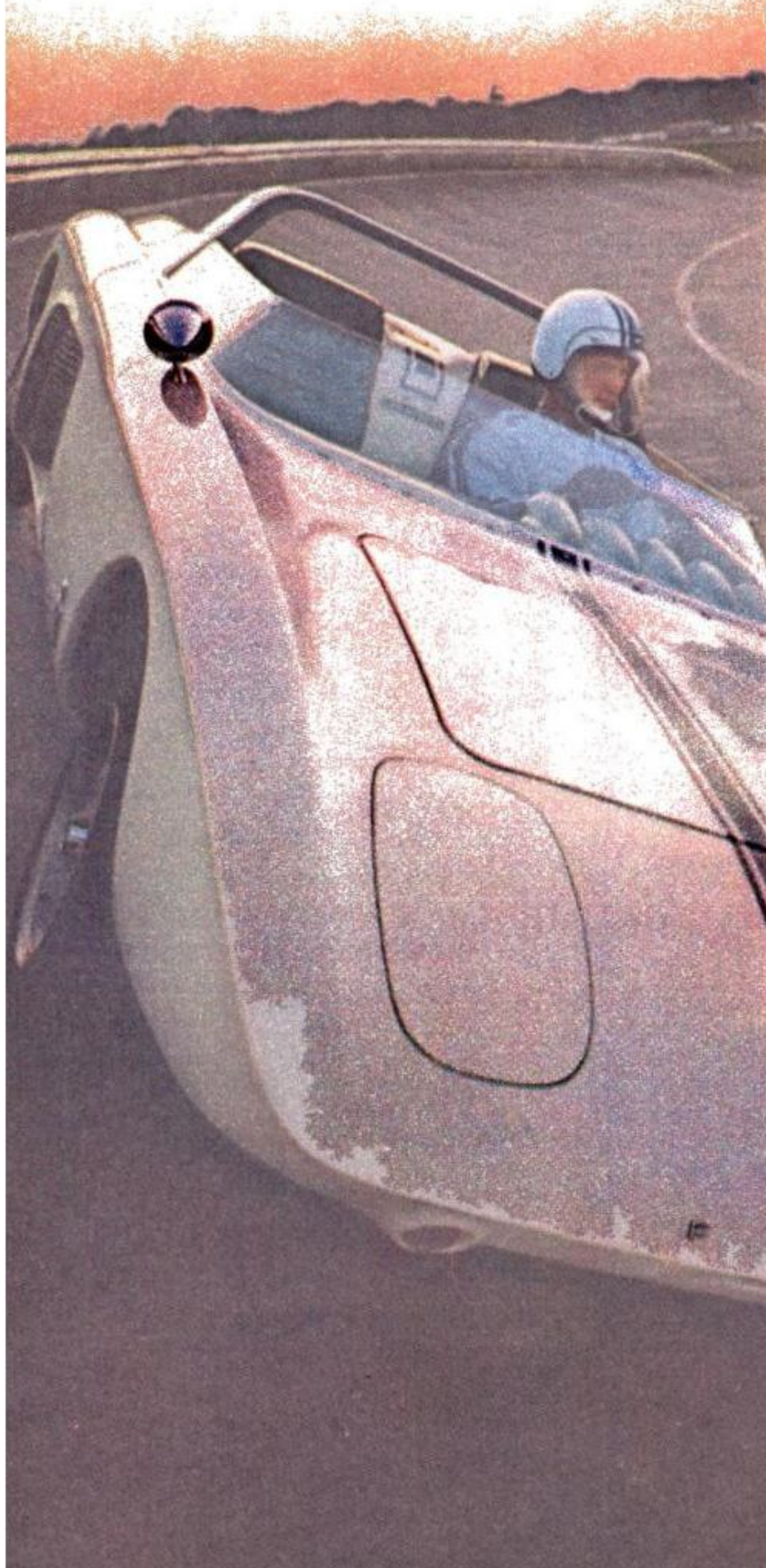
3. Shut off the engine, and retighten all bolts to the specified torque. This second torquing provides uniform sealing over the entire gasket surface.

● **Is your 1967 Dodge** with 383 or 440 cu.-in.-engine plagued with a rumble from under the hood? If the car's airconditioned, the noise could be coming from the compressor; a new compressor front mounting bracket (part No. 2899836) will stop it. Service Bulletin D67-24-6 (10/18/67) authorizes your dealer to do the work. This also goes for other Chrysler-built cars with these engines.

Furthermore, all those Chrysler-made cars with 383 and 440 engines and airconditioning that are stalling after starting them hot can be cured. The stalling occurs on cars equipped with the Carter BBD-4423S and Holley R-3918A carburetors. The solution is to set the idle speed to the specified 600 rpm with the airconditioner on, rather than off.

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Write to Auto Clinic, c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Unfortunately, we can't answer each letter personally, but there's a good chance your question—or one like it—will be answered in the column. Let's hear from you.

When Ford spent \$250,000 on this experimental car, they weren't about to cut corners on the oil filter. So they used an Autolite filter. Like you buy. Under \$4.



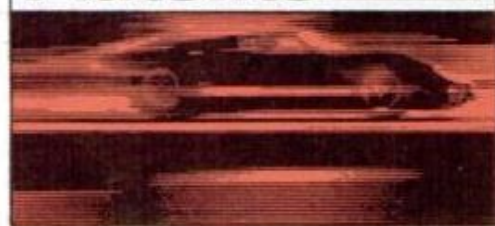
From the ground to the roll bar, this car is only three feet tall. It was built by Ford to test new design concepts. At a cost of \$250,000. The movable control panel cost \$10,000. (It adjusts to the driver.) The hand-formed aluminum body cost \$50,000.

And the oil filter? Less than \$4. It's an Autolite oil filter. The same kind you buy. What's a \$4 Autolite oil filter doing in a \$250,000 car? Simple. There is no better filter at any price.

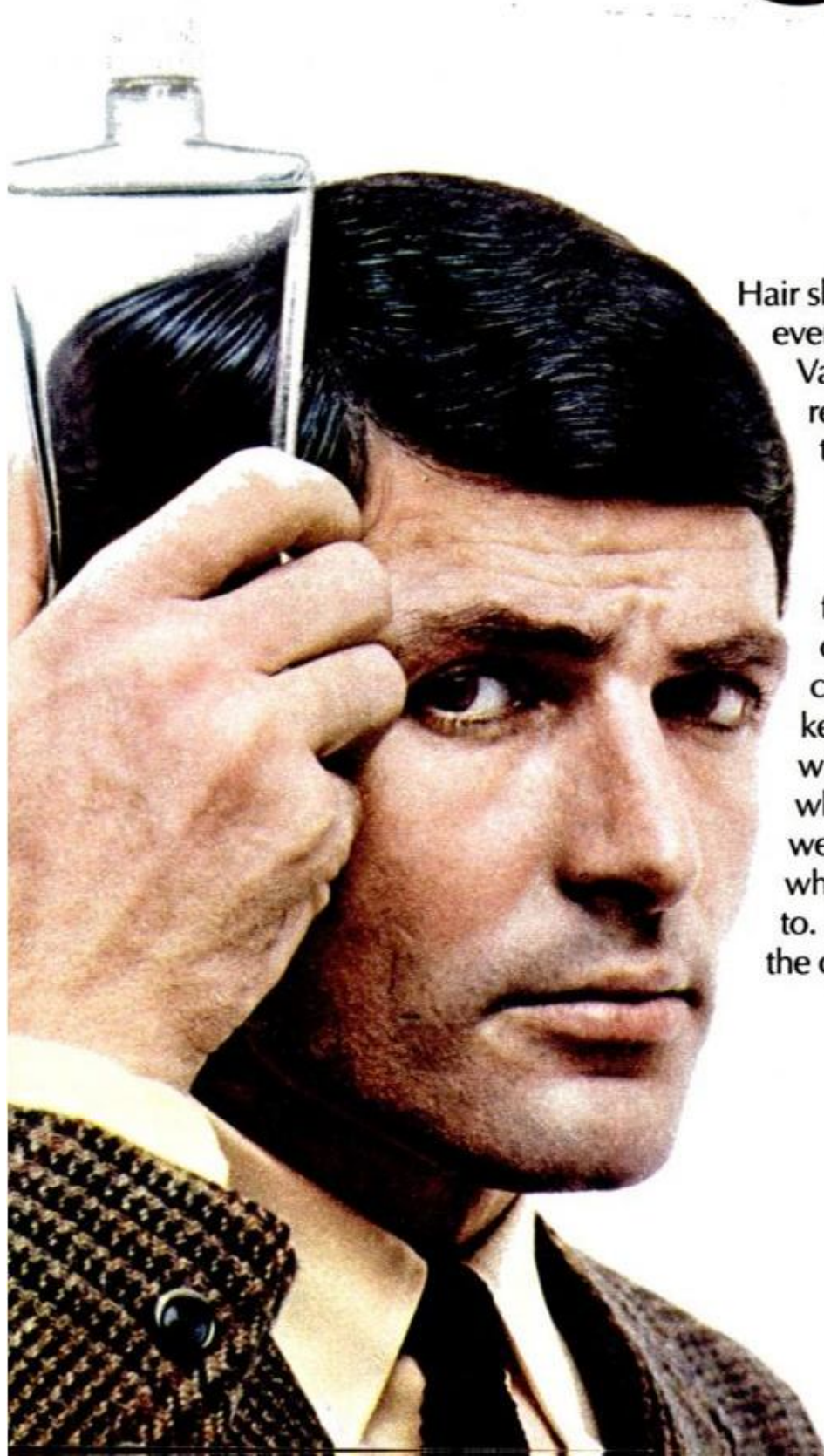
The Autolite filter is a two-stage filter. A depth filter that removes up to ten times as much dirt and sludge as ordinary filters. It can actually double the life of your oil. What's more, it has an up-front bypass valve to prevent trapped dirt from washing back into your engine.

So put this kind of filter in your kind of car. Whatever kind you drive. Autolite... the only name you need to know for filters, spark plugs, batteries, shock absorbers and complete ignition systems.

Autolite 



For the clean guys.



Hair shows up clear and clean even through a whole bottle of Vaseline Hair Tonic (label removed). No surprise, then, that Vaseline Hair Tonic looks clear and clean after you put it on...so pure, so refined that there's no need for us to cream it, gel it or color it. Just a little clear clean Vaseline Hair Tonic keeps your hair doing just what you want it to (no matter what length you choose to wear your hair). Ask any girl who she'd prefer to snuggle up to. And she'll tell you. One of the clean guys.



... and I walked away from it!

The article starting on the next page is important to everyone who drives or rides in automobiles. PM is printing it not so much because it's our type of project (which it is), but because it concerns something we feel is needed in all cars—an adequate rollbar.

Stereo tape systems we got. "Rich, distinctive" interiors we got. What we haven't got is a better-than-even-money shot at surviving a high speed flip.

As these photos dramatically prove, crash protection provisions can save lives. Racing star Sam McQuagg walked away from this epic smash-up because his car had a built-in roll cage and because his seat belt and restraining harness were securely fastened. Literally thousands of lives—maybe even yours—would be saved if cars had rollbars. Detroit is thinking seriously about them, may make them standard in a few years. But you can do something about one now! True, for the moment they aren't very pretty. But neither is a wreck.

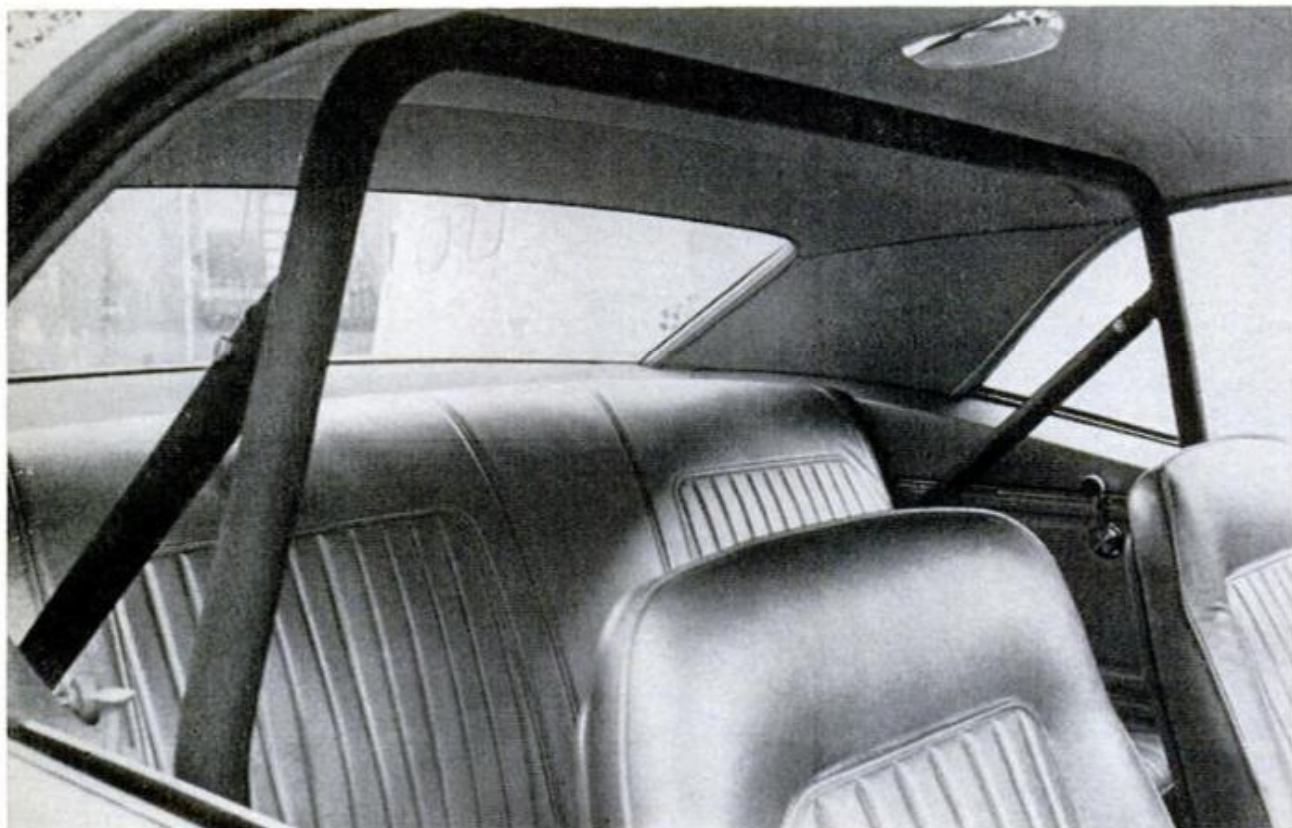
Bill Koppert
Auto Editor

Don't Wait for Detroit! Install Your Own Rollbar

Adding this important protection to your car takes a few tools, some simple skills and a day's work

By CHARLES E. DOLE

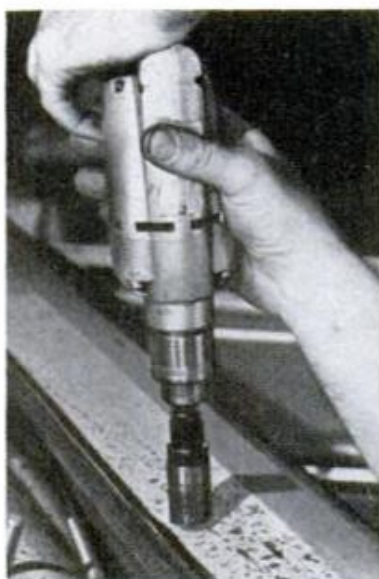
Photos by Peter Main



FOLLOW THESE SIMPLE STEPS . . .



POSITION large footplates, centerpunch, drill six holes



ACCESS to top bolts requires drilling, slotting of rocker panel



TEMPORARILY ATTACH the footplates, then center and tack-weld the rollbar to plates

LIKE SEAT BELTS, rollbars save lives. There's plenty of evidence.

Walk down pit row at any racetrack. Most drivers you see will be there because a rollbar once saved their lives.

Take any accident study like the one recently done by Cornell Aeronautical Laboratory: In 6000 single-car accidents, 2360 resulted in turnovers. A lot of people died. Maybe with rollbars they wouldn't have.

This year every new Corvette coupe has a built-in rollbar. So do the new Porsches, Saabs and Volvos. All the proposed safety cars (e.g., Liberty Mutual's Survival Car) call for built-in rollbars. Somebody must think rollbars make sense. They do.

You should have one in your car, be it a limousine or a little two-seater. You can, too. If you've got the price, finding a shop that specializes in rollbar installation is a matter of a few phone calls. If you haven't got the price, there are custom kits available for just about every car made. The cost is anywhere from about \$50 to well over \$100. You can do the installation yourself, although you may want to farm out a step (such as welding).

The kit described below costs about \$70 and is available from Kay-Dee Automotive Engineering, 1090 Commonwealth Ave. (Rear), Boston, Mass. It's typical of several *PM* looked at.

Kay-Dee needs your car's make, year, model and a few measurements, plus your money.

To install the kit, you'll need a pair of metal-cutting shears (if your car, like the Camaro shown, has unit-body construction), plus a welder's torch, hammer, hacksaw, center punch, power drill and $\frac{3}{8}$ and 1-in. bits. Add a screwdriver, wrench, razor blade and paint to match the interior—you're all set.

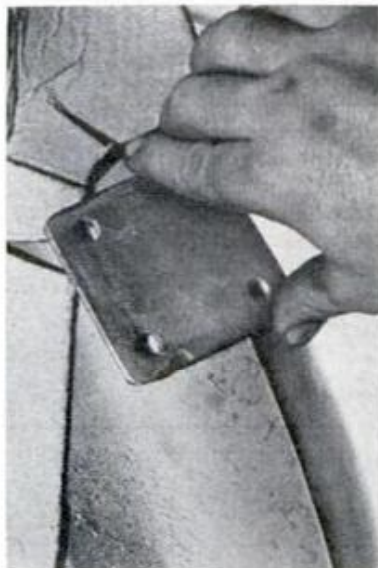
Remove the back seat and both threshold moldings so you can roll back the carpet or rubber matting. Position the two large footplates, or brackets, in line with the door jamb, then counter-punch and drill the six holes for each plate. Loosely attach the bottom part of the plate to the body with four $\frac{3}{8}$ -in. bolts. To thread on the nuts for the two bolts in the upper part of the footplates, you'll have to drill two 1-in. holes about 3-in. apart through the bottom of the rocker panel. Then use the shears to cut between them to form a slot large enough for your fingers.

When both footplates have been temporarily mounted, center the rollbar on the top flats of the plates and tack-weld the bar to the plates. *Be careful of fire!* Place a piece of sheet metal between the bar and the inside of the car—and keep a small fire extinguisher handy, just in case.

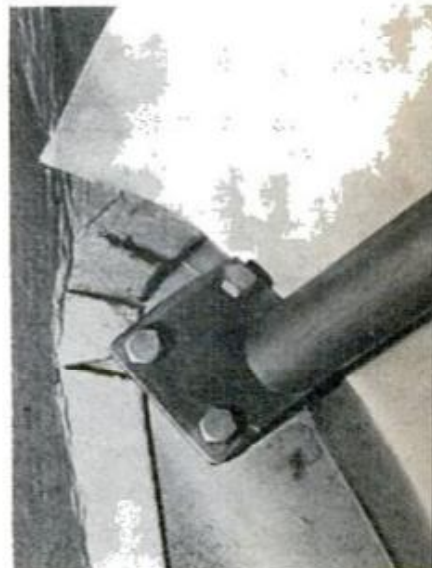
Slip the lengths of brace tubing into



BRACE TUBING is fitted and marked, and then cut to approximate required length



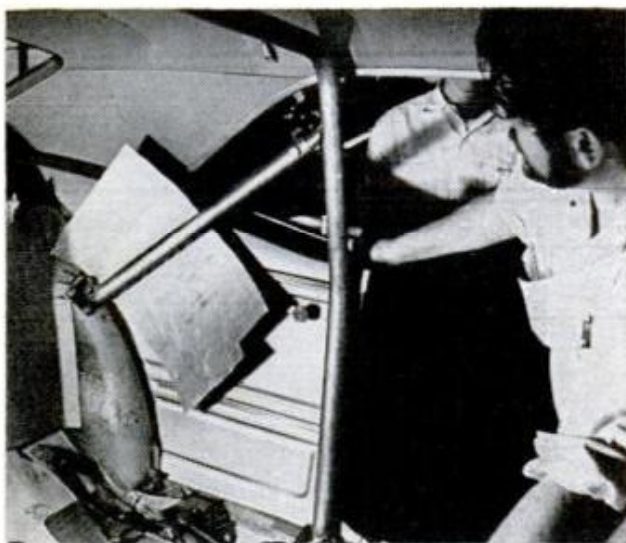
FOOTPLATE for rear wheel well slips between the tube and well



THREE BOLTS through plate hold it in place for welding



SLEEVE MUST BE ANGLED where it contacts the rollbar to produce a strong, safe joint between the two



FINISH TACK-WELDING of tube to plate, sleeve to bar, bar to plate before removing rollbar from car

the extension sleeves and position these between the ends of the tubes and the rollbar. At the point where each sleeve meets the rollbar (about 6 to 8 in. below the top), mark and trim the sleeve so it butts against the bar at an angle.

Similarly, trim the brace tubes so you can position the small footplates between the ends of the tubes and the wheel wells. Once the plates are in place, center-punch the well for the three holes in each plate, then remove the braces and sleeves and drill the three holes through each well. Temporarily attach the plates, reposition the braces and sleeves, and tack-weld the sleeves to the rollbar and the braces to the plates. Again, beware of fire!

When all welds are cool, remove the bolts from the four footplates and the

extension sleeves and take the rollbar out of the car. Reassemble the rollbar and complete the welding of the sleeves to the bar, the bar to the footplates and braces to small foot plates.

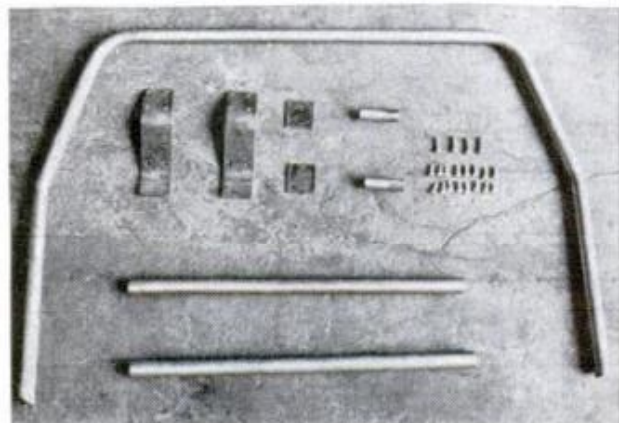
Remove all welding slag, lightly sand and smooth all joints, prime and paint.

That's it! Just bolt the completed rollbar into the car, trim the floor mats so they fit around the bar, jockey the back seat in place and reinstall the threshold moldings.

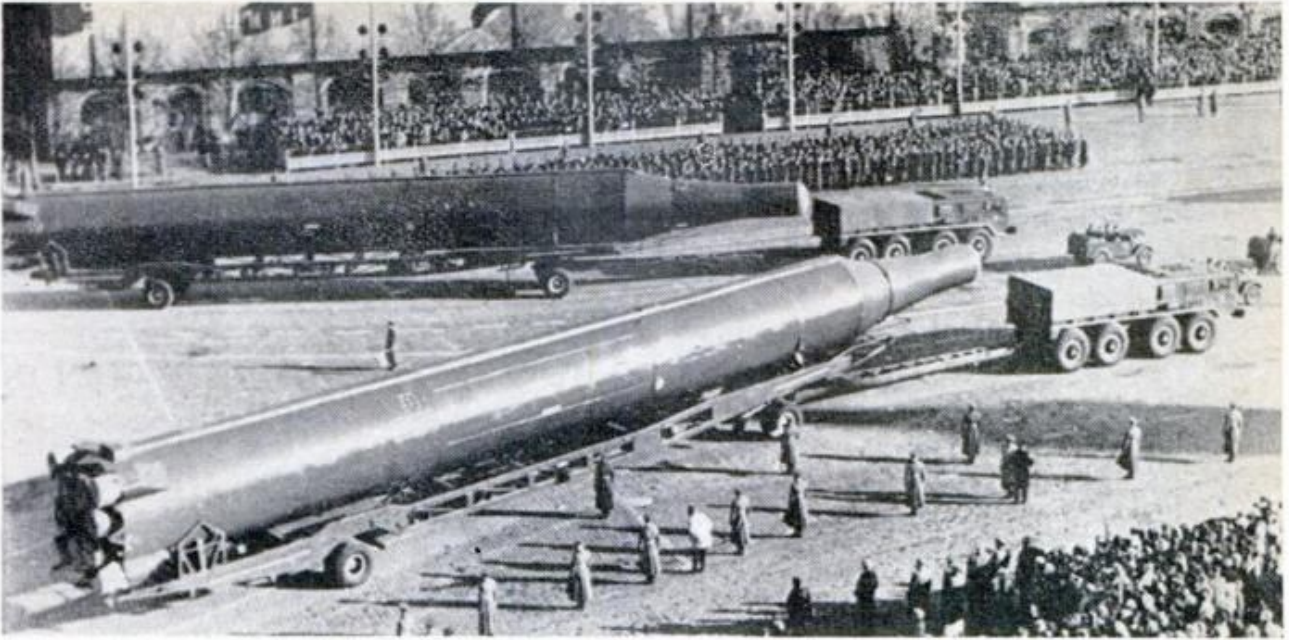
The installation procedure will, of course, vary slightly if your car is constructed with a conventional frame and body. In this case, you simply bolt the footplates to the chassis. ★★★



CHECK ALIGNMENT of braces—difference should be only a fraction of an inch. Then complete all welding

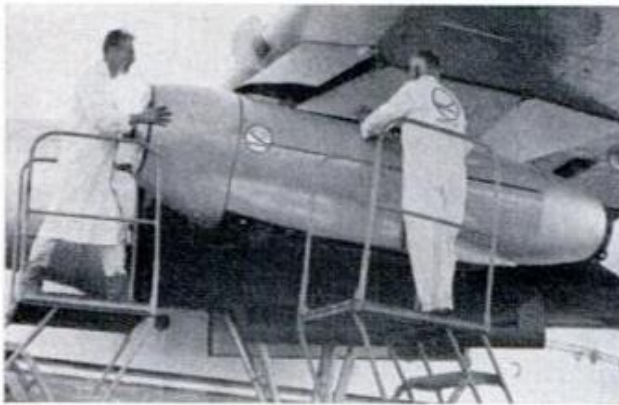


TYPICAL KIT COMPONENTS are bar, tubes, sleeves, footplates. Latter may vary with make, model of car



New Soviet intercontinental ballistic missiles

Two SS-9 ICBMs appeared in Red Square during the Bolshevik Revolution anniversary parade. Each three-stage missile is 120 feet long and has a warhead 7 feet in diameter.



Add-on jets give new zip to an old-timer

Quick-change jet pods that attach to a C-119G cargo plane in 30 minutes (left) are transforming that lumbering giant into a sprightly short-field carrier. Using the plane's regular fuel, a single Jet-Pak 3402 kept a C-119 flying 150 mph with both its piston engines shut down (right). With three pods, the plane can take off with 77,000 pounds gross weight 12,000 feet above sea level in less runway than an ordinary C-119 uses at sea level.



Kids are tired of slot cars? Try these

A Mini Ferrari and Ford Mini GT are now being offered by Sinclair's Auto Miniatures. The fiberglass, steel-framed cars can go 24 mph on their one-cylinder, two-cycle engines.



"CAN DO!"

THE SEABEES SWARM AGAIN!

The Navy's build-or-fight crews in Vietnam are barely out of their teens, but they're working the same kind of construction miracles that 'civilized' advanced bases in World War II

By MORT SCHULTZ

IN 1942, a group of potbellied, middle-aged civilian construction men were sworn into the U. S. Navy to build amidst the destruction of war from Guadalcanal to the shores of Japan. They were called Seabees—short for Construction Battalion.

People who remember how they constructed desperately needed airstrips while fighting off the enemy on Iwo Jima and Saipan, and how they erected in a few hours livable facilities for battle-weary Marines at Tarawa may wonder what happened to them.

Well, today's seabees have trimmer waistlines, and the majority are barely out of their teens. But they are still paving and building—now in Vietnam.

Like their World War II counterparts, the Seabees of today do amazing things. To them, building a "city" in 12 days to house 7000 troops in the middle of a jungle is commonplace. So, for kicks, they construct a 345,000-cubic-foot, self-generating cold storage plant to freeze enough food for the entire population for 90 days.

These are the kinds of things they can do when tools are handy. Even more spectacular is what they do *without* equipment.

Recently, for instance, Seabee Team 0507 was ordered to build a bridge across the Da Nhim River in Tuyen Duc Province. There was a need for an open route into the Vietcong-infested countryside. Once a year, like clockwork, the crude, wooden footbridge erected annually by the natives would be washed away by the monsoon-swollen river.

How do you build a bridge over a swift-moving river that never goes dry? By driving piles, of course. What do you do when you don't have a pile driver? You make one, of course!

The 13-man team constructed a 2400-pound hammer by filling a hollow shell made of sheet piling with scrap steel and concrete. They placed it between two welded-together guide leads, so



YOUNG SEABEE is more typical of today's combat construction crews. World War II types were older



MAJOR WORKLOAD is construction of new airfields. Another is building of whole communities for troops

that the hammer could be raised by crane and then dropped onto the piles, guillotine fashion. The hammer was attached to the crane by a catwalk of wire picket stakes.

It wasn't the prettiest-looking pile driver in the world, but it did the job. As each small section of bridge was completed, the triangular-snouted crane was inched farther out onto the newly constructed bridge deck to drive piles farther across the chasm.

In all, 36 hardwood logs ranging in size from 29 to 32 feet were driven an average of 14 feet to bedrock. The deck of the bridge stands 16 feet above the riverbed. It's high enough to be immune to rising water and strong enough to support any combat equipment, including tanks. To the Vietnamese farmers, who will have the bridge after the war, it looks as indestructible as the Golden Gate Bridge does to us.

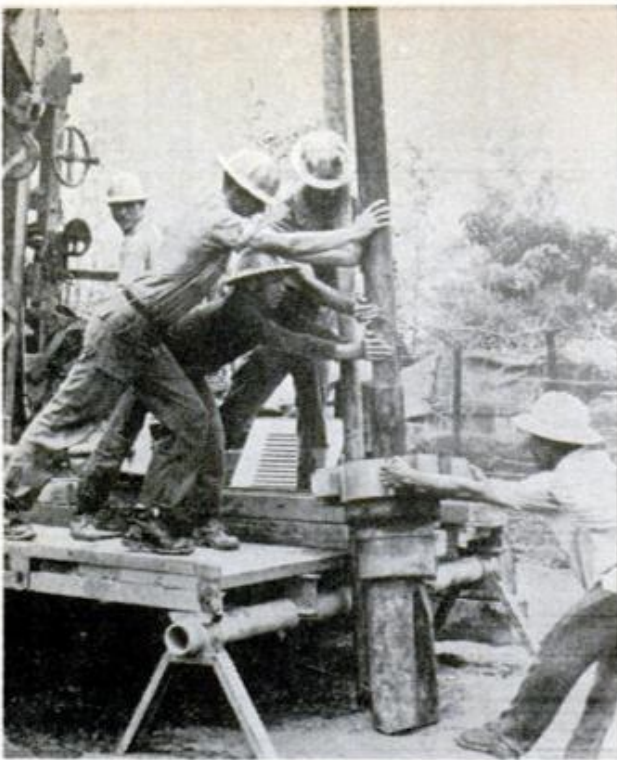
Building bridges such as this is one

thing, but building them in the middle of a war is quite another. However, the Seabees are military and they fight when they have to. Their combat training is under Marine Corps auspices.

"Although he's a first-class construction man who can build anything, anywhere, a Seabee will fight like hell to



CONSTRUCTION AND COMBAT equipment are constantly juxtaposed in Vietnam where Seabees operate



DIGGING WELLS in disease-infested Southeast Asia is vital task to insure supply of pure drinking water



SEABEE UNITS all include doctor, dentist and technicians to care for natives as well as U.S. troops

keep someone from destroying what he builds," says Cmdr. James C. Day Jr., who should know. He commanded Mobile Construction Battalion (MCB) 6 in the Da Nang area for eight months.

But they are a funny lot. Talk to any Seabee and he'll tell you how his outfit built this road or that airfield, this hospital or that church, this dog kennel or that urinal. Unless you literally pull it from him, though, he'll not talk about combat.

Yet, one Seabee, Marvin Shields, has been awarded the Medal of Honor posthumously for action at Dong Xoai. Others have won Silver and Bronze Stars for gallantry. Some 200 have been awarded Purple Hearts for wounds.

No matter where the Seabees go in Vietnam, they build "cities" to house and service from 5000 to 12,000 people. One such cantonment—the military term for "hometown"—to house 7000 troops was built in 12 days by MCB 7 in Hue Phu Bai through "automation."

The cantonment consisted of 122 16 by 22-foot strongback huts, a galley to feed 500 men at a time, eight latrines, three showers and miscellaneous buildings for headquarters and recreation.

A strongback is a "house" constructed

of 2x4s, half-inch plywood and a tin roof. Tin is used instead of canvas because it allows for cooler living—25° cooler in fact. And in a place where the temperature can soar to 150°F., a 25° difference is like airconditioning.

To do the job in record time, the Seabees set up a "prefabrication" plant. Floor joists, deck sections, side and end walls, rafters, doors, steps and louvers



HEAVY RAINS in Vietnam require many drainage culverts to prevent erosion of roads and airstrips

were all cut to specification on jigs and radial arm saws. At its peak output, the plant was easily prefabricating 10 huts in a day, half the time usually needed to complete one strong back.

One vital job done at cantonments concerns erection of water facilities. Water—both too much and not enough—is a tremendous problem in Vietnam.

“The Vietnamese think that the all-outdoors is their own private latrine,” Cmdr. Ralph S. Stedman told me. Stedman was executive officer of MCB 1.

For this reason, Seabees are dotting the landscape with wells, some as deep as 400 feet. Water is pumped to a nearby Seabee-built purification plant where it is filtered, chlorinated and stored.

As important as getting potable water is the job of getting rid of water that destroys highways and airstrips, especially during the monsoon season.

“Last October,” Stedman recalls, “we were hit with 24 inches of rain in one week—14 inches of which fell in one night. Good subsurface drainage, then, becomes absolutely essential to prevent washing away of everything we build.”

One job cited by Stedman that demonstrates the enormity of the problem occurred at Chu Lai where the Seabees were building a crosswind runway for the Marine Corps. Much of the job consisted of constructing three concrete culverts to drain off water and prevent the airstrip from being destroyed.

Each culvert was about 300 feet long by 12 feet wide and 8 feet high. Each took about 2000 yards of concrete, sufficient to pave a mile of highway.

“The Navy,” Commander Day recounts, “had a problem of security for its major supply depot at Da Nang. The VC are always probing, hoping to knock it out. To secure it, the Navy called for sentry dogs from the States. MCB 6 got the job of building a 40-unit dog kennel, but not just any kind. When we finished, this thing became the Canine Hilton of the Far East.”

Sentry dogs are expensive animals . . . strong, but also highly susceptible to tropical diseases. To protect them as



HOMEMADE PILE DRIVER was used to pound logs for bridge into tempestuous river that often overflows



TIME OUT for Seabees from building job often means combat duty, trading picks and shovels for guns

much as possible, the Seabees built each a separate kennel and a special diet kitchen. They also built a dog hospital.

Almost as unique was the construction by MCB 6 of a permanent TV station halfway up 3500-foot Monkey Mountain, which overlooks Da Nang.

“We wanted to give combat troops some home entertainment,” Day says.

The building was made of wood, was air-conditioned and provided with complete electrical facilities. Daily newspapers and live shows by USO personnel are now piped to combat units within a 50-mile radius.

Most Seabee officers hold an engineering degree: electrical, mechanical, civil or architectural. Every enlisted man must be a trained expert in a construction trade, such as carpentry,

(Please turn to page 210)



KITES AREN'T KID STUFF ANymore

By JOHN FIX

READY FOR LAUNCHING is Harry Sauls' 100-square-foot, modified Airfoil—a cargo-landing kite.

MEN FLY KITES! What's so surprising? William the Conqueror is said to have lofted observers over enemy lines so that they might signal the decisive moment for an attack.

A legendary Japanese bandit of the 16th century had himself suspended from a kite so he might filch two fabulous gold fishes from a castle tower.

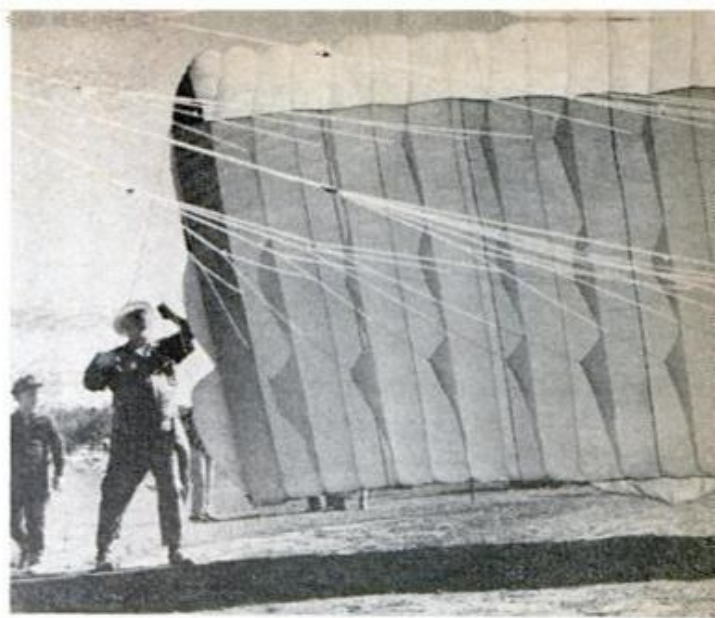
And in the United States wasn't it Ben Franklin who used a kite to prove a point about lightning and electricity?

Today men are still flying what most consider a boy's toy, but the toy has changed and the flying is done for serious purposes. Most of the men are members of the American Kitefliers Assn., a nonprofit organization with headquarters in Silver City, N.M., and chapters throughout the country. One is the Gold Coast chapter of South Florida, where these pictures were taken. Its members fly such exotic creations as the "Para-Foil," an unframed fabric wing that resembles a mattress in flight but can fly untethered, even in rain or snow, and the "Paraglider," which, among other things, has floated a *Gemini* capsule to Earth safely.

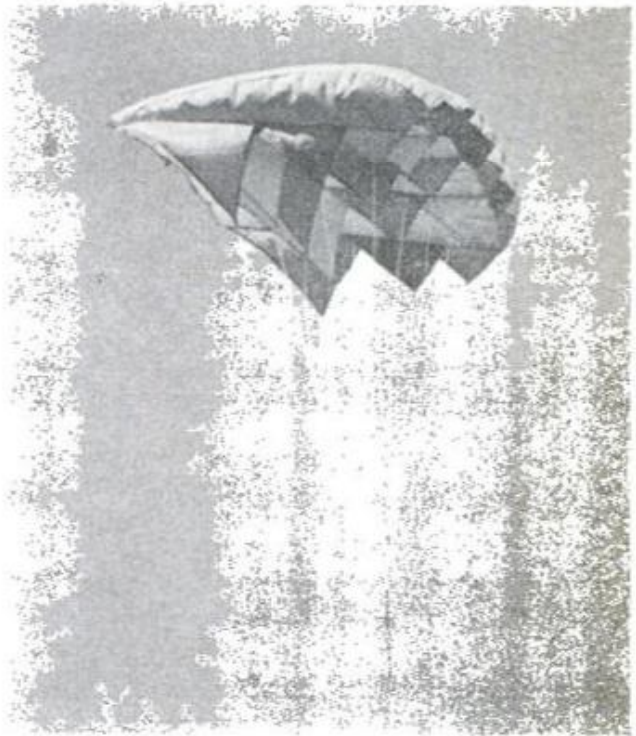
Among the serious projects which the fliers hope to design kites for are:

- Pulling a liferaft or boat to shore.
- Using kites as rain catchers.
- Kites as shields from the sun for occupants of a liferaft.
- Kites to suspend radio antennas.
- Kites with instruments to collect samples of gases and solid particles causing air pollution.
- Kites to seed clouds to release rain.
- Kites to make pollen counts.
- Kites to trap disease-causing insects.
- Kites to mark pathways for hunters.
- Kites as distress signals.
- Kites as sight markers for surveyors.
- Kites for taking aerial pictures.
- Kites to develop and test wind-resistant sail materials.

The Floridians haven't forgotten the youngsters, however. They've developed an inexpensive one, more exotic than the drugstore variety, and less complicated than kites they fly. ★ ★ ★



HUGE PARA-FOIL KITE resembles a mattress, but in flight (below) is extremely stable. All cloth, it's strong enough to hoist a ton with 300 square feet of surface, or a 160-pound man with 66 square feet



PEEK-A-BOO KITE, designed for local youngsters by Gold Coast kilters, uses vents for greater stability





EDITOR BOB CROSSLEY drove Honda N600 on Sayama track and found "Japanese Flea" an agile performer

Handy Little Honda

Japan's motorcycle king has hooked a new air-cooled engine to a front-wheel drive for people who think a Volkswagen is too big

By ROBERT P. CROSSLEY, Editor

IT WAS JUST GETTING DARK. The November air was crisp for Japan, and nobody was swimming in the huge, free-form pool in front of the employees' recreation building. An electronic carillon was pealing *O Susanna!*—why, I'll never know. All was right in the revved-up world of Mr. Soichiro Honda.

I had just driven the motorcycle wiz-

ard's latest brainchild, a tiny automobile called the N600 which he is putting together at Sayama, 50 miles west of Tokyo, and into which he hopes to pack Americans who want cheap transportation but are reluctant to take it on two wheels. Admittedly this is a gamble. The car that the N600 most closely resembles is the Austin Mini. The British Motor Co. doesn't even try to sell

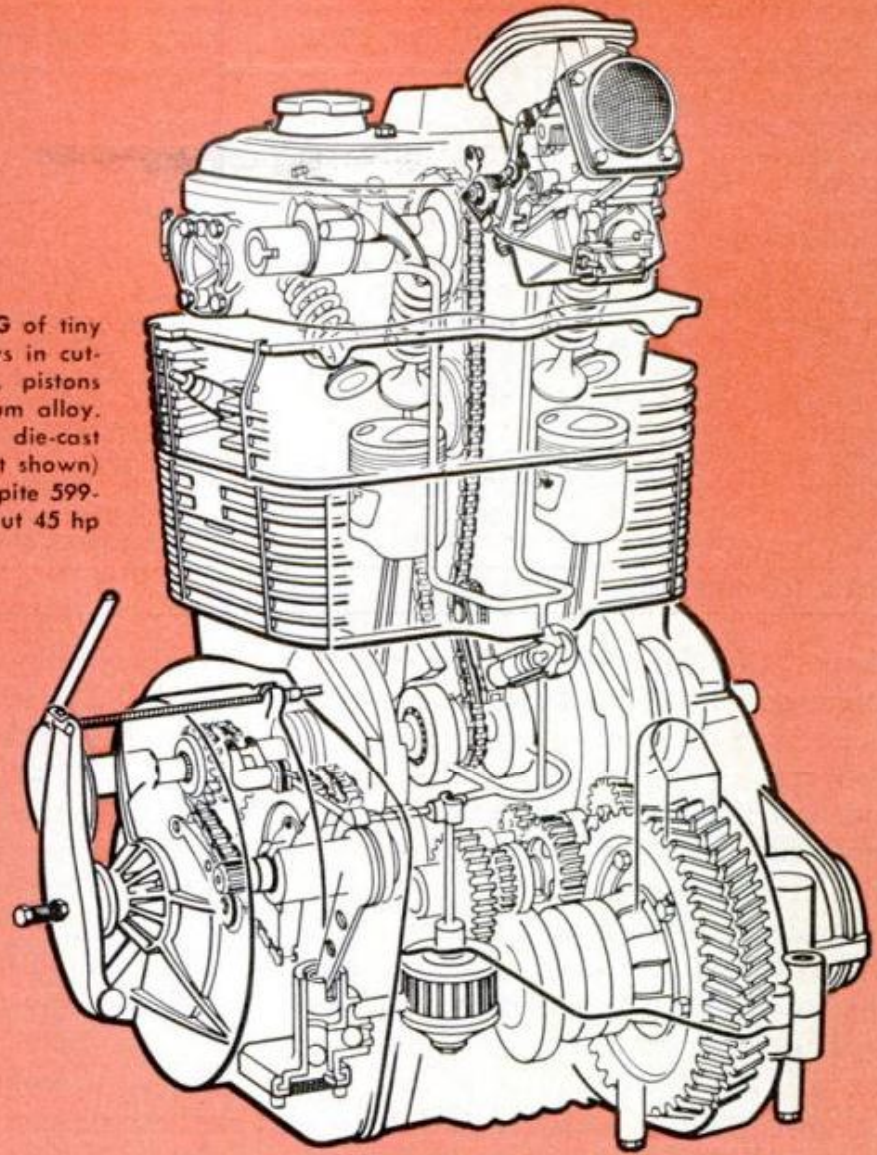
45-HP ENGINE in the N600 enabled Crossley to accelerate from 0 to 80 km/h (50 mph) in just 15 seconds

N600 has independent suspension in the front only. With Crossley is plant manager Shigeru Shinomiya



REAR VIEW OF HONDA 600 ENGINE

SOPHISTICATED ENGINEERING of tiny front-wheel-drive Honda shows in cut-away at right. Block, head, pistons and crankcase are of aluminum alloy. Cast-iron cylinder sleeves are die-cast into block. Air-cooling fan (not shown) mounts on back of motor. Despite 599-cc displacement, engine puts out 45 hp



it in this country. And Fiat stopped importing its rear-engined mini-car, the 600D, this year. But Mr. H. has gambled before. No one thought you could sell a million lightweight motorcycles in the United States either. The Honda strategy is to look for a market no one is serving, then move in on it. He would rather dominate whatever market he can create for mini cars than pick up strudel crumbs from the Volkswagen table.

It wouldn't be fair—or accurate—to call the N600 a four-wheel motorbike, although it brings to mini-car design much of the sophistication that enabled Honda to revolutionize the two-wheel business. Its air-cooled, two-cylinder, four-stroke, single-overhead-cam, hemihead engine, mounted transverse

ly and hooked to a front-wheel drive, is a bored-out version of a brand-new motor introduced when the car made its debut in Japan a year ago as the N360. Except for the more powerful engine and modifications to satisfy U.S. safety laws (because it's under 800 cc it doesn't have to have exhaust-emission control), the N600 is essentially the same as the N360, which car-hungry Japanese are grabbing up at the rate of 20,000 a month.

Even with the "big" engine, the N600 is the smallest car any manufacturer has ever put a real push behind in this country. The first ones should be showing up for around \$1275 at selected motorcycle dealers and foreign-car outlets this summer.

Too small to be labeled a "Japanese

HOW THE N600 COMPARES WITH FIAT 600D AND AUSTIN MINI

	Fiat 600D	Austin Mini	Honda N600
Cylinders	4	4	2
Displacement	767 cc	848 cc	599 cc
Horsepower	32 @ 4800 rpm	37.5 @ 5500 rpm	45 @ 7000 rpm
Cooling	Water	Water	Air
Drive	Rear	Front	Front
Main bearings	3	3	4
Block, head	Cast iron	Cast iron	Aluminum alloy
Compression ratio	7.5:1	8.3:1	8.5:1
Top speed	68.4 mph	73 mph	80 mph
Acceleration (1/4 mile)	26.7 sec.	23.6 sec.	19.7 sec.
Power/weight ratio	42.3 lbs. per hp	32.9 lbs. per hp	27 lbs. per hp
Wheelbase	78.74 in.	80.16 in.	78.8 in.
Length	129.72 in.	120.25 in.	122.1 in.
Width	54.33 in.	55.5 in.	51 in.
Height	55.31 in.	53 in.	52.2 in.
Weight	1356 lbs.	1230 lbs.	1213 lbs.
U.S. price (POE)	\$1237*	(not sold in U.S.)	\$1275

*Price for remaining 1967 models.

Beetle," the Honda might be called a Japanese Flea. Its literature says it is "conceived as a dual-purpose family saloon car." They may buy that in Tokyo, but if I were starting off for Yellowstone with the wife and kids I'd take my '53 Hudson.

But if the Flea is tiny, it's also agile. The N600 is anything but sedentary. The track at Sayama is short, and daylight was almost gone, so I didn't get to really "test" the N600 the way Dan Gurney wrung out the AMX for this month's *PM*. But I did get the feel of it and I'll give it a vote of confidence.

I didn't have a stopwatch, and the speedometer registered kilometers per hour, but I got a reading of 0 to 80 km/h (50 mph) in 15 seconds. Honda's official claim is 1/4-mile in 19.7 seconds. That's not bad for 45 hp.

The N600 is considerably more nimble than either the Fiat 600 or the Austin Mini. Both have larger engines—767 and 848 cc, respectively, to Honda's 599—but the Fiat takes 24 seconds to get up to 50 mph, the Austin, 18.3. As we said, we unofficially got the Honda up to that in 15 seconds. Honda claims a top speed "over 80 mph." The Austin's top is 73, the Fiat's 68.4.

To achieve its low weight-to-horsepower ratio—27 pounds against 32.9 for the Austin and 42.3 for the Fiat—the N600 gives up a little in size and

weight, but not enough to really hurt. Honda says it designed space into the N600, then placed the engine.

The N600 has independent suspension in front only, but its ride isn't bad, and the car wasn't hard to control when I drove it fairly fast over the test track's corrugated bumps.

In keeping with the Honda tradition of high engine speed, the N600 is turning 7000 RPM when it develops maximum power. Block, head, pistons and crankcase are made of aluminum alloy. Cast-iron cylinder sleeves are die-cast into the aluminum block.

The unitized body is of .9-mm steel —(Volkswagen's is .88-mm)—with front fenders and trunk lid made of tough ABS plastic. The whole body is dipped in a paint bath. After tests in Canada, the rustproofing formula was improved to provide greater protection against salt. The car was also tested in the Nevada desert.

The one we drove was white, the most popular color in Japan, but for export the N600 will also come in blue and scarlet. A long list of options includes reclining seats and an automatic transmission. The latter has a seven-position quadrant: P-R-N-D-3-2-1. The first four are for automatic driving; the last three permit manual shifting.

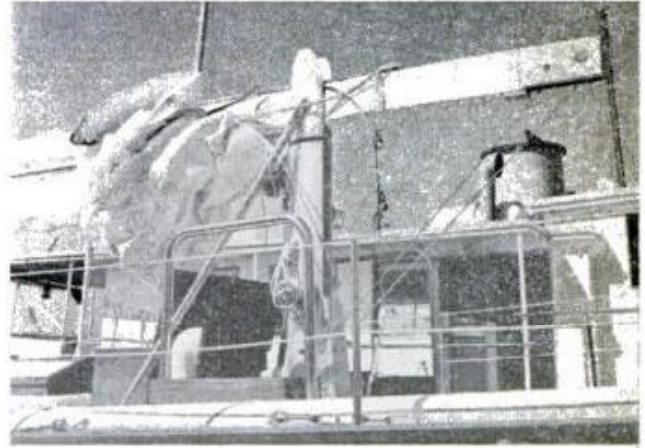
The Sayama factory, just three years

(Please turn to page 202)



Mast takes a dip

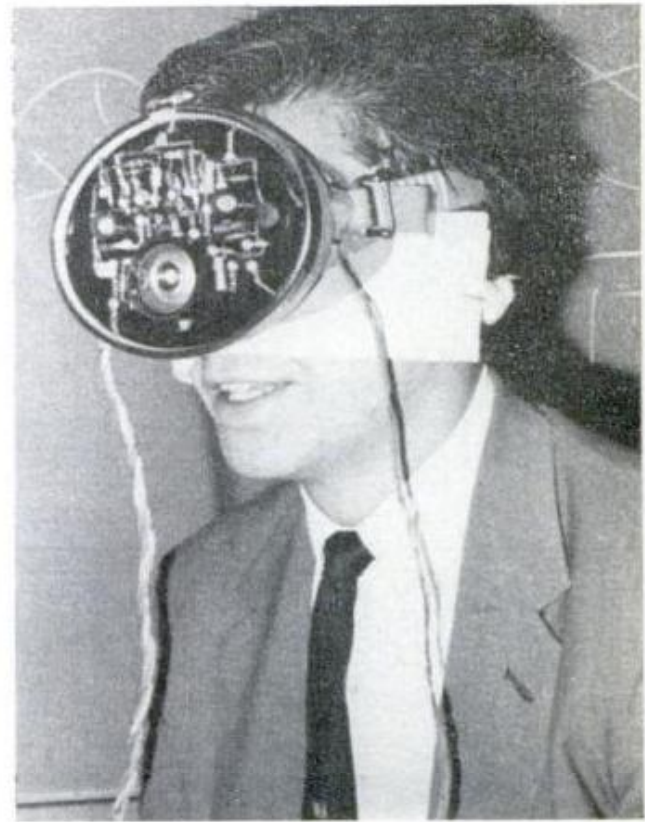
Something has to give when a 61-foot-tall sailboat goes under a 12-foot-high bridge. In this case, it's the boat's mast—but, because of an ingenious pivot, there's no damage. The folding mast is on the *Astral II*, a Columbia 50 racing/cruising sloop owned by Californian Cornelius Vanderstar, who has to go under a highway bridge whenever he wants to sail. Two men can raise or lower the mast in two minutes; one operates pushbuttons that control an electric winch while the other handles two steadying guys.



Apollo firefighter

Spacecraft fires can be smothered by Southwest Research Institute's extinguisher; it ejects foam (water and methyl cellulose) from bellows surrounded by compressed freon gas inside the cylindrical container.

MARCH 1968



Seeing without sight

Photosensitive receivers on the amauroscope catch light and transmit impulses to a blind person's brain via wires attached to his skull. "Dark" reception indicates a solid object. The device is a Mexican development.

91

Hi-fi components go compact

BIG SOUND IN A SMALL PACKAGE

PM listens in on the new compact music systems for proof that hi-fi sound does come from these all-in-one designs, successors to separate stereo components

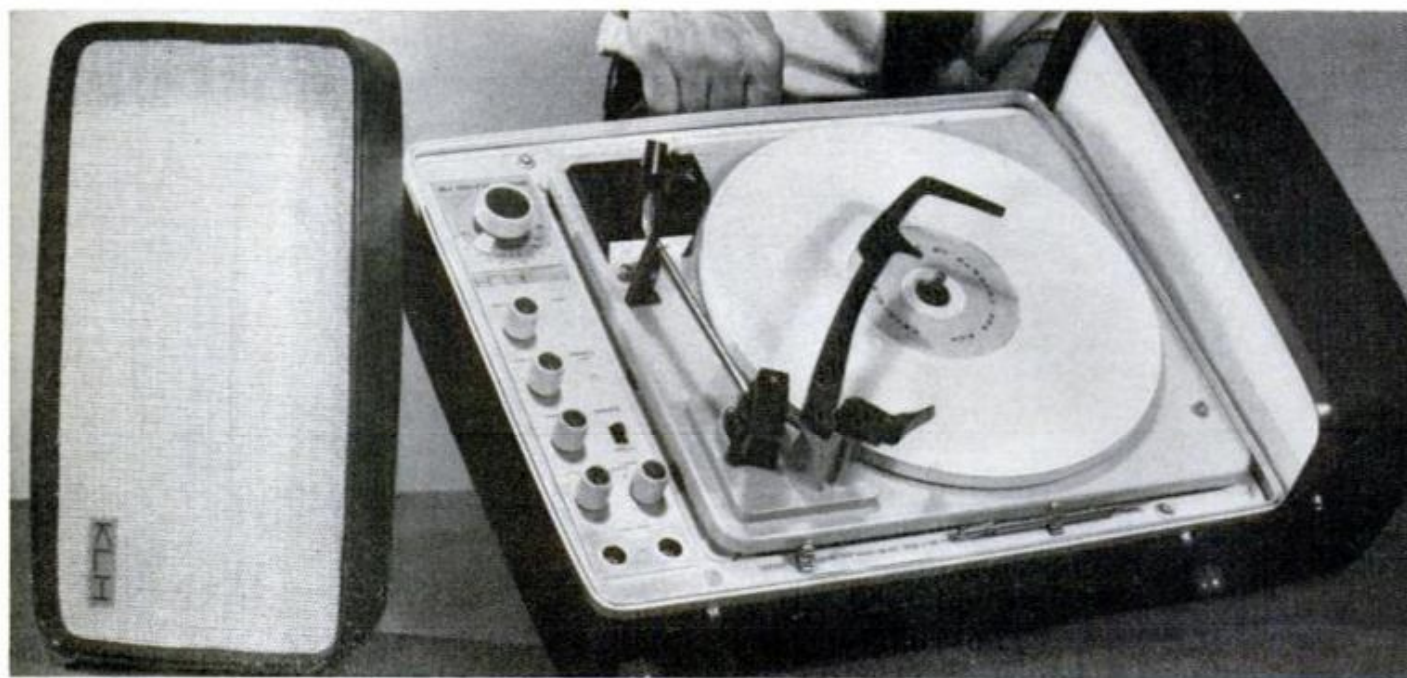
By HANS FANTEL

IF YOU'RE BIG ON SOUND and tight on space, listen to the latest advance in audio design: the stereo compacts. As a group, the new compacts mark a breakthrough in engineering and offer the "soundest" bargains in music systems.

Until recently, experts would say flatly that for a component-quality system you'd have to shell out upward of \$400 and find room for a whole lineup of separately housed sound gear. But thanks to the compacts, you can now

get a good earful in a handy self-contained unit that can sit on an end table. And the price tag is easier to take, too.

Top-grade sound still doesn't come cheap, though. Lend a critical ear to the current crop of compacts and you'll find that genuine high-fidelity starts at around \$200. And the price is higher when a tuner or tape machine is included. The accompanying chart of hi-fi component manufacturers lists stereo compacts that are technically up to par. These manufacturers, pioneers in the

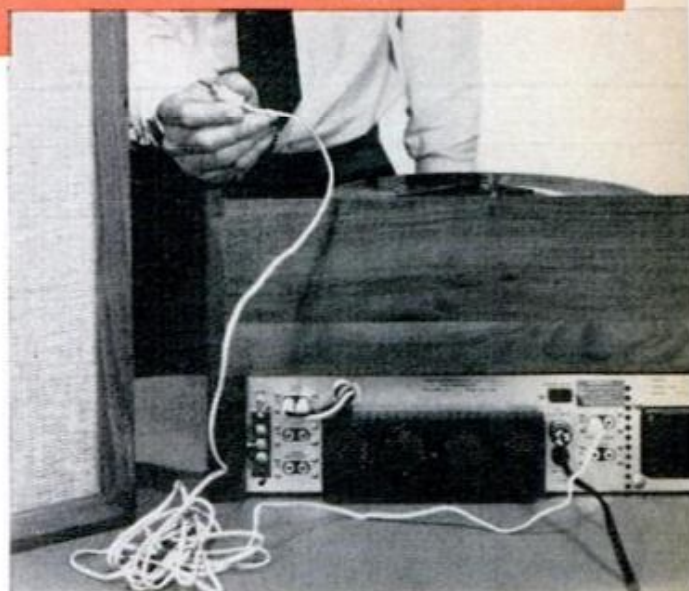




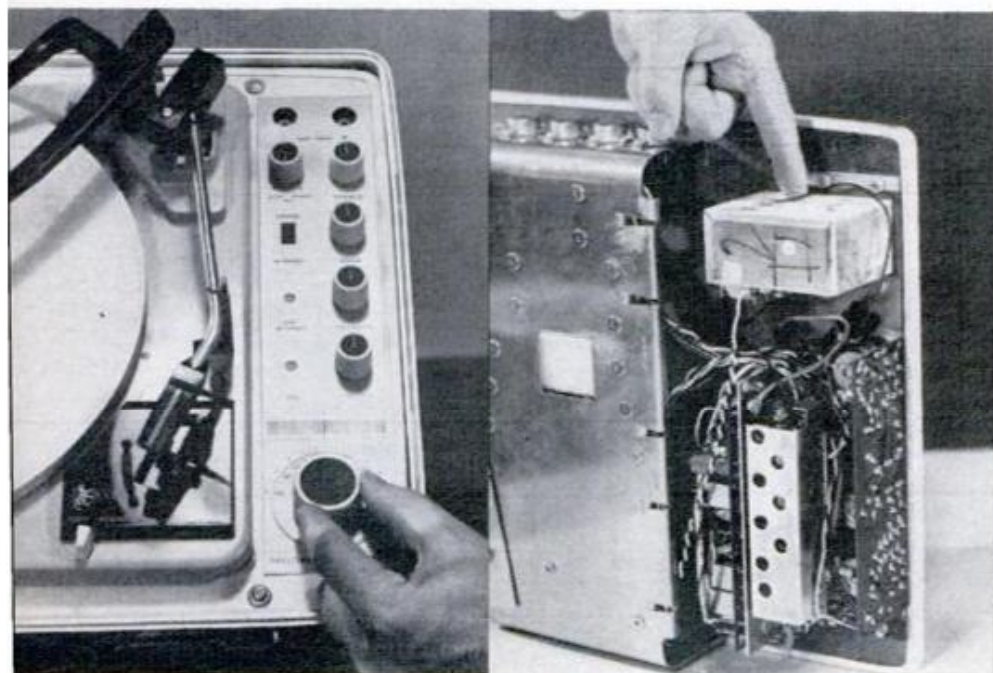
audio art, are setting the standards for sound that manufacturers of less expensive equipment can't meet.

The basic idea behind the compacts is a three-piece design: two speakers and a unit that contains all the "works"—record changer, stereo preamplifier, power amplifier, radio tuner(s) and a full complement of controls. Combining all these elements in one package eliminates a lot of separate hardware.

The speakers are detachable from the principal unit in luggage-type



BOGEN MSC-1 (above) combines AM/FM stereo tuner, amplifier, record changer, 8-track tape player and speakers. Just plug in the speakers and the power cord (which has a built-in FM antenna). Other jacks on rear are for remote speakers and the like



KLH 11-FM is "unpacked" at far left. Cover comes off and the speakers flip off ends. All controls, including FM vernier, are on top panel. Chassis underside shows FM tuning, multiplex and control circuits. Amplifier is directly underneath the changer

compacts so you can put them out of the way—on shelves or into corners. With home-type compacts, the separate speakers are also included in the price and are connected to the main unit as simply as plugging in a lamp with the long speaker leads provided.

A growing trend is to price compacts with the speakers optional. That is, you can get the electronics package without having to buy the speakers since you may already have a pair. This is the case with the new Benjamin 1040, announced too late to be listed on the chart. The price of all the compacts listed does include two speakers.

Since they first appeared just a few years ago, compacts have claimed a chunky share of the stereo market. At the moment, they're the fastest-selling kind of audio equipment, and the swing to the sweet-sounding bantams is still gaining momentum.

This fact raises a basic question: Why

can quality sound systems be made so small now when they couldn't before? The answer is part of hi-fi history. The small table-model phonograph has been around since long before Bing Crosby, but you wouldn't see any in a bona-fide high-fidelity shop. Most were outright insults to the ear. Their puny speakers chopped off the bass, leaving the music sounding thin and shrill. Worse yet, their wheezy amplifiers and stiff-jointed pickups piled up enough distortion to turn the deep swell of an orchestral climax into an ear-grating screech.

No wonder component manufacturers, who made their reputation by sticking to strict high-fidelity standards, shied away from portable or table-model design. Small equipment was left to the noncomponent, "lo-fi" trade. In those days, the designers' dogma was: "You can't shrink size without shrinking sound."

Then came the transistor. In the



BENJAMIN 1050 has a special microphone and instrument input with gain controls for playing guitar through the system



HARMAN-KARDON SC-440 is easily identified by angled front panel. As in most compacts, front panel has stereo headphone jack



SCOTT 2503 has fine AM/FM stereo tuner with usable sensitivity of 2.1 microvolts. The plastic dust cover is optional



FISHER 50-B weighs 35 pounds and has detachable speakers that snap on to form the portable's cover



SONY HP-550 is a walnut and aluminum home unit with compact bookshelf-size speakers

STEREO COMPACTS (Complete, Component-Quality Music Systems)

Mfr.	Model	Type	Record Changer	Power (Watts/channel)	Radio and Tape Features	List Price
Benjamin	1030	Walnut home unit	Miracord	25	AM/FM Stereo	\$400
	1050	Walnut home unit	Miracord	42.5	AM/FM Stereo	500
Bogen	MSR-1	Walnut home unit	Garrard	30	AM/FM Stereo	445
	MSC-1	Walnut home unit	Garrard	30	AM/FM Stereo; 8-track Stereo Tape-Cartridge Player	522
Fisher	50-B	Luggage, portable	Garrard	15		200
	105	Walnut home unit	BSR	17.5	FM Stereo	430
	110S	Walnut home unit	BSR	17.5	AM/FM Stereo	450
Harman-Kardon	SC-440	Walnut home unit	Garrard	25	AM/FM Stereo	450
	SC-2020	Walnut home unit	Garrard	15	FM Stereo	330
	SC-2320	Walnut home unit	Garrard	15	AM/FM Stereo	360
	SC-2520	Walnut home unit	Garrard	15	AM/FM Stereo; Cassette Tape Recorder	480
KLH	11	Luggage, portable	Garrard	15		200
	11-FM	Luggage, portable	Garrard	15	FM Stereo	270
	11-W	Walnut home unit	Garrard	15		200
	24	Walnut home unit	Garrard	35	FM Stereo; AM Tuner optional (\$39.95)	300
	20	Walnut home unit	Garrard	50	FM Stereo; AM Tuner optional (\$39.95)	400
Roberts	RP2000	Walnut home unit	BSR	15	AM/FM Stereo	360
Scott	2501	Walnut home unit	Garrard	18		250
	2502	Walnut home unit	Garrard	18	AM/FM Stereo	400
	2503	Walnut home unit	Garrard	20	AM/FM Stereo (more sensitive than 2502)	470
	2504	Walnut home unit	Garrard	20	FM Stereo	300
Sony	HP-550	Walnut home unit	Garrard	33	AM/FM Stereo	380
	HP-450A	Walnut home unit	Garrard	15		250
	HP-150	Walnut home unit	Garrard	10		180

early 60s, this miniature marvel was used mostly in non-fi applications, such as pocket radios, and rarely in designs where tonal quality was critical. Most audio engineers were still messing with bulky tube designs that cooked up so much heat that big enclosures were needed to allow adequate ventilation.

Solid-state hi-fi circuits were the first step toward compact audio. The result was a solid-state stereo amplifier small enough to fit right under a turntable without taking extra space, yet with enough power to pump out those fat, sassy bass notes.

But before the compacts could move from the lab into the shops, one more hurdle had to be cleared. Big sound, everyone believed, had to come from big speakers. Offhand, this makes good sense. After all, to make lots of sound, you've got to move lots of air. That's where big speakers have a natural advantage. Their large cones push on a greater air surface.

But there's another approach to get comparable results from smaller speak-

ers. What really counts is not the size of the speaker cone, but the amount of air pushed with each stroke, or movement of the speaker cone. Small speakers with a deep stroke can push as much air as big speakers with a shallow stroke. Redesigned speaker magnets, coils and cone suspensions lengthened the stroke of small speakers.

To lower the resonance of the small cones all the way down to the musical bottom—to get a realistic wallop for kettledrums and the right kind of thump for bass fiddles—small speakers were mounted in special airtight enclosures. The air volume trapped in these “baffles” was calculated to give just the right amount of elastic backup force to the swinging cone to let it move in powerful thrusts without booming, rattling or buzzing.

Putting everything together—compact transistor electronics and the new bantam speakers—made it possible at last to design a really compact stereo system without sacrificing sound to

(Please turn to page 221)



Bike trouble

Graham Fulcher, English hovercraft driver, was getting along famously in his twin-prop vehicle until he ripped the craft's skirt on a discarded bicycle. Here he's being towed out.



Cop at corner is camera

Drivers dashing illegally through traffic lights in Frankfurt are "caught" in photos that include a record of date and hour, plus number of seconds since the light changed.



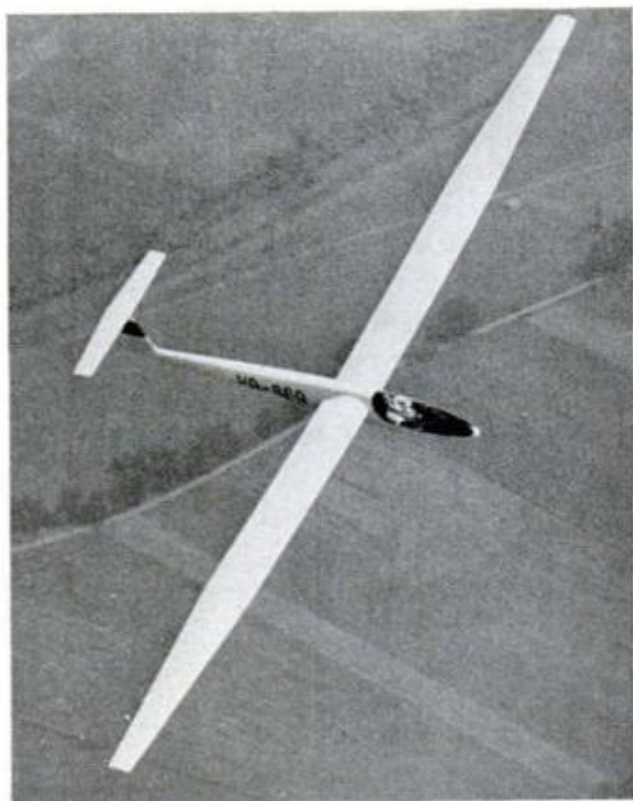
Amphib for snow and water

A propeller-driven Russian amphibian can carry five passengers and baggage over snow, marshland and water. The machine, built in the A. N. Tupolev Works, has a top speed of 93 mph on snow and 50 mph on water.



No hijinks from hijackers

Special markings painted on the top of its trucks may help cut down on hijacking, believes one large British trucking firm. Once a truck is taken by thieves and the alarm broadcast, the vehicle can be spotted easily from the air and the police directed to it.



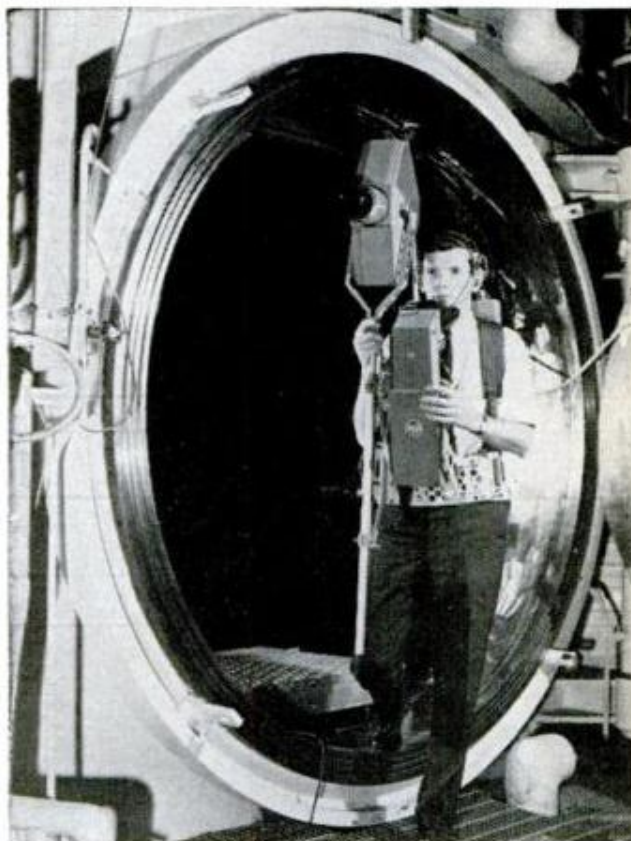
Swiss-style sailing

The Diamant, an all-plastic sailplane developed in Zurich a few years ago, has received FAA certification. It's now being produced in Switzerland by the Fahr & Flugzeugwerke at Altenrhein.



Airconditioned sleeping

You can be about as warm or as cool in bed as you want to be with the Dormair, a new British appliance that lets the user regulate the temperature within a range of 60 to 105° F. The heating-cooling unit, in a steel case, bolts to the foot of the bed. When it's plugged to an electrical outlet, a thermostat regulates the output of air. Steel rods hold the nylon cover above the sleeper.



Portable color TV for orators and orbiters

Two new portable cameras for color television have been demonstrated by two U.S. manufacturers. At left is the Norelco "Little Shaver," which, with harness and electronic backpack, weighs 44 pounds. It'll be used for televising next summer's political conventions, reports the maker, Philips Broadcast Equipment Corp. At right is RCA's portable color camera, designed for various aerospace uses. The camera and power pack weigh 56 pounds. It's shown being carried from a space simulator by an engineer of the RCA Astro-Electronics Div.



High in Style, Low on Mileage

Chevy Chevelle owners—hot on handling and sold on style—still have their share of complaints about fuel and finish

By **BILL HARTFORD**, Associate Auto Editor

Photos by *Bob Mills*

ASK A MAN why he bought the car he's driving and you'll invite some answers you didn't bargain for. Like when you ask a man why he married his wife, you can find yourself wondering why you asked in the first place. It's a question that often has some unexpected answers.

For example, there's the Pennsylvania schoolteacher who bought a Chevelle because "Ford was on strike." And then there's the Pennsylvania Army man who just "needed a new car." And nothing remains to be said when an Ohio manager tells you simply that he "buys a new Chevy every year." More power to him.

But, nevertheless, there's no arguing with the fact revealed by *PM's* survey that the answer for over half of 1968 Chevelle owners was that they were seduced by the car's curves. Forget safety, function and practicality: Chevelle owners aren't asking "how does she cook?" but "how does she look?"

And this is a switch, because when it comes to past experience or owner loyalty, as the auto boys call it, Chevy owners are a very faithful bunch. A look at last year's Impala Owners Report (page 94, May '67 *PM*) is a good example of just how faithful. Owner loyalty was the No. 1 reason for buying. But for this year's Chevelle owners it's style that's way out there selling cars for the master marketers at Chevrolet. Past experience is in second place, not even close behind.

So, because of the Pennsylvania forklift driver who "fell in love with it just looking at a picture," and the Florida engineering planner who "liked the exterior design," and dozens of others whose money is riding on style, the 1968 Chevelle designers are deserving of a hearty pat on the back.

Along with the pat on the back, however, many owners would follow up with some slaps on the wrist. A handful of design goofs is their beef. Most fre-



LACK OF HEADROOM was the only gripe about the otherwise comfortable seating in front and rear

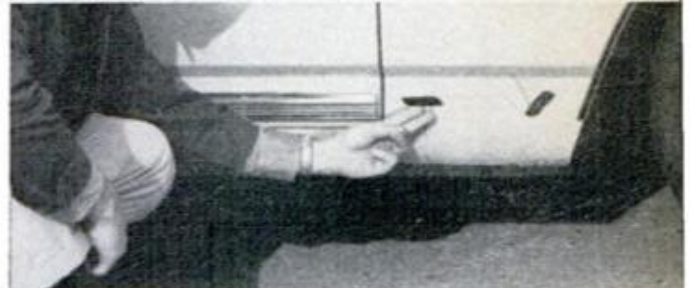
requently mentioned was the design of the recessed ignition switch. The diameter of the indentation is too small to allow your fingers to get a firm grip on the key to turn it on.

This safety feature, which keeps a protruding key from splitting knees in the event of an accident, was said to be such a glaring goof it makes one

TRUNK ROOM was insufficient for some owners; others criticized poor weatherstripping around trunk lid



MARCH 1968



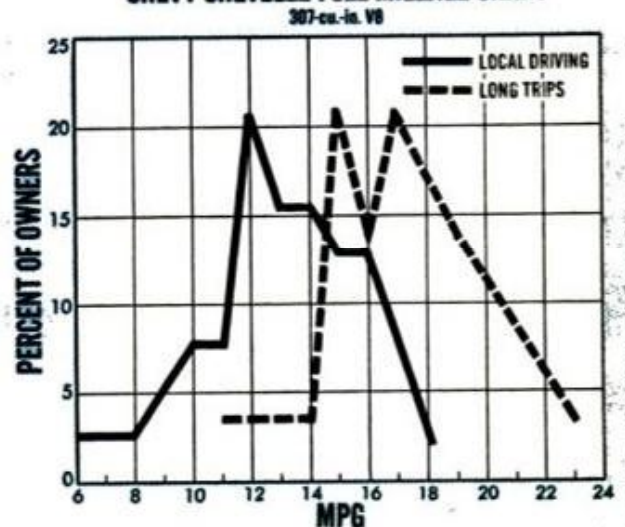
"STOPS ON A DIME," "could be put together better" and "poor ignition switch design," the owners said

wonder if a GM designer, hurt at being scolded for neglecting safety, didn't do it for spite. An Iowa office manager, either innocently or from a desperate need to get his car started and the heck with protruding keys, asks that GM "furnish longer key blanks for the ignition switch."

► Hopefully, this stopgap solution won't be

AVERAGE MILEAGE for most popular 307-cu.-in. engine was 13.0 mpg around town, 16.7 on long trips

CHEVY CHEVELLE FUEL-MILEAGE CHART





PRAISE FOR HANDLING was high, especially among younger Chevelle owners, most of whom drive the SS396

necessary and next year an improved design will be adopted.

Until it is, however, a Nebraska Air Force sergeant has a tip for Chevelle owners suffering with the present design: He keeps his ignition key on a heavy key ring which he uses to turn the key.

Other dash controls and the cigaret lighter were also criticized as difficult to manipulate. The dash design itself was often referred to as "recessed" and

"sunken," the consensus being in favor of a design that brings the entire sweep of the dash and the projecting, padded top edge closer to the driver.

Before letting designers off the hook, owners want it known that rear visibility is another area that could be improved. Poor rear visibility is not the result of one design element but several. An Oklahoma cashier finds the "space between back window and rear

(Please turn to page 200)

Summary of Chevelle Owners Reports*

Total miles driven 280,316

Average miles per gallon:

307-cu.-in., local driving ... 13.0
 long trips ... 16.7
 327-cu.-in., local driving ... 14.1
 long trips ... 16.9
 396-cu.-in., local driving ... 11.6
 long trips ... 14.9

Specific likes:

Handling 51.2%
 Style 48.8
 Power 23.8
 Ride 19.0
 Comfort 19.0
 Performance 17.9

Specific dislikes:

Workmanship 20.9%
 Gas mileage 17.9
 Dash design, layout 10.4
 Insufficient headroom 9.0
 Rear visibility 7.5
 Ignition key location 7.5

What changes would you like?

Improved ignition switch design 14.9%
 More headroom 10.8
 Dash less sunken, brighter .. 9.5
 Rear visibility improved ... 9.5
 Better workmanship 8.1

More trunk room 5.4

Model:

300 Deluxe 4.8%
 Malibu 71.4
 SS 396 22.6
 Nomad 1.2

Transmission:

3-speed manual 9.0%
 4-speed manual 20.2
 2-speed Powerglide 59.6
 3-speed Turbo-Hydramatic .. 11.2

Had any mechanical trouble?

Yes 53.8%
 No 46.2

What kind of trouble?

Carburetor 16.3%
 Electrical 12.2
 Brakes 8.2
 Transmission 8.2
 Alignment 6.1
 Wheel bearing 6.1

Dealer repair satisfactory?

Yes 55.6%
 No 44.4

Why the Chevelle?

Style 51.4%
 Past experience 34.5

Size 28.6
 Price 11.9

Is the Chevelle your only car?

Yes 54.4%
 No 45.5

Other cars owned:

Chevrolet 34.1%
 Ford 17.1
 Corvair 12.2
 Buick 7.3
 Cadillac 7.3
 Volkswagen 7.3
 Rambler 7.3
 Pontiac 7.3

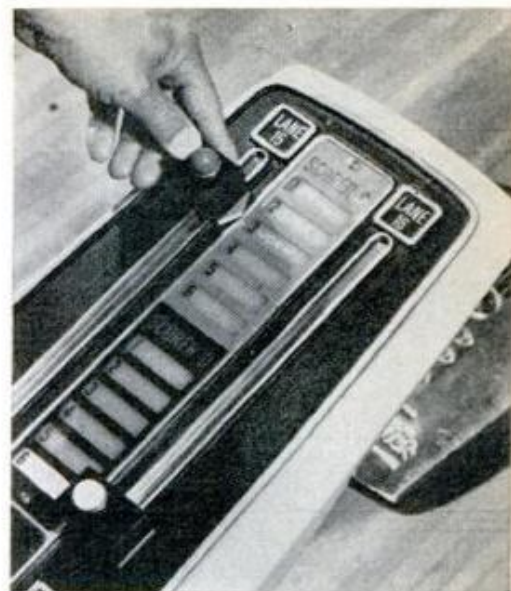
What options/accessories?

Radio 80.0%
 Power steering 71.4
 Airconditioning 24.0
 Whitewall tires 20.0
 Tinted glass 20.0
 Power brakes 16.5
 Vinyl top 16.0
 Bucket seats 14.7
 Positraction 12.0

Age distribution of owners:

15-29 47.7%
 30-49 27.7
 50 plus 24.4

*Where applicable percentages may not equal 100 percent due to rounding and/or insufficient sample.



All the bowler does is bowl

Are you intimidated by the job of keeping score for a group of bowlers? If so—here's help. Brunswick now has an automatic scorer that records pinfall—ball by ball, frame by frame—computes and totals individual and team scores, and, in a fraction of a second, prints them on a permanent scorecard (left) and projects them onto an overhead screen (upper left). As each bowler's turn comes up, he moves the lever on the identification panel to his name (above), and then he bowls. A digital computer linked to the automatic pinsetter records the pinfall and calculates the score.



Fair pair in fairing

This is an English version of a Japanese motorcycle ridden by an astronaut's version of femininity. The Suzuki two-wheeler is enclosed in a fiberglass housing for display at a motorcycle exhibit; the ladies are in heat-protection material used in spacecraft.

MARCH 1968



Nuclear heater for wet suits

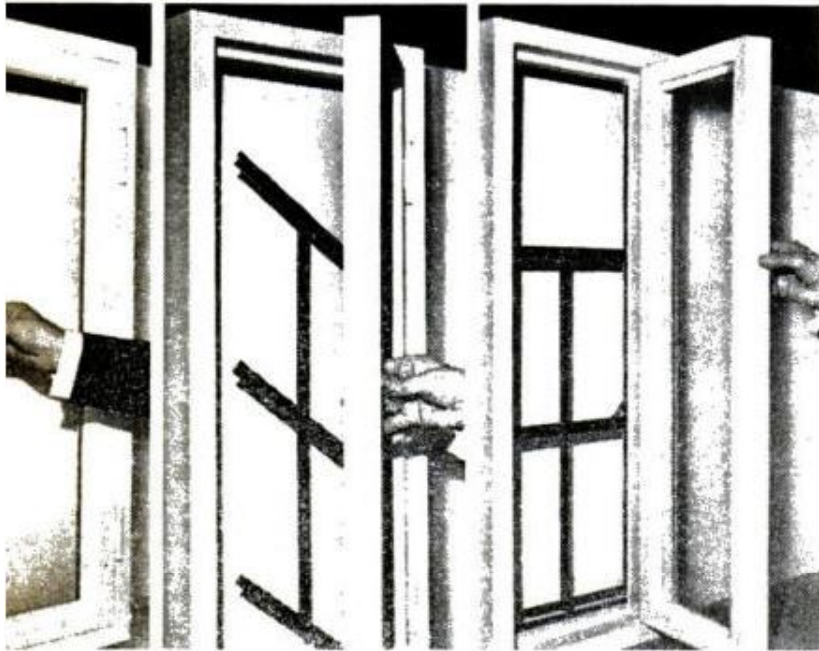
Tiny plastic tubes interwoven through the mesh of these "long johns" circulate warm water to keep a diver comfortable in his wet suit. The water is heated by an isotopic source, plutonium-238, in an aluminum container. It'll keep a diver warm in 45° water.

101

Just patented

PM'S PICK OF THE NEW INVENTIONS

Illustrations by Don Evans

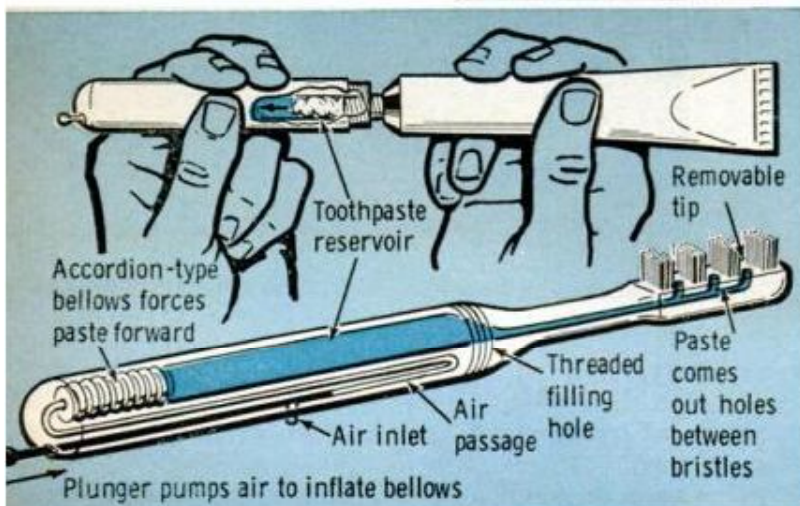
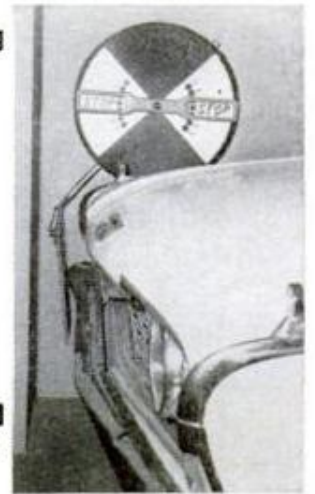


1. DISAPPEARING BARS protect children from falling out of windows without the ugly appearance of permanent grillwork outside the glass. When the window is safely closed, the bars are retracted out of sight. As the window is opened, a metal grid automatically swings down to block the opening, as shown in the photos at left. As the window is closed, the pivoted bars fold up into the casing again, out of the way. An arm at the back of the sash is linked to a lever inside the casing to move the grid up and down. The mechanism is designed to fit a variety of stock-size window openings so it can be installed as a replacement

2. THERE'S NO DANGER of smacking the back wall of your garage with the clever parking indicator at right. It consists of a pivoted disc mounted on the wall with an arm suspended below it. The arm is adjusted so that the bumper strikes the end of the garage. This rotates the disc until a warning to stop appears in the indicator windows. By watching the disc, you have plenty of time to stop safely with the car still an inch or so from the wall or from articles that are stored in front

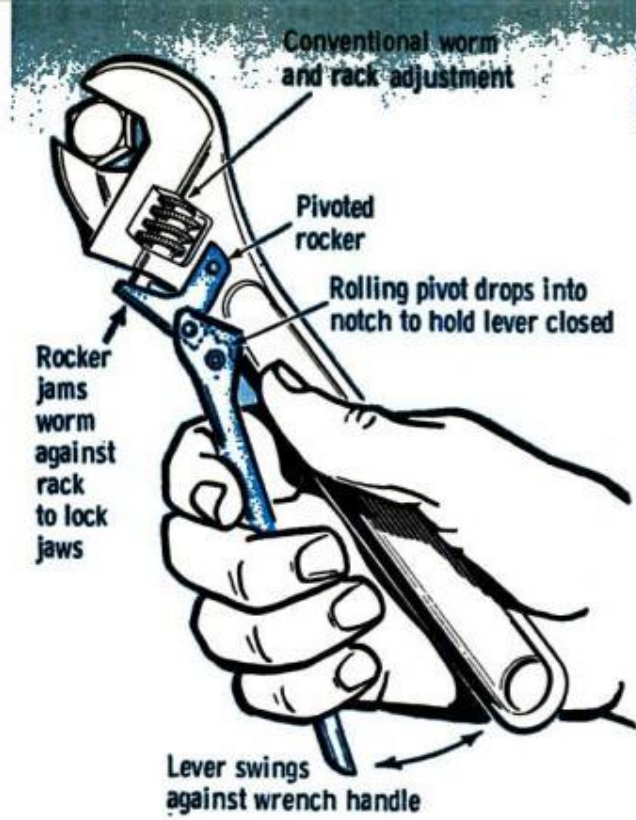


Warning disc rotates on central pivot
 Mounting plate screwed to wall
 Adjustable collar
 Window indicator remains horizontal
 Bumper plate swings forward as car presses against it



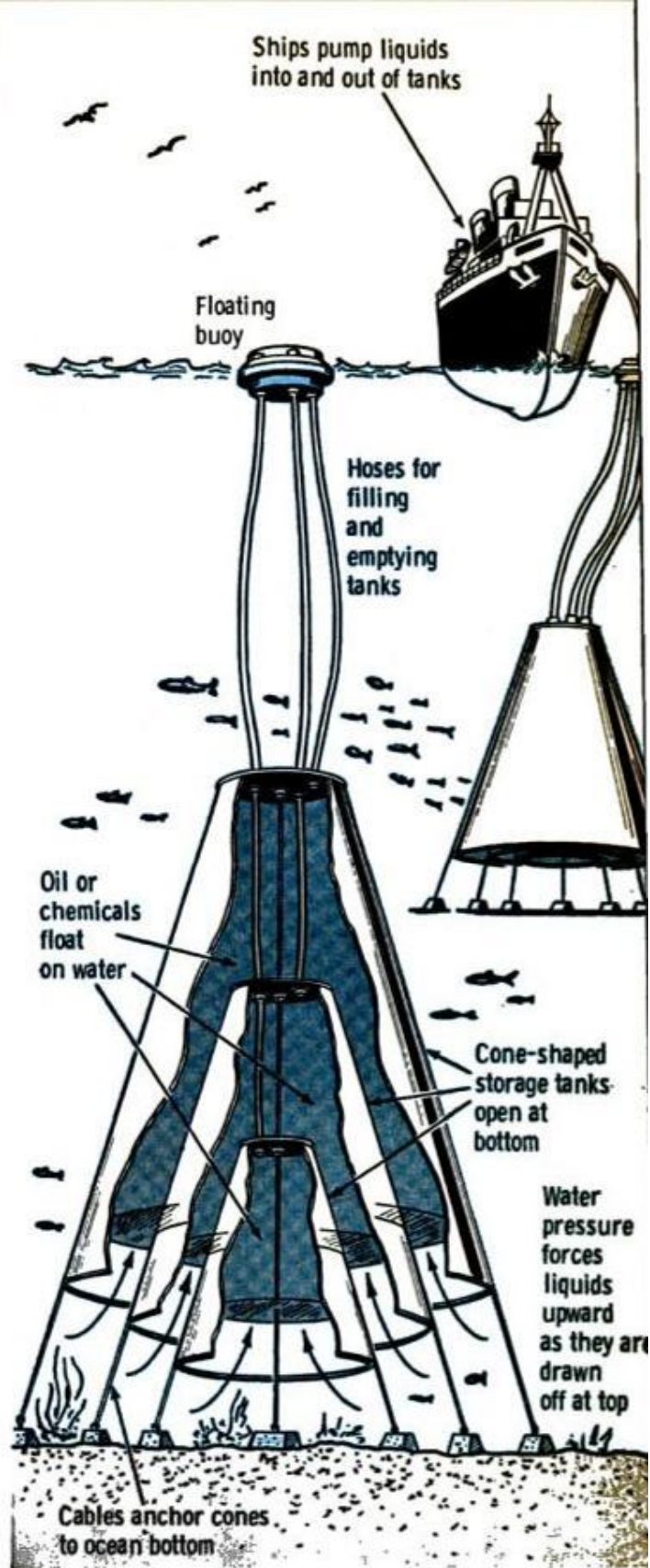
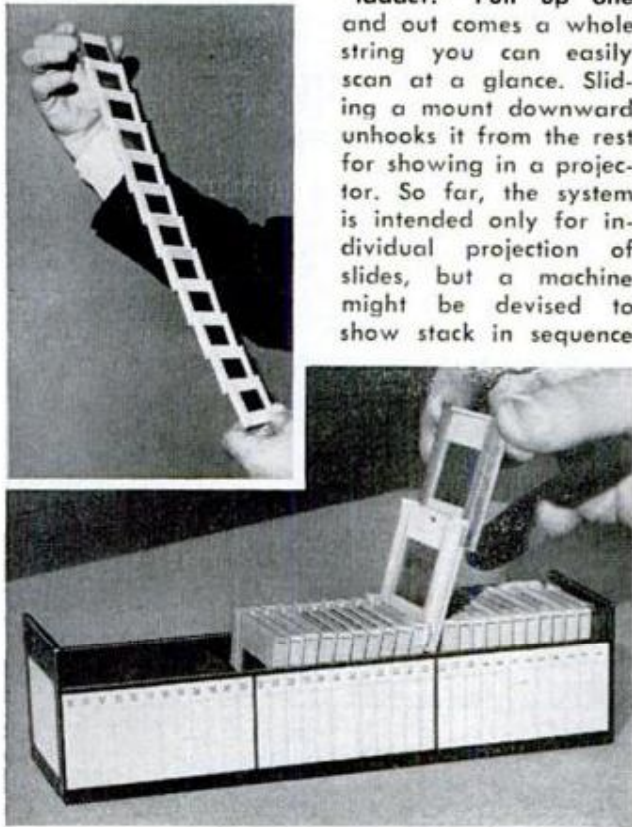
3. PASTE-DISPENSING TOOTHBRUSH at left carries its own supply of dentifrice right in the handle. Pumping a plunger a few times squirts toothpaste out onto the bristles, ready for instant use. A miniature accordion-type bellows inflated by the plunger provides the pressure to force the paste out of the reservoir. To load the handle, the brush tip is removed and a conventional tube of paste is screwed into a hole threaded to match the tube's cap threads. Squeezing the tube then fills the handle with no mess

Inventors of the items shown on these pages are as follows: 1. Finnish Market Facts, Ltd., Helsinki, Finland; 2. Otto Mandl, North Baldwin, N.Y. (No. 3,261,321); 3. Raul J. Eklund, Lincoln



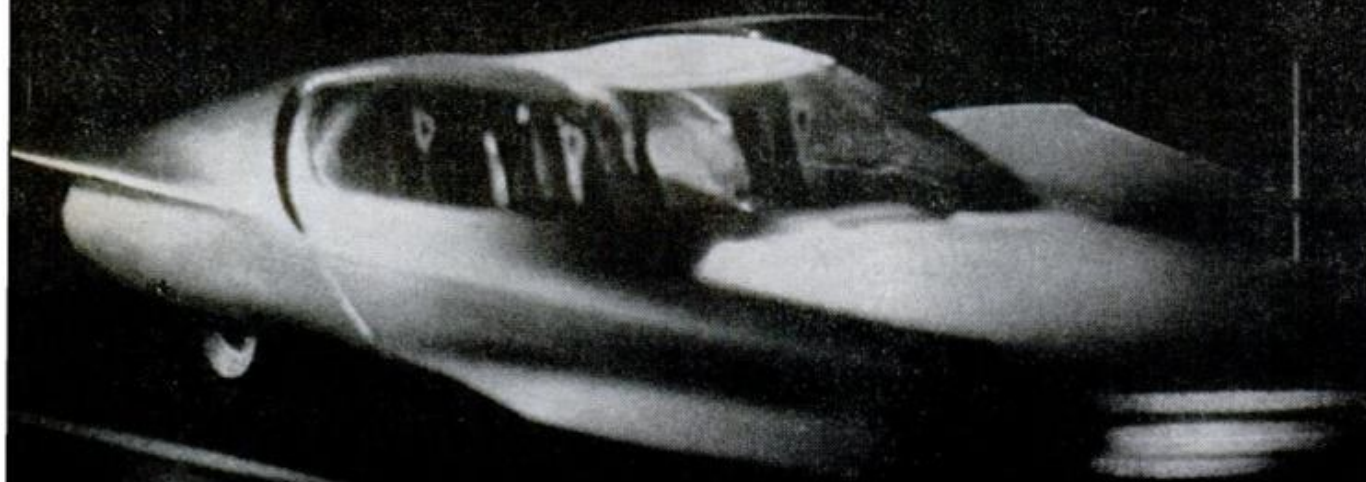
4. **LOCKING JAWS** on the adjustable-end wrench above eliminate the annoying slipping and loosening that often develop after you've set the adjustment. Squeezing a lever on the handle jams the worm wheel against the rack that moves the sliding jaw in and out. This removes the play between the worm and rack and prevents the jaw from shifting once it's set. Releasing the lever frees the jaws

5. **SORTING THROUGH SLIDES** to find one you want would be faster with these special plastic mounts that hook together to form a telescoping "ladder." Pull up one and out comes a whole string you can easily scan at a glance. Sliding a mount downward unhooks it from the rest for showing in a projector. So far, the system is intended only for individual projection of slides, but a machine might be devised to show stack in sequence



6. **UNDERWATER STORAGE TANKS** for gasoline, oil and other lighter-than-water liquids are designed to solve many problems: They lessen the chance of fire and explosion, get the hazardous liquids away from shore communities, save valuable land, and put the supplies out where tankers can readily reach them for loading and unloading. The ingenious tanks are merely a series of stacked cones open at the bottom. The cones are anchored in the sand and have hoses running up to a float on the surface. Water pressure keeps forcing the lighter liquids upward where they're easily drawn off at the top

Park, Mich. (No. 3,187,758); 4. William C. Chapman, Brighton, Mich. (No. 3,333,492); 5. Rektor Jan Emn, Osterbybruck, Sweden; 6. Gilbert Siegel, Garden Grove, Calif. (No. 3,339,512).



HOLOGRAPHY: 3D MAGIC IN MID-AIR

Holograms—incredible images that seem to hang in space—promise three-dimensional movies and TV, automatic fingerprint recognition and whole libraries stored on tiny matchbox-size crystals

By JAMES R. BERRY

Technical Art by ZIK Associates, Ltd.

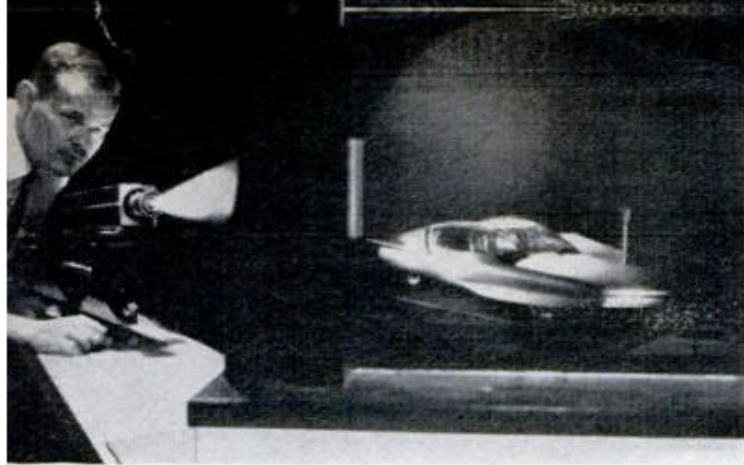
GHOSTLIKE, the three-dimensional image hung in space before me. A few seconds earlier, Dr. Emmett Leith of the University of Michigan's Institute of Science and Technology had splashed the light of a laser onto the back of what looked like a foot-square sheet of thin glass. Suddenly, I found myself staring at the image of a sleek, futuristic-looking car. In the background, partially hidden by the first car, was another.

"Take a look at the car's rear wheels," said Dr. Leith. As I bent down, more of the car's underside came into view. Through the wheels, I could see the

second car. I stood up, got closer and peered into the car's cockpit. There were bucket seats, a padded dash and a floor shift—all clearly visible *inside the car*. At the same time, the car in back could be plainly seen *over the roof* of the one in front.

Dr. Leith then snapped a switch and the fantastic illusion disappeared, leaving only the small pane of dirty gray glass in front of me. What I had been watching was a hologram—an image on a sheet of film that's so lifelike you'd swear you could reach out and touch it.

A hologram, unlike a conventional



PHANTOMLIKE IMAGES seen here and on the opposite page are holograms of two futuristic model cars made at the University of Michigan in cooperation with General Motors. The images appear only when film is illuminated by intense light from a laser, as above. Setup for making the hologram is shown below. It includes prism for splitting laser beam and mirrors to reflect the beam onto the film



photograph, is not an actual picture of an object. It is a picture, made without a lens, of a complex pattern of light waves reflected by an object. By itself, a hologram is merely a meaningless blur of streaks, blobs and swirls. These streaks and blobs are a kind of code representing light waves imprisoned on the surface of the film—just as the hills and valleys in the grooves of a phonograph record are a code representing sound waves imprisoned in the plastic disc.

When a hologram is illuminated by a laser beam, it is "played back" in much the same way as a phonograph needle converts the impressions on a record into live sound. The streaks and blobs on the film shape the light waves into a visible image that's an exact duplicate of the original object that formed them.

The big difference is that a holographic image contains much more than a conventional photographic

image. Because light reflections spread out in all directions from all points of an object, the light pattern captured by a hologram contains information about parts of the object not directly visible to the eye or to a camera lens.

A hologram can, in effect, "see" around corners and behind and under and into things. As you move your head to the right, you see more of the object's right side and the same for the left side, just as you would if the object were real. You see more of the bottom if you stoop down low, and more of the top if you get up high.

Holograms are thus the first truly three-dimensional pictures. Their name comes from the Greek word "holo" meaning "whole" — literally "whole pictures."

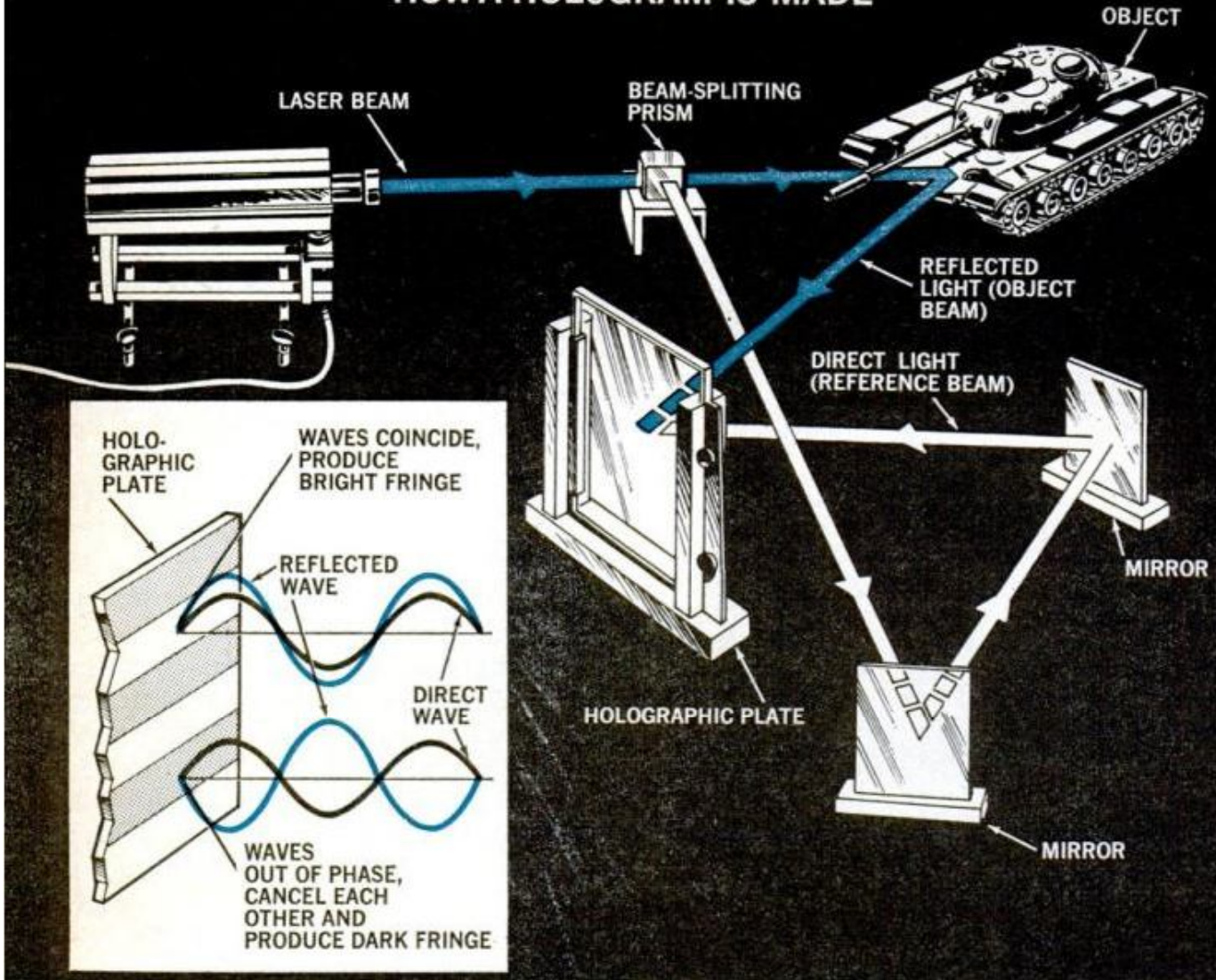
The hologram's incredible realism promises exciting developments. Imagine the startling effects possible with 3D movies and TV. Of more immediate importance to science are holographic images made through a microscope. Because holograms capture more than is directly visible to the eye, researchers can study minute organisms like cells and microbes a layer at a time, penetrating through the surface. The American Optical Co. already has prototype equipment capable of producing such holograms.

By recording identifying information

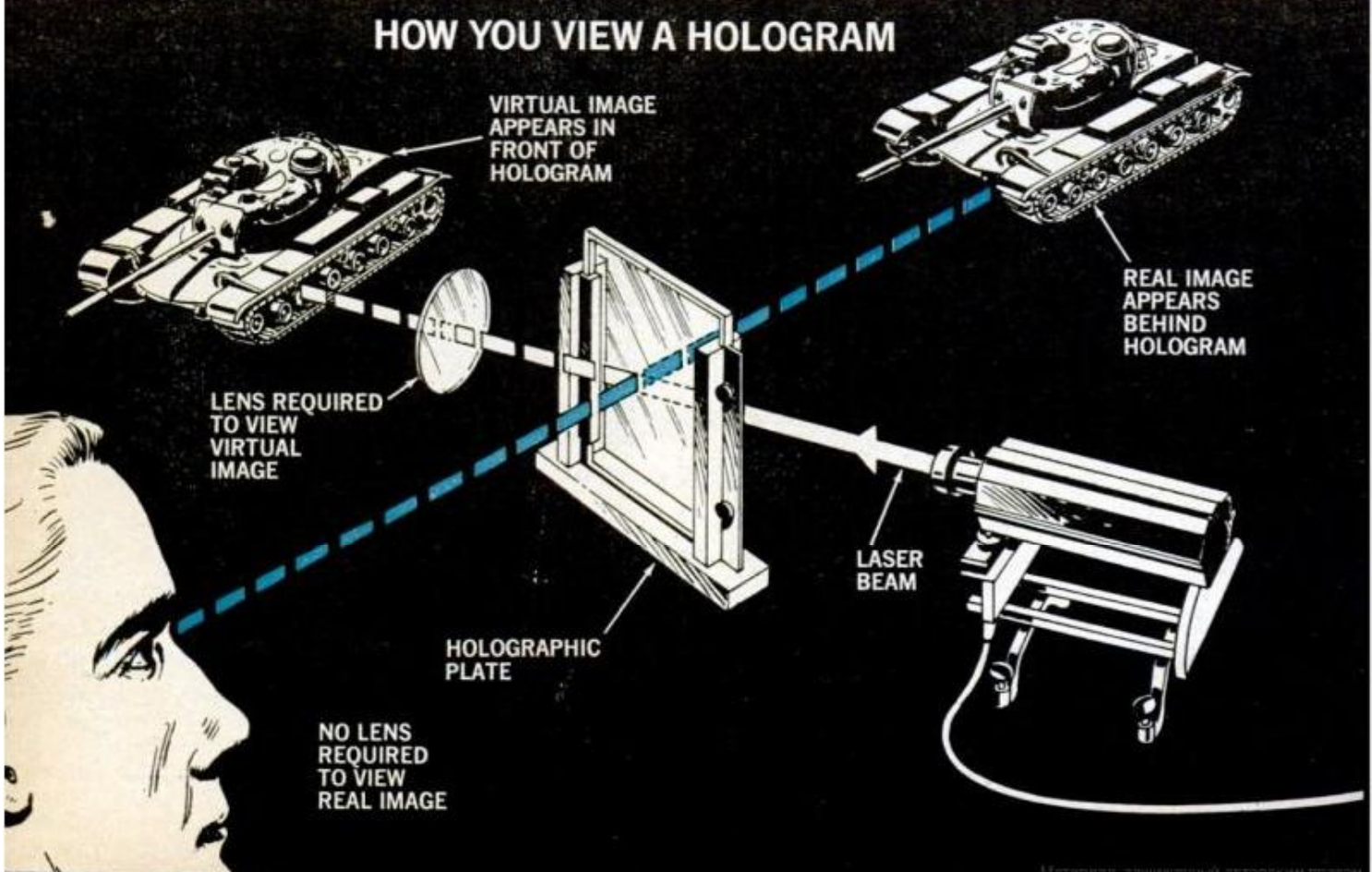


MEANINGLESS MASS of streaks and swirls is all you see on a typical hologram. They represent a code—like the grooves on a phono record. Image is reconstructed when light shines through the film

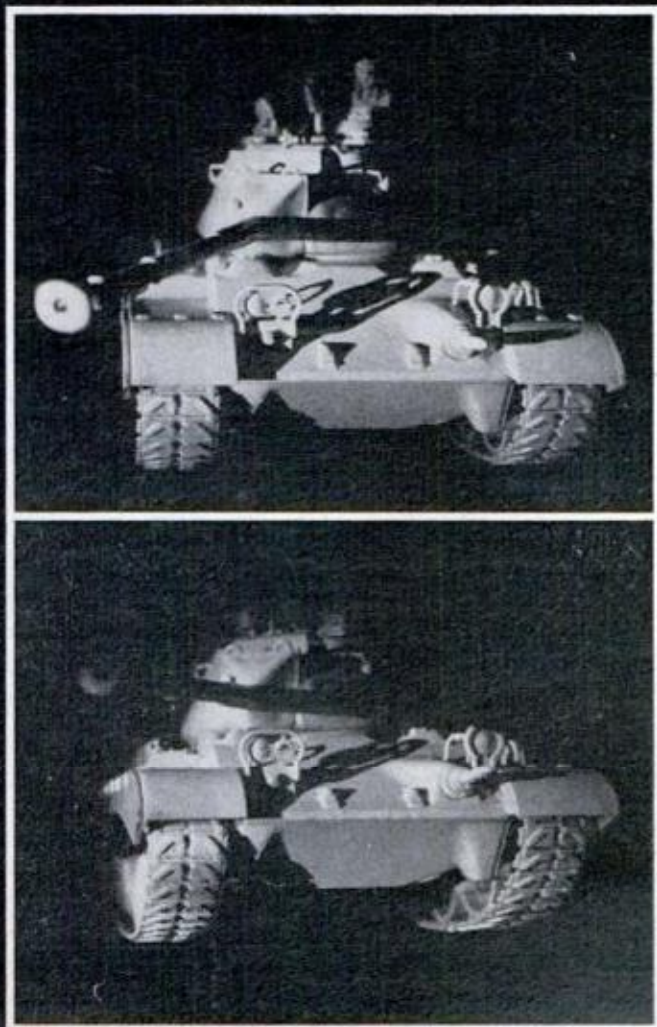
HOW A HOLOGRAM IS MADE



HOW YOU VIEW A HOLOGRAM



UNUSUAL PICTURES of a toy tank (below) illustrate the amazing three-dimensional quality of holograms. They are actually two photos of the same hologram, made by shifting the camera. In the upper view, with the camera high and almost head on, you see the top of the tank and only the front of its right track. In the bottom view, with the camera lower and moved to the left, you now see the side of the right track and more of the underbody — just as if you had shifted your head while looking at a real model. Drawings on the facing page show the two basic setups for making and viewing a hologram. A laser is used in each case, but the arrangement is slightly different. In making a hologram, the beam is split by a prism so one half illuminates the object and the other hits the film directly. The inset diagram shows how waves from the two beams meet at the film and either reinforce each other or cancel each other out. The resulting light and dark streaks, called "fringes," constitute a code pattern recorded on the film. When the developed film is illuminated by a laser, this code pattern bends the waves to reconstruct the original image. Two images appear, one behind the hologram called "real" and one in front called "virtual." The real image is readily visible, while the virtual image usually requires a lens to focus it



on a hologram, it can be used to recognize fingerprints, words and seismic wave patterns. This leads the way to automatic classification and retrieval of things like electrocardiograms, brain-wave recordings and names and addresses.

Because holograms record only light patterns in an abbreviated code, thousands of different pictures can be squeezed onto a single hologram and viewed consecutively by slightly changing the angle at which the laser beam illuminates the film. The number of possible images skyrockets up into the millions if, in place of film, a tiny light-sensitive crystal is used. Eventually, it may be possible to store a thick book on a crystal the size of an aspirin or an entire library on one no bigger than a matchbox.

How a hologram is made

Obviously, if film were merely exposed to a flood of light, it would turn black all over and contain no image at all. What produces the coded light patterns is the interaction between two separate sources of light. The laser beam that's used to illuminate the subject is split in two by a prism. One half is aimed at the subject and is reflected onto the film just as in conventional photography. The other half is aimed directly at the film. This half is called the "reference" beam.

Light waves in the reference beam march along in neat, regular rows, like a column of soldiers, because there is nothing to get in their way. But the waves that bounce off the subject are jumbled and scattered, just as a column of troops would be if marched through a dense forest.

When the two sets of waves meet at the film, they clash. At the point where the crest of one wave coincides with the crest of another, the two reinforce each other, becoming brighter than either would be by itself. Where the crest of a wave meets the trough of another, the two cancel each other out, leaving

(Please turn to page 206)

Sun Too Bright? Just Dial Your Own Instant Shade

This amazing new glass blocks out light at the twist of a knob, promising glareproof car windshields, curtainless windows and exotic camera filters that turn any color you want for wild special effects

By SHELDON M. GALLAGER and LEONARD E. SABAL

Photos by Robert D. Borst

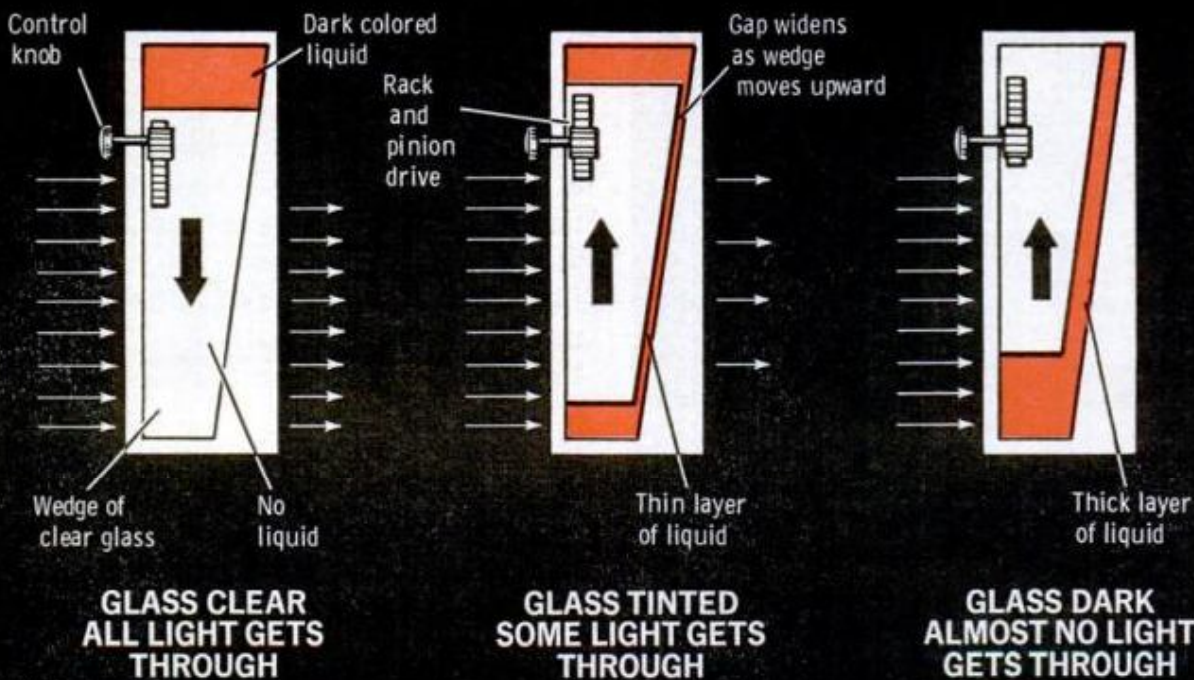
YOU DON'T BELIEVE your eyes at first. You're looking through a piece of clear glass. As you turn a small knob, the glass suddenly gets dimmer and dimmer until you can't see through it at all. You keep twisting the knob back

and forth, trying to figure out what's making it happen. Nothing appears to move—the glass just turns black.

This remarkable new development is the brainchild of Spanish inventor Luis Aparicio of Madrid. Its magical



ADJUSTABLE SUNGLASSES let you dial any shade from clear to dark. The drawings below show how the thin glass wedge inside moves up and down to vary the amount of dark-colored liquid that acts as a light-absorbing filter

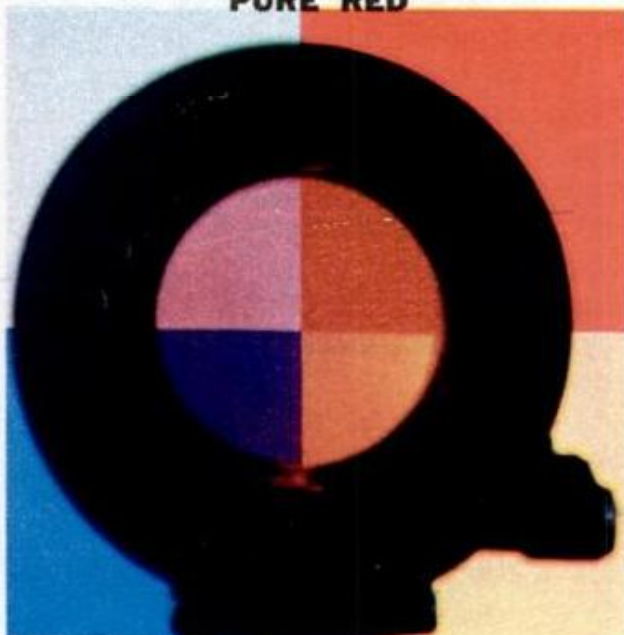


You Get Striking Colors, Too

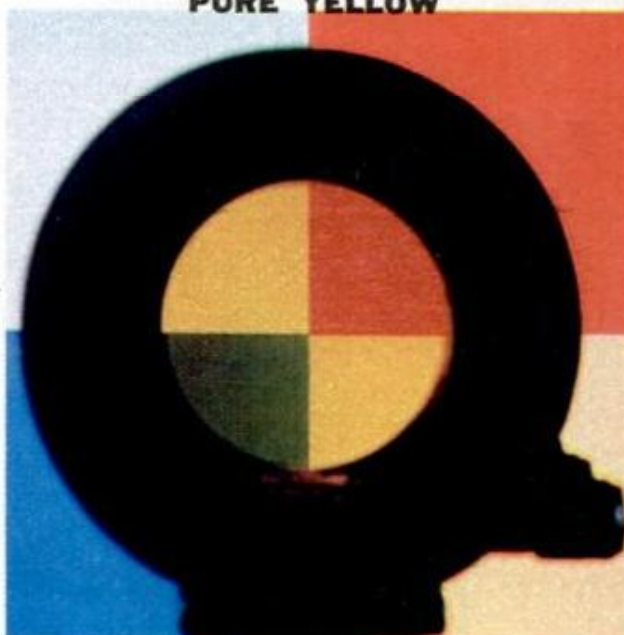


COLOR-CHANGING FILTERS work just like the glare-reducing type except that the dyes are colored instead of black. The thicker the layer of liquid inside the glass, the deeper the color produced. The filter shown here is actually a combination of three separate elements—one for red, one for yellow, and one for blue, with a knob to control the intensity of each. The filters can be operated individually to give varying shades of one color, or they can be intermixed to create additional hues. The test shots below, made against a background panel of different colors, show the effect each filter has on those colors. In the first three, pure primary colors are used. Note how the white background square turns the color of the filter in each case. The fourth example, at lower right, shows how two filters can be combined to produce a third color—in this case, blue and yellow to give green. In photography, such filters could provide any shade needed for precise color correction or to create dramatic special effects, such as accentuating red in a fiery sunset or adding blue to a cold winter scene

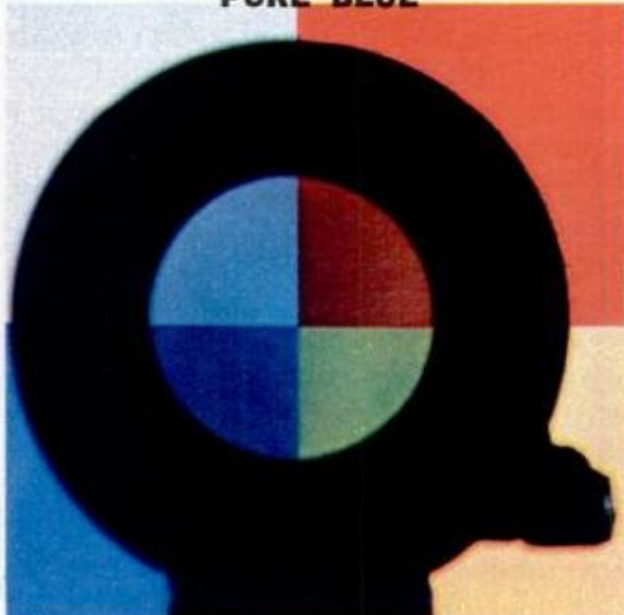
PURE RED



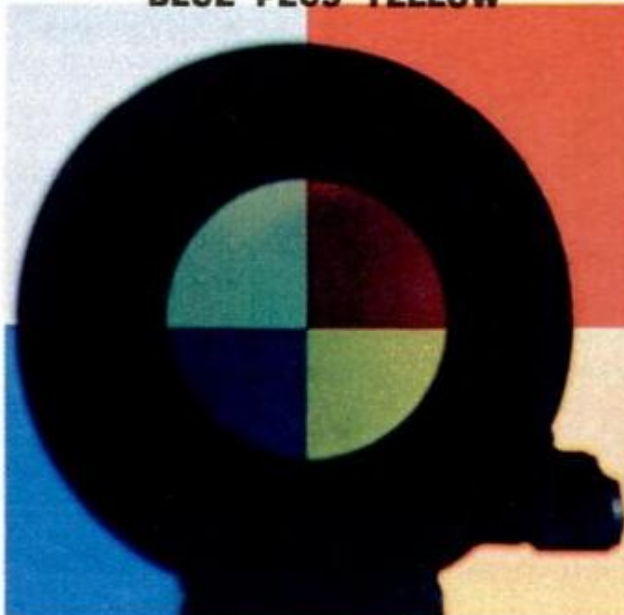
PURE YELLOW

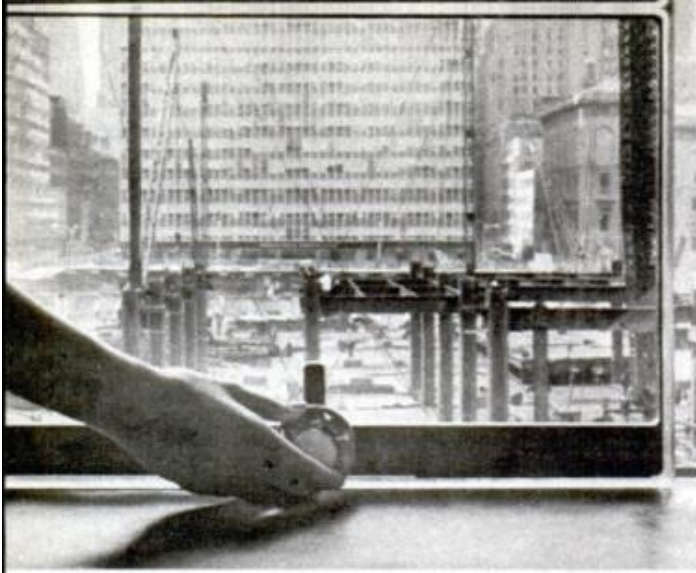


PURE BLUE

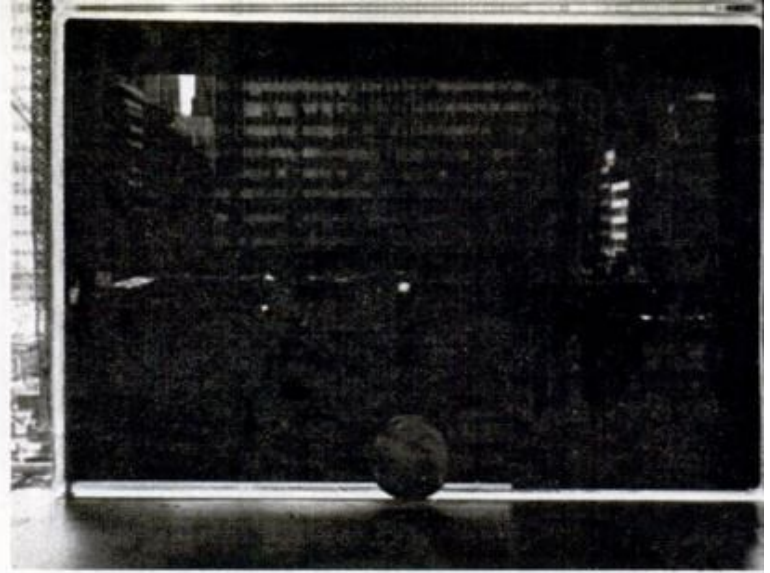


BLUE PLUS YELLOW

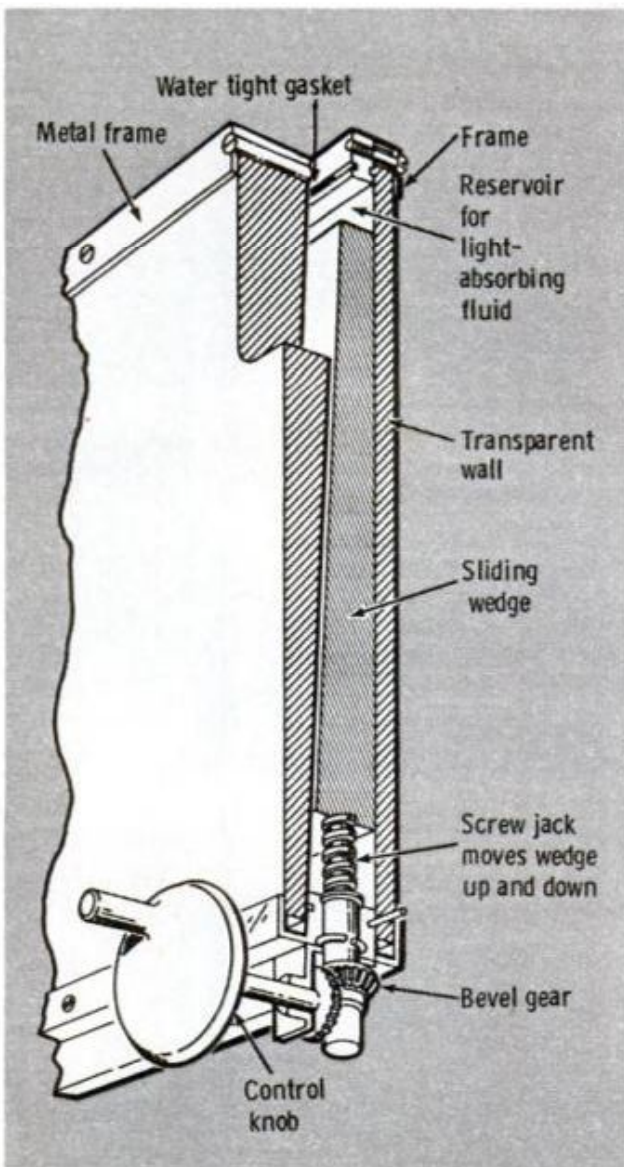




NOW YOU SEE, NOW YOU DON'T. Test panel of the new glass shows view through office window with it



clear (left) and dark (right). Dark band at bottom in photo at left is reservoir of dye-colored liquid



SANDWICH OF GLASS shows how layers are arranged to form a tiny, watertight hollow space inside

qualities promise to make possible many ingenious light-dimming and glare-reducing devices. Imagine being able to tint your car windshield light

or dark depending on how much sun is in your eyes. House windows would need no shades or curtains—you'd just dial the degree of visibility you want at any time of day or night.

As in many great inventions, the basic principle is deceptively simple. The glass actually has a tiny hollow space inside to hold a dark-colored liquid. The liquid acts as a filter, controlling the amount of light that can pass through the glass. The hollow space is tapered so it's narrower at one edge than at the other, as shown in the drawings. Sliding inside this space is a matching wedge of thin glass.

As the wedge moves toward the narrow edge, it squeezes the dark liquid out of the way, leaving the glass clear. As it moves toward the wide edge, the liquid flows into the gap, blocking the passage of light. The thicker the layer of liquid, the darker the glass appears.

The liquid is ethylene glycol containing a black dye. By substituting a colored dye, you get a variable-density color filter. Aparicio has already devised an experimental setup combining three such filters in the three primary colors—red, yellow and blue. By intermixing the filters in various ways, you can produce almost any shade of any color—a trick that opens up many fascinating possibilities in photography, stage lighting and color TV. The system won first prize at the last International Inventors and New Products Exposition in New York City. ★★★

You, Too, Can Break the Sound Barrier

It won't be long now. The first supersonic plane designed to carry passengers should make its maiden flight this year. Here's how the British-French Concorde was built, how it will fly and what you can expect when you take your first ride at 1450 mph.

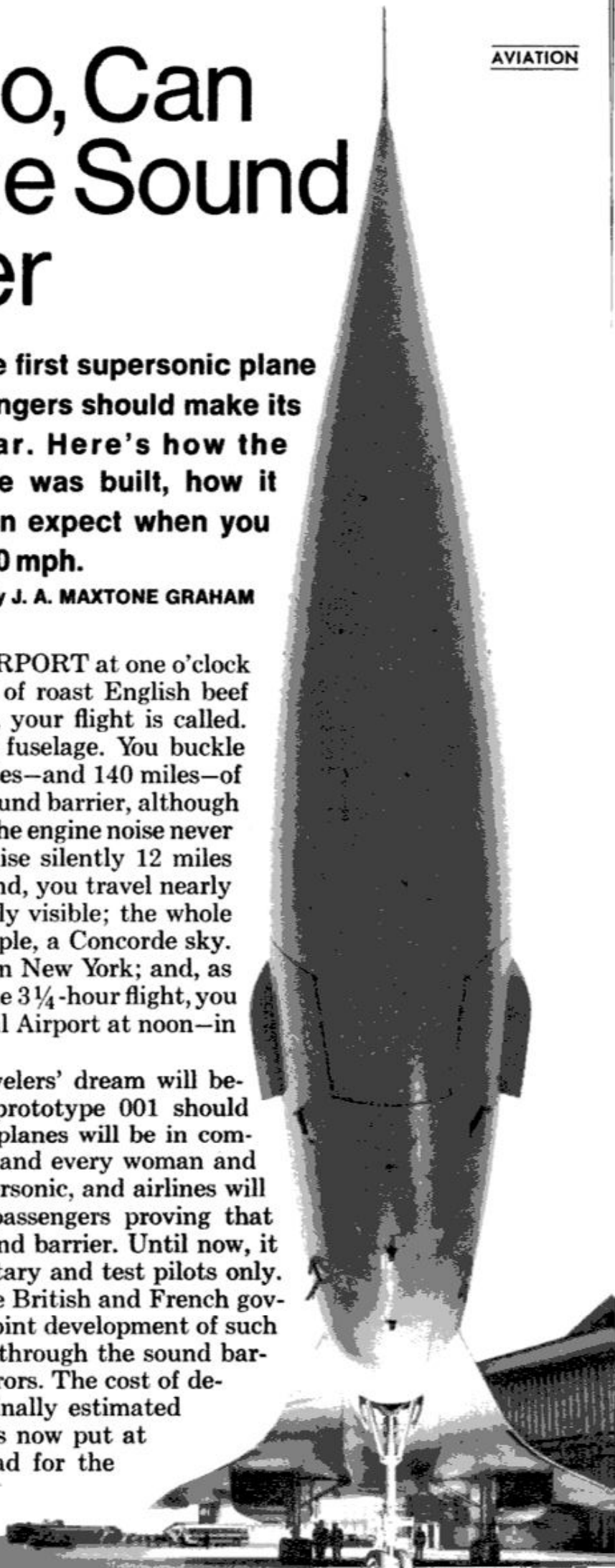
By J. A. MAXTONE GRAHAM

YOU SIT IN LONDON AIRPORT at one o'clock and eat a leisurely lunch of roast English beef and Yorkshire pudding; soon, your flight is called. You enter a long, pencil-slim fuselage. You buckle your seat belt. After 15 minutes—and 140 miles—of flight, you pass through the sound barrier, although you hear nothing. And, since the engine noise never catches up with you, you cruise silently 12 miles above the Atlantic; each second, you travel nearly half a mile. The globe is barely visible; the whole sky is a deep but delicate purple, a Concorde sky. Before long, you are landing in New York; and, as you adjust your watch after the 3¼-hour flight, you land at Kennedy International Airport at noon—in time for lunch again.

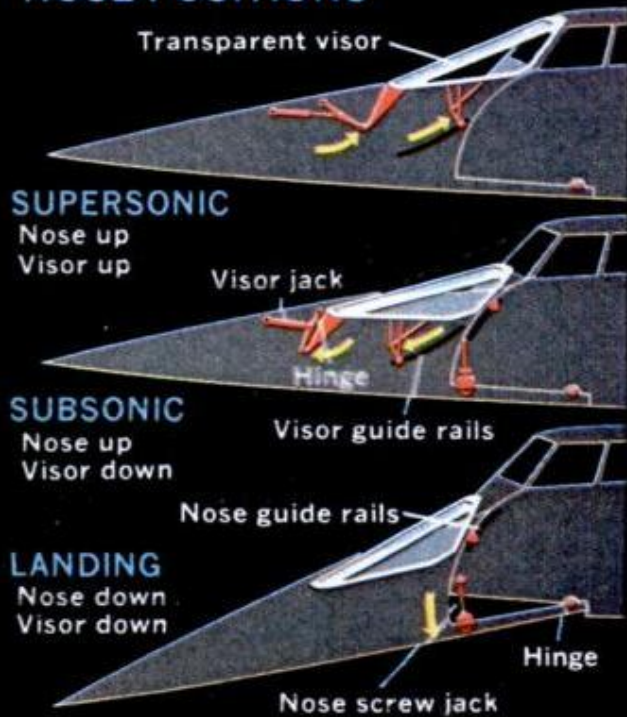
In three years, such a travelers' dream will become real. Soon, Concorde prototype 001 should take to the air; by 1971 the planes will be in commercial service. Every man—and every woman and child—will be able to fly supersonic, and airlines will issue distinctive badges to passengers proving that they've been through the sound barrier. Until now, it has been the privilege of military and test pilots only.

More than 12 years ago, the British and French governments met to discuss the joint development of such an aircraft, once the passage through the sound barrier was proved to hold no terrors. The cost of development was colossal. Originally estimated at \$450 million, the project is now put at \$1.5 billion—about \$15 a head for the

(Text continues on page 114)

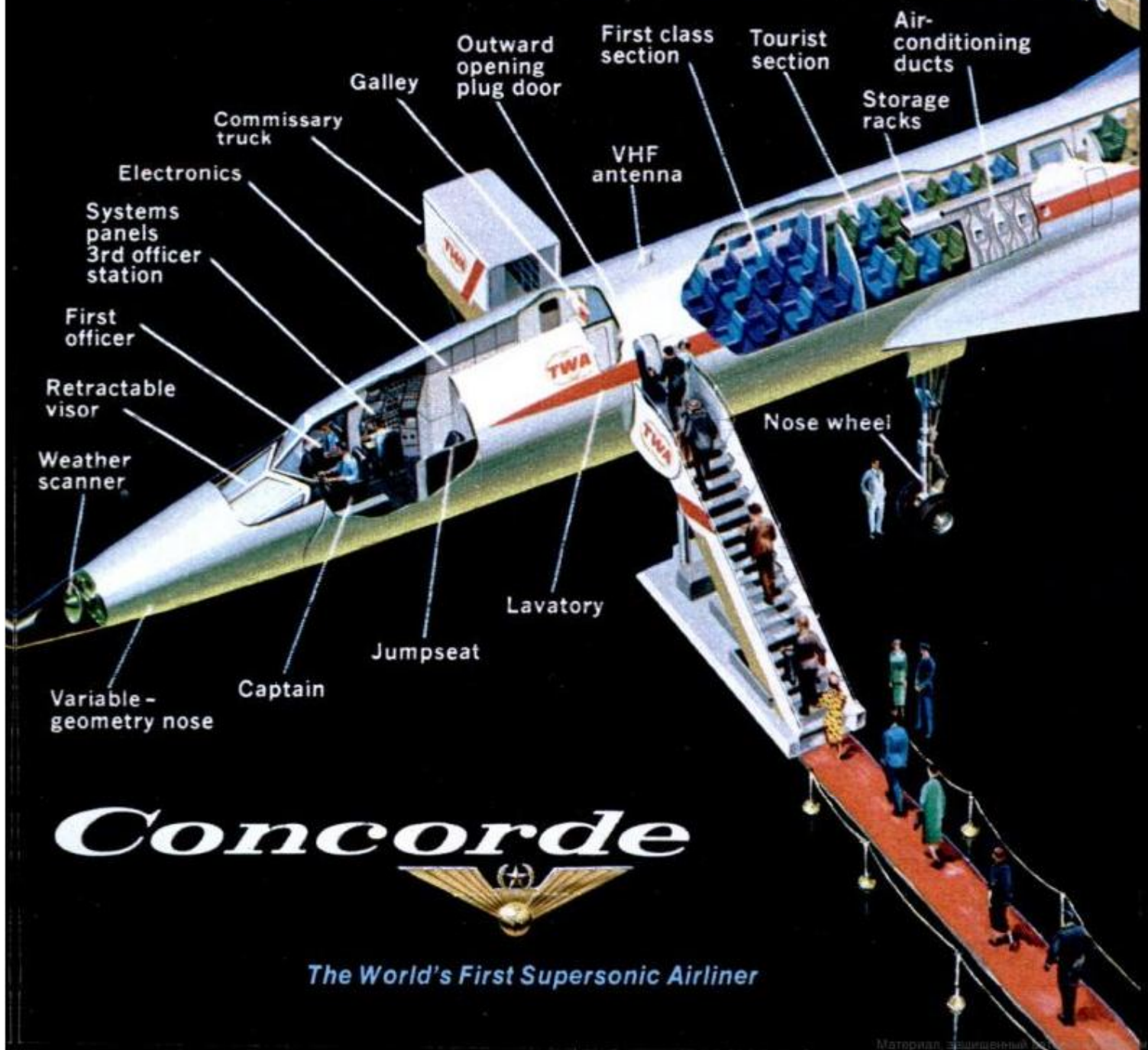


NOSE POSITIONS



THIS is it! This is the Concorde, the first airliner that will offer the thrill of supersonic flight to the average passenger. You, or anyone, will now be able to board this plane and break the forbidding sound barrier, fly at more than twice sound's speed, and streak into a world where no bird has been, nor man either except for that happy breed of military and test pilots. They paved the way so you may follow. Now the limits of flight seem less limited. The Concorde will take you from New York to London in 3 hours and 22 minutes, and no point on earth is more than 12 hours away. Besides supersonic flight, the Concorde offers several other firsts for commercial aviation. It's the first airliner with a delta wing, the first to change its configuration while in flight (see left), and the first jetliner to introduce sound suppressors on its engines.

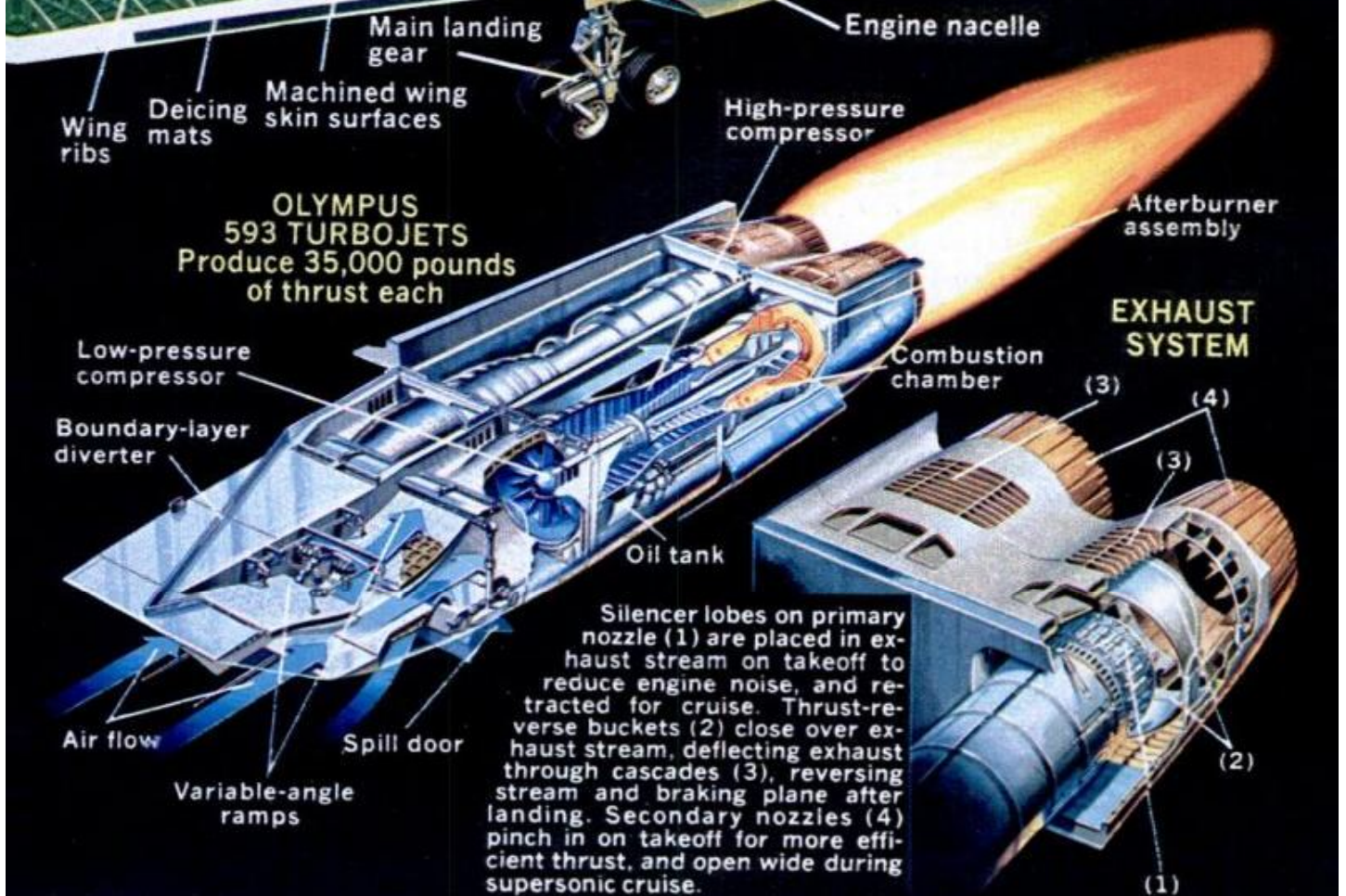
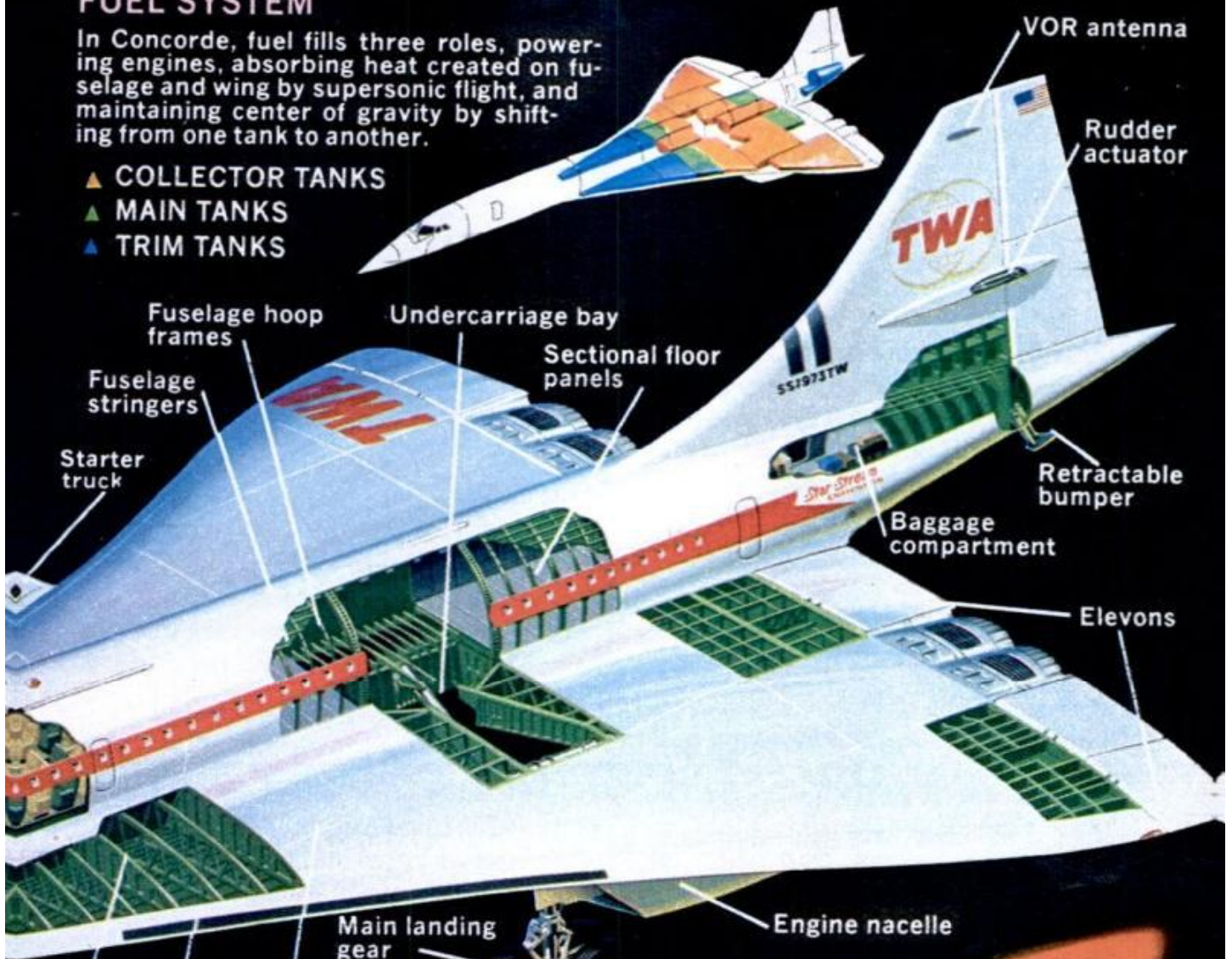
ILLUSTRATION CREATED EXCLUSIVELY FOR
POPULAR MECHANICS
By Fred Wolff, Dale Gustafson, Roger Chapin
and Howard Schafer



FUEL SYSTEM

In Concorde, fuel fills three roles, powering engines, absorbing heat created on fuselage and wing by supersonic flight, and maintaining center of gravity by shifting from one tank to another.

- ▲ COLLECTOR TANKS
- ▲ MAIN TANKS
- ▲ TRIM TANKS



Silencer lobes on primary nozzle (1) are placed in exhaust stream on takeoff to reduce engine noise, and retracted for cruise. Thrust-reverse buckets (2) close over exhaust stream, deflecting exhaust through cascades (3), reversing stream and braking plane after landing. Secondary nozzles (4) pinch in on takeoff for more efficient thrust, and open wide during supersonic cruise.

You, the Concorde traveler, will revel in a highly subsidized bargain.

population of the two countries. (The American supersonic airliner will probably cost three times as much.)

The cost per plane has been estimated at from 18 to \$20 million. Even so, there is some doubt that the development costs will ever be recovered. France and Britain regard it as a way to earn prestige, new knowledge in the fields of computers and electronics, and billions in foreign currency.

You, the Concorde traveler, may thus revel in a highly subsidized bargain.

The Concorde is unique as an international venture. It's the sort of brave partnership normally attempted only in the emergency of wartime.

Nominally, France and England each builds an equal number of the planes. In practice, all the wings, center sections of fuselages and the undercarriages are made in France, while the noses, tails and engines are built in Britain. Special low-loading trailers carry the parts to and fro across the channel. Six times a week a private jet speeds between Bristol and Toulouse, carrying engineers and executives to a day's work abroad. To help with the language problem, there's even a special Anglo-French aeronautical dictionary, in which "sonic boom" comes out, surprisingly, as "bang sonique."

One hundred ninety-three feet long and only four seats and a corridor wide, the Concorde at rest is distinguished by a most unusual nose. Long and sharp like a cartoonist's mosquito, it appears to droop wildly toward the ground. For power, the Concorde will be whooshed upward and forward by four massive Olympus 593 turbojets, developed by Bristol Siddeley and the French firm, SNECMA. They pack, in all, some 140,000 pounds of thrust, or almost enough power for the huge ocean liner *United States*. So much of this power is in reserve that the plane will take off

from regular-length jet runways. The engines will get the aircraft to 40,000 feet in just 11 minutes, compared with half an hour for a subsonic jet. The normal cruising altitude of 60,000 feet will be reached in 500 miles and only 30 minutes.

The Concorde has none of the complications of "variable-geometry" wings; endless trials, calculations and wind-tunnel tests showed designers how to build a slim, wineglass-shaped delta wing that would be efficient both below and above the speed of sound. So thin that they hardly look able to support the aircraft's 188-ton loaded weight, the 83-foot-span wings derive their lift from a highly intricate and sophisticated cambering and curvature. The whole plane resembles that most elegant and basic aircraft, a schoolboy's paper dart.

Fuel is ballast and heat sink

Stowed within the wings—and under the fuselage—are the plane's 18 fuel tanks. The Concorde holds a maximum of 95 tons of kerosene, about 15 tons of which is in reserve, enough to meet 45 minutes of airborne "holding" and a 260-mile diversion. The fuel performs two other functions: Pumped to and from the front and rear tanks, it can adjust the plane's trim to cope with the different center of lift as speed changes, eliminating drag-producing trimming of control surfaces; it is also used as a "heat sink" to absorb surplus heat extracted from the rest of the plane. Although it must be pressurized to keep it from boiling at high altitudes, the increased temperature of the fuel actually makes it more efficient.

The Concorde will gladden the hearts of record buffs. It's the first civil plane designed to fly faster than sound, or to have a droop nose or delta wing; the most completely automated; the fastest; the most expensive to date; and, say British Aircraft Corp. and Sud-Aviation who built it, the safest.

Automation and the computer have played a bigger part in the Concorde than in any other plane. The whole con-

struction program was worked out by an American management aid called PERT (Program Evaluation and Review Technique). Much of the mechanical work is controlled by magnetically taped instructions to the multitude of power tools. During engine testing, the French and English test stations and the associated government research institutions were all wired to one computer link. Urgent results could thus be swapped—with complete accuracy—20 times faster than by telephone.

The Concorde is a riot of new and ingenious inventions, many of which, as spin-offs, may bring benefit soon to the man in the street. Take automatic chart display (ACD), for instance. In the center of the dashboard, an illuminated map shows the plane's course and position, and the surrounding countryside. As the plane moves or turns, the computer-controlled map shifts with it, always leaving the plane's position dead in the center. At the flick of a switch, the map—it's really a mini-TV screen—blows up to double scale. One tiny cassette holds 8000 2000-mile routes, any of which can be exposed at will. It is not hard to imagine the ACD—and its associated computerette—becoming a splendid "optional extra" in the vacationer's family car.

The Concorde may be the most "computerized" plane ever built. It reaches over 200 mph on the runway alone, and in the air the three-man crew would have little time to work out the hundred-and-one things that affect course, altitude and speed. One computer collates current information about weather, fuel consumption, payload, noise regulations and course, and then recommends the

correct setting. If, for example, one of the engines lost some power, the computer would adjust instantly to the new conditions: The pilot doesn't have to do anything. "He could sit and do a crossword puzzle," said a British Aircraft Corp. spokesman, "but he won't, of course."

30 minicomputers at the controls

In all, the Concorde carries about 30 microcircuited computing devices, as small as a telephone or as big as a typewriter. (Their combined weight is only 70 pounds.) Computers take over the autopilot, including the autothrottle, the autostabilization (which makes the plane fly straight and level regardless of any roll or yaw), and the electric trim, which keeps the plane well balanced as conditions change, when fuel is used, at acceleration or deceleration, or even when three or four passengers walk down the aisle! The computer systems are completely duplicated for safety, and are built to such exacting standards that not even the minutest fault is expected more often than every 600 hours.

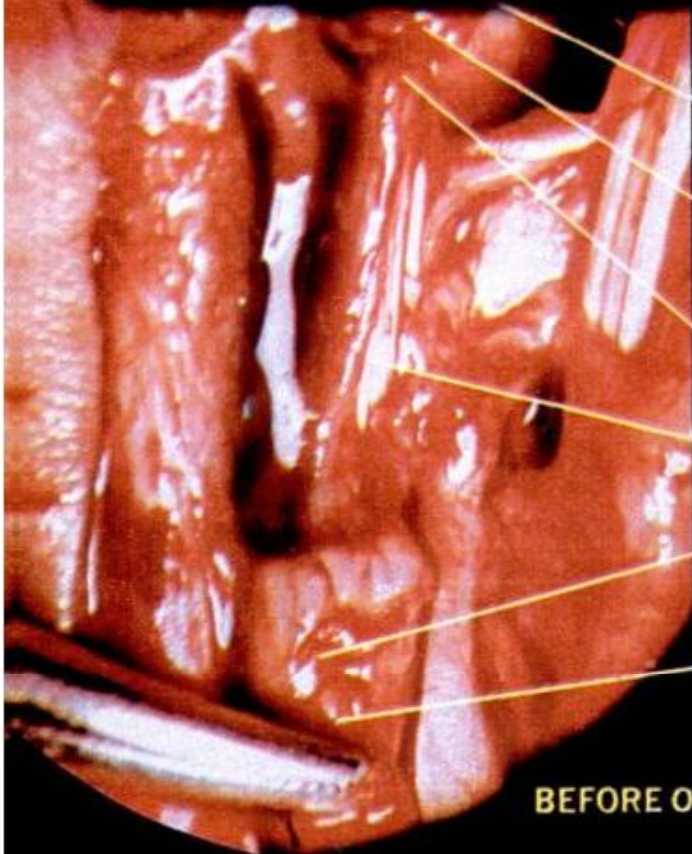
"It's a belt-and-braces job," explained the BAC spokesman, unconsciously hitching up his tweed trousers. Computer duplication is only one way that the Concorde is planned as the world's safest aircraft. The hydraulics system is triplicated—and even if all four engines should fail, their "windmilling" action would still be enough to keep the hydraulics going. There are two parallel electrical circuits. The strict certificate-of-airworthiness conditions even lay down that the aircraft shall be flyable manually, if all electric and electronic signaling aids break down together. In the same way, new

(Please turn to page 220)

REAR VIEW OF CONCORDE shows "lumps" on fin which are housings for rudder actuators

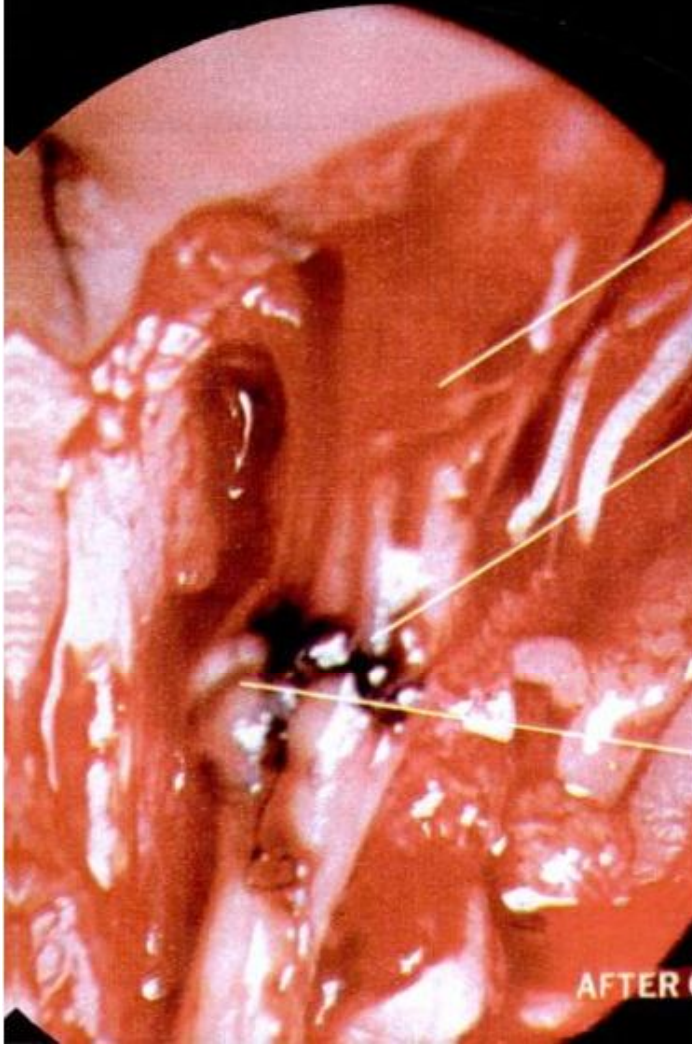


MICROSURGERY: Hooking Up



- NERVE END FROM WRIST
- MEDIAN NERVE SEVERED
- FUNICULI (INDIVIDUAL NERVE FIBERS)
- TWO UNCUT NERVE FIBERS
- EPINEURIUM (OUTER NERVE SHEATH)
- NERVE END FROM ARM

BEFORE OPERATION



- MEDIAN NERVE REPAIRED
- ROW OF SUTURES (STITCHES) IN NERVE SHEATH
- BULGE CAUSED BY BUNCHING UP OF LONGER UNCUT NERVE FIBERS

AFTER OPERATION



the Body's Nerves by Microscope

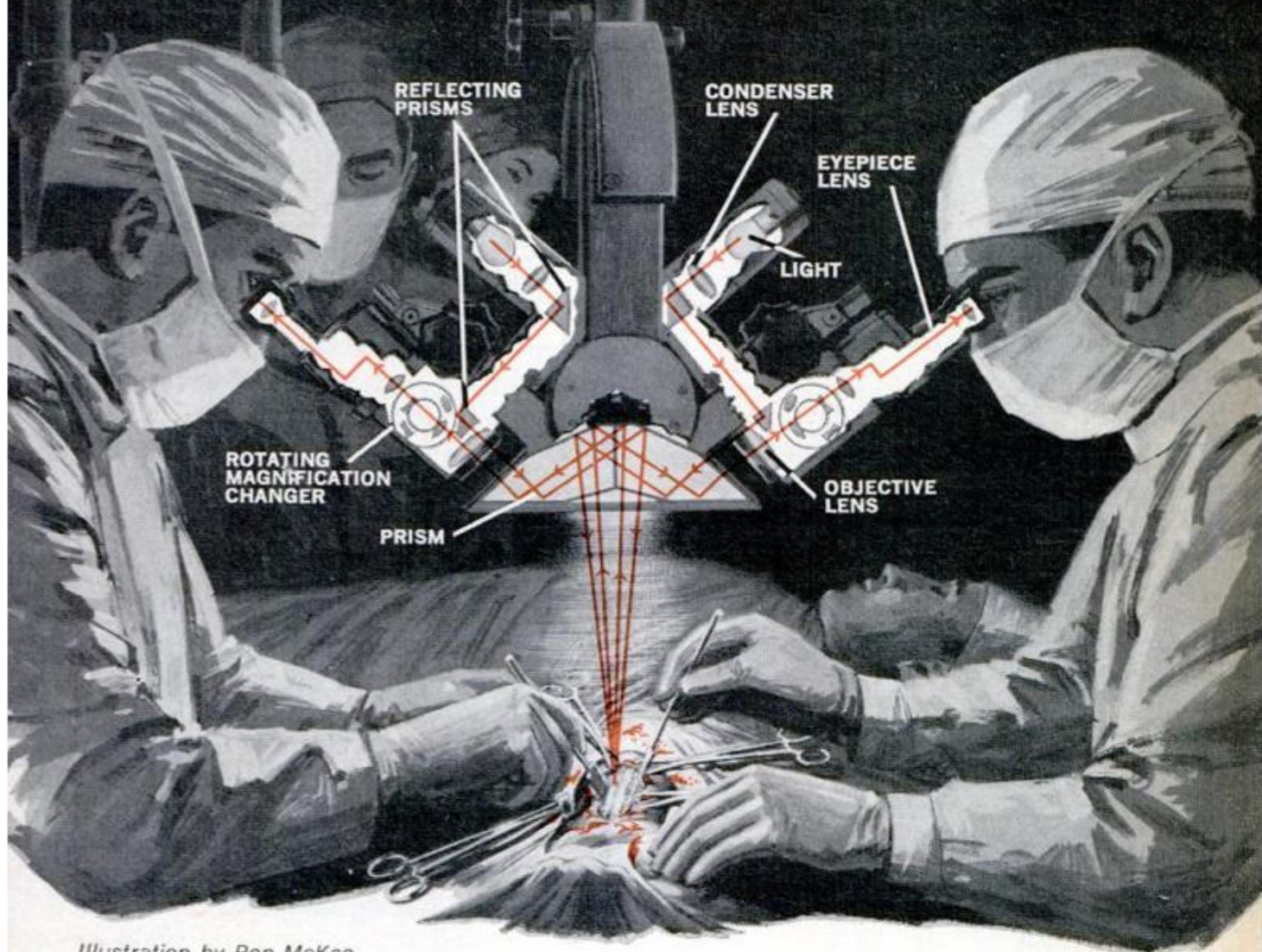


Illustration by Ron McKee

A strange-looking four-eyed device, called a diploscope, magnifies tiny nerve fibers 40 times so surgeons can sew them back together

By ARTHUR S. FREESE

Medical Art by Fred Wolff



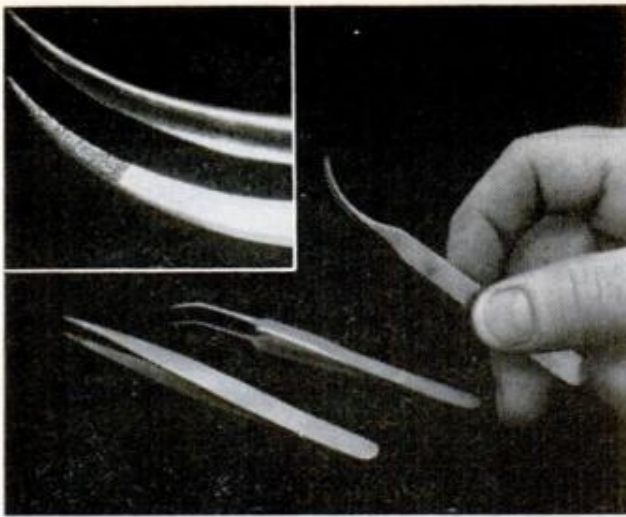
A DEEP GASH in a young boy's wrist left the hand useless until the severed nerve was rejoined through microsurgery with the aid of the diploscope shown above. On the facing page are actual photos of the operation taken through the diploscope. In the upper view, the median nerve, enlarged many times, can be seen almost completely cut through except for two tiny strands. The lower view shows how the nerve ends were sewed back together, creating a lump where the uncut strands, having stretched longer, bunched up

MARCH 1968

IT WAS A STRANGE SCENE, even for an operating room accustomed to strange scenes. There were the usual bustling nurses, gleaming instrument trays, anesthesia cart—but there was also something different. Two surgeons, hunched over a small table, were peering into an odd-looking device hanging in mid-air between them, something like a submarine periscope.

Directly below the device was a young boy's arm, shrouded except for an opening at the wrist. The surgeons worked on the wrist

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FINE DIAMOND DUST coats the tips of these special forceps to help them grasp microscopic tissues

silently with scalpels, probes, sutures—never taking their eyes from the weird apparatus. From time to time, there was a muted whirring sound as small electric motors inside the device responded mysteriously to unseen commands.

The boy on the operating table was Donald, a blond, good-looking six-year-old. Four months earlier he had cut his left wrist so badly that, even though the injury had healed, he couldn't move his fingers and had no feeling in most of his hand. The median nerve—the main signal-carrying trunkline to the hand—had been severed and the hand was useless.

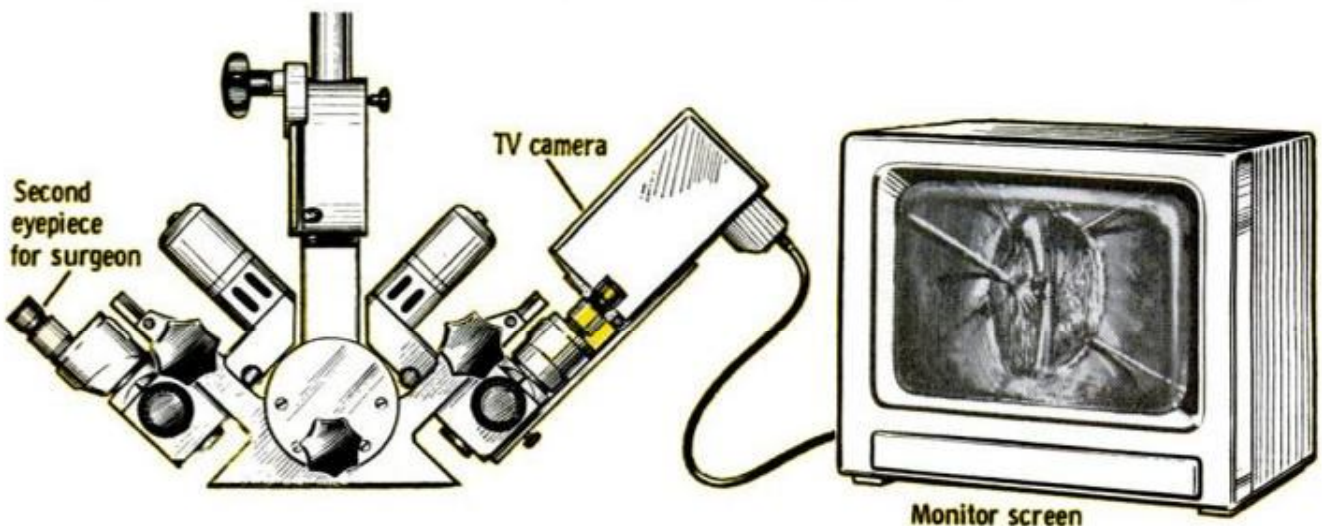
Now Donald was about to get his hand back through a medical miracle

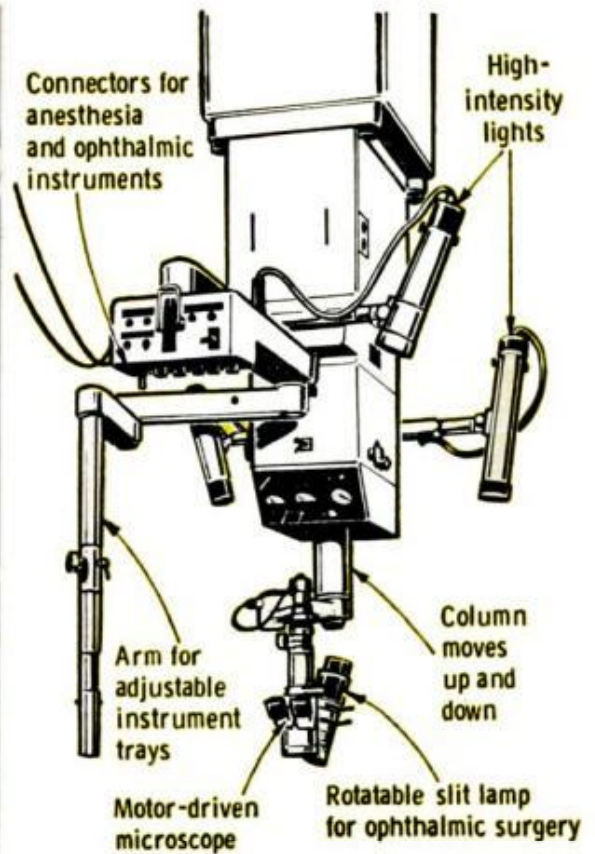
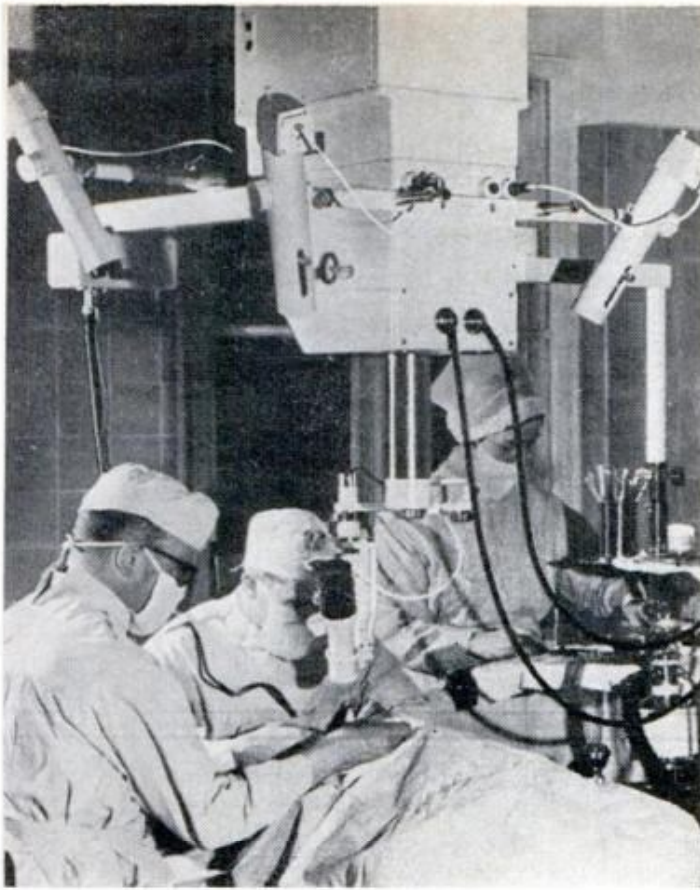
known as microsurgery—surgery under a microscope. The strange device the surgeons were peering into was a diploscope, one of several new optical instruments that let doctors operate on parts of the human body so tiny they can't be seen by the naked eye.

The diploscope, recently introduced by the optical firm of Carl Zeiss, Inc., is actually two binocular microscopes arranged back to back, giving it a total of four eyepieces. The binocular optics—one set of optics for each eye—give a three-dimensional stereo effect for better depth perception. The dual back-to-back arrangement enables two surgeons to see the same area simultaneously, so a team can work together. Where only one surgeon is needed, the other set of eyepieces can be fitted with a movie or TV camera to record every step in the operation for students.

With the diploscope, surgeons can get magnifications from 6X to as much as 40X—40 times the size of the original object. All adjustments are power-operated and are controlled by buttons under the doctors' feet, leaving their hands free. These raise and lower the twin scopes, adjust the focus, change lenses for different magnifications, and zoom in and out to vary the field of view. Throughout all of this, the surgeons keep their hands on their instru-

BACK-TO-BACK ARRANGEMENT in the diploscope makes it possible to televise operations without interfering with the surgeon. TV camera mounted on one side feeds a monitor screen for student surgeons





SUSPENDED FROM THE CEILING, this huge motor-driven microscope moves up and down on a column like a submarine periscope. Designed mainly for delicate eye operations, it is similar to the diploscope except that it has only one set of eyepieces for use by a single surgeon. Around it are high-intensity lights

ments and their eyes on the work area.

The need for devices like the diploscope has risen sharply in recent years as a result of the war in Vietnam and mounting highway accidents at home. Both produce violent injuries that frequently involve extensive nerve damage.

The problem of trying to repair an injured nerve is that it is not just a single strand you can sew back together. A major nerve, no bigger than a lead pencil, is actually a bundle of tiny individual fibers—like the thousands of wires inside a transatlantic telephone cable. When a nerve is severed, it's like cutting a transatlantic cable in two. The only difference is that a telephone cable can be color-coded to identify the individual wires. Nerve fibers aren't color-coded.

If the fibers in one end don't line up with the right ones in the other end when a nerve is reconnected, the signals get all mixed up. Commands meant for the little finger go to the thumb—

just as if the telephone circuit for Paris had gotten crossed with the one for London. Sometimes no signals get through at all, and then there is a complete loss of feeling and movement.

In the past, all a surgeon could do was sew up the outer sheath around a nerve and hope that the fibers inside might line up. Today, with devices like the diploscope, doctors can actually see the microscopic nerve fibers and can join the ends so they align properly.

In Donald's wrist, the median nerve was not entirely cut through. Two fibers or strands were left intact, giving a clue to the correct relationship of the other fibers. Today, Donald has regained the control of his fingers and is able to use his hand almost normally. This is the miracle of microsurgery.

Even when a nerve is completely severed, there are a number of aids the surgeon can use to identify the parts that fit together. A blood vessel that

(Please turn to page 224)

'Don't call us, we won't call you' would seem to be the auto industry's attitude toward outside inventors. Still, there's that occasional longshot.



HOW TO SELL YOUR

By DON MACDONALD

Illustrations by Joe Farris

ANY REASONABLY ASTUTE, inventive person need spend but a few hours pondering the collection of 15,000 odd parts that make up a modern automobile and chances are he will spot somewhere therein a way to make it better—or so he thinks.

The next step is to dash off a letter to his favorite automaker outlining the idea in terms guarded enough to protect a fortune in the making, yet revealing enough to intrigue. Letter mailed, our man sits back to dream of his invitation to Detroit and how he'll hold out for at least 25 cents a car. He does get prompt action. Almost by return mail an answer arrives that with a singular lack of gratitude informs him

"... he'll hold out for at least 25 cents a car."



that his letter has not been read by personnel qualified to judge the merits of the idea it contained and will not be until the enclosed "Request to Consider Submission" is signed and returned. With the letter is a pamphlet that could be, but isn't, entitled *The Closed Door*.

It is a masterpiece of discouragement. It points out that each year nearly 8000 people submit ideas to Ajax Motors and that few, if any, are new or useful to its work. It notes that chances are, Ajax has already thought of it, and therefore if it should pop up on future models you have no recourse. It states that Ajax has too many employees to properly keep a secret and therefore a confidential disclosure is refused. It also warns that, if your idea has been patented by you, Ajax retains the right to prove this patent invalid.

Surprisingly, the disclosure form itself frightens more inventors than the facts of life outlined in the pamphlet accompanying it. "I'll be darned if I'll tell those people what my idea is until they pay for it," is the common reaction. Actually, of all the frustrations you'll encounter if you persist in trying to sell your idea to Detroit, the disclosure is the least noxious. It is designed, essentially, to put on a legal basis the fact that Ajax did not solicit your idea and since it is you who went



INVENTION TO DETROIT



to them of your own free will, you do so on their terms. It definitely does not give Ajax a license to steal.

To be blunt, Ajax wishes you had never written them in the first place. In doing so you have embarrassed its 3000 full-time engineers and scientists who are paid very well to think of your idea before you did. This is called the "NIH" (not invented here) factor. That the automobile as we know it today is a conglomerate of basic inventions emanating years ago from quite a few separate basement workshops is of no matter. Now nothing of value can be added to it that the Ajax design team does not already know about. And as if this threat to the establishment were not enough, you and your helpful ilk have necessitated the creation of an expensive full-time staff whose sole

duty is to fend off your suggestions. And finally, every time we, Ajax, put something new on our cars, some crank will take us to court and claim he invented it.

The attitude of fictitious Ajax Motors is no exaggeration. It is shared by Ford, General Motors, Chrysler and American Motors, who each receive just about Ajax's annual quota of 8000 unsolicited ideas from the outside and who therefore must maintain organizations to properly and safely—from their standpoint—process them. And process them they conscientiously do. If the idea has any merit at all, a patent search must be made. If it still seems useful and is patentable, but not yet patented, the idea is turned over to the appropriate engineering laboratory for evaluation. Full-dress treatment can take upwards of two years. Meanwhile the inventor must be kept informed of the progress, if any. It is obviously a costly procedure made no more palatable by the fact that an average year's batch of suggestions will produce nothing destined to appear on a car.

All is not dark. One recent ray of light is a lone inventor who dreamed up a unique device used by American Motors that automatically sizes a seat belt to fit the stomach of its wearer. One secret of the sale here is that the

inventor not only felt, like the rest of us, that normal seat-belt-adjustment procedures left something to be desired, but he followed through with a piece of hardware that worked. The second essential secret is that he approached a vendor selling to a company which at



"One idea was that horns should blare the name of the car."

that moment was willing to spend a little extra per car for the kind of trifle that could possibly clinch an extra sale. We mention these essential ingredients because, one, it wasn't the awareness of a seat-belt problem that was sold, it was a solution to it; and two, the eventual customer happened to need every little plus it could lay its hands on in its desperate fight for survival. Others more plush probably would have turned it down because it cost rather than saved money.

What differentiates an idea from a useful invention is sometimes a very thin line. Chrysler is currently paying an inventor for his suggestion that the expense of a separate courtesy-light switch could be saved by incorporating the circuit in an already existing sheet-metal screw. Here the idea was enough; hardware was not needed. On the other hand, a very popular suggestion to all auto companies is to eliminate seat belts entirely by some sort of mechanism embodied in the seat itself that would grasp your torso at the moment of impact. It's a good idea, to be sure, but no one so far has sent in any hardware that will accomplish this. Also, it's an "IH" idea because it's been thought of and worked on by all the auto

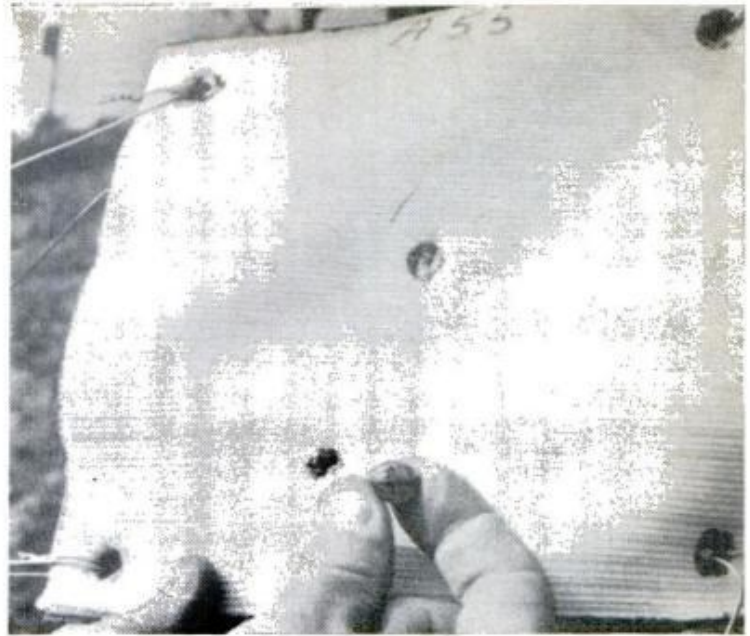
companies. Further, it's an "NIA" idea, which means it's probably not inventable anywhere.

Let's take two recent actual, but unused, suggestions sent to Chrysler and analyze why they were not adopted. One was an idea that horns should blare the name of the car rather than a conventional note. This fell flat because such a signal would more likely surprise, annoy or startle than warn. Another was to replace the cigaret lighter with a lipstick. Majority rule and usefulness favor the lighter.

There is no rule that compels you to mail your suggestion to Detroit. You can appear in person, although the pamphlet we mentioned earlier clearly states that Ajax will not under any circumstances be responsible for your expenses. You don't even need an appointment. Once you arrive, just pick up the phone, dial the company of your choice and ask for directions to its new devices section or equivalent. You'll be received with courtesy and dignity even though the person who preceded you might have

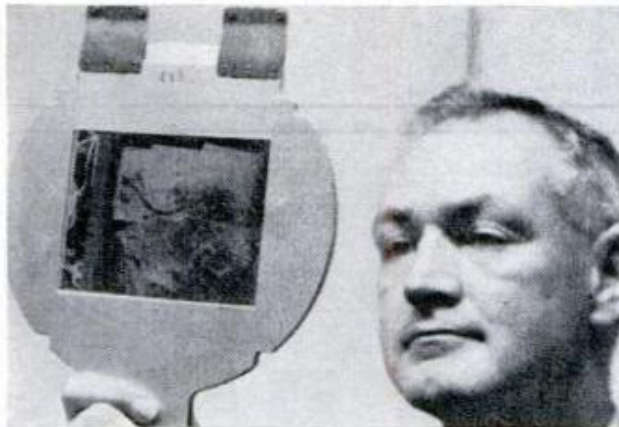
(Please turn to page 190)





Specially woven nylon stops bullets

Body armor made of specially woven nylon will—depending on the number of layers—stop virtually any small-arms fire. The vest shown at left protects against lead bullets traveling 850 feet per second. The material at right stopped a .38-cal. slug at point-blank range. A Canadian development, the armor will be made in the U.S. by Davis Aircraft Products.



Pilots preview storms

Pilots leaving for Europe and the Caribbean from Kennedy Airport in New York now receive actual photos of cloud patterns through which their flights will pass. Negatives (top) of satellite photographs go into a Kodak Ektamatic Processor (bottom) which turns out finished prints in 15 seconds. Pilots then use the pictures to avoid storms.



Rounder grounder

A British driver who stops off for a nip can learn very quickly whether he should risk getting back at the wheel. He drops a coin in a "reaction meter." In a few seconds a bell rings and the coin drops down a chute. He tries to stop the coin by pushing a button. If his reaction is quick, he gets the coin back. If not, he'd better walk.

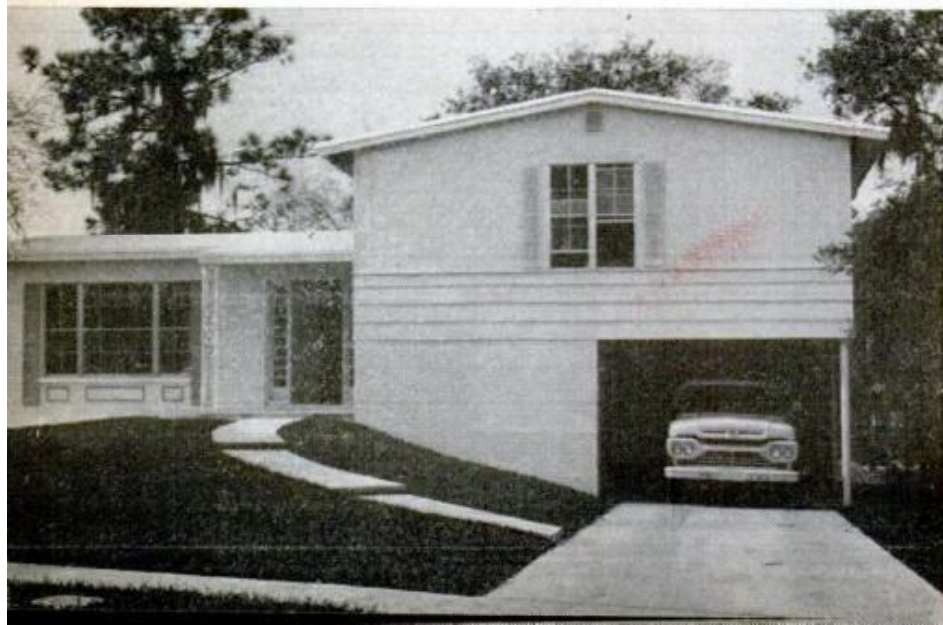


THESE THREE HOUSES look attractive at first glance, but illustrate design characteristics that might become monotonous over a long period. One at top combines modern awning windows with ornate Southern-style wrought-iron columns, added merely for decoration. House at center has overly complicated roof line for its basically simple shape. The partial brick-veneer facing, covering only the front, tends to look false and out of character with the rest of the structure. Photo at bottom of the page shows what happens when a split-level house is placed on flat land where its stepped design isn't needed. The earth must be artificially graded up on one side, giving the lawn an odd, humped-up look

Published by permission of Meredith Press. From HOW TO AVOID THE 10 BIGGEST HOME-BUYING TRAPS by A. M. Watkins. Copyright 1968 by A. M. Watkins.

How to Buy a House

By **A. M. WATKINS**, author of the new book, *How to Avoid the 10 Biggest Home-Buying Traps*



A poorly designed house may not show its faults until it's too late. Here are tips from an expert on how to tell the good from the bad —before you buy.

THE THREE MAIN INGREDIENTS of a well-designed house are: (1) good appearance; (2) a well-planned house-to-site relationship, and (3) good interior planning. The no-design house lacks style, proportion, and is hard to live in. It's set on its lot like a bump on a log. No thought is given to taking advantage of the best view or the best exposure in relation to the sun and prevailing winds (heat and cold). Little or no thought is given to privacy from passing traffic or neighbors. And inside, the plan and room arrangements are often just as bad.

Take a look at a no-design house and the facade is likely to be broken up with a mishmash of different materials thrown together like a banana split. It may include blotches of stone or brick mixed in with two or three different kinds of wood siding. There is no coherence. Instead you'll generally see walls jutting in or out here and there with too many jogs and breaks. The roof line is broken up at different places for no reason at all. It's supposed to add variety and interest, but contributes to chaos instead.

The doors and windows not only do not line up, but often they are out of scale and character with the rest of the house. And here and there is hideous gingerbread, such as unnecessary flowerboxes or other decoration that adds to the clutter in much the same manner as cheap

jewelry piled over a flashy ill-fitting dress.

There are the one-story, one-and-a-half-story, two-story and split-level houses. The one you choose can have an enormous influence on your day-to-day living convenience and pleasure. Knowing the pros and cons of each also can help you single out the best architectural style for your family.

The one-story house

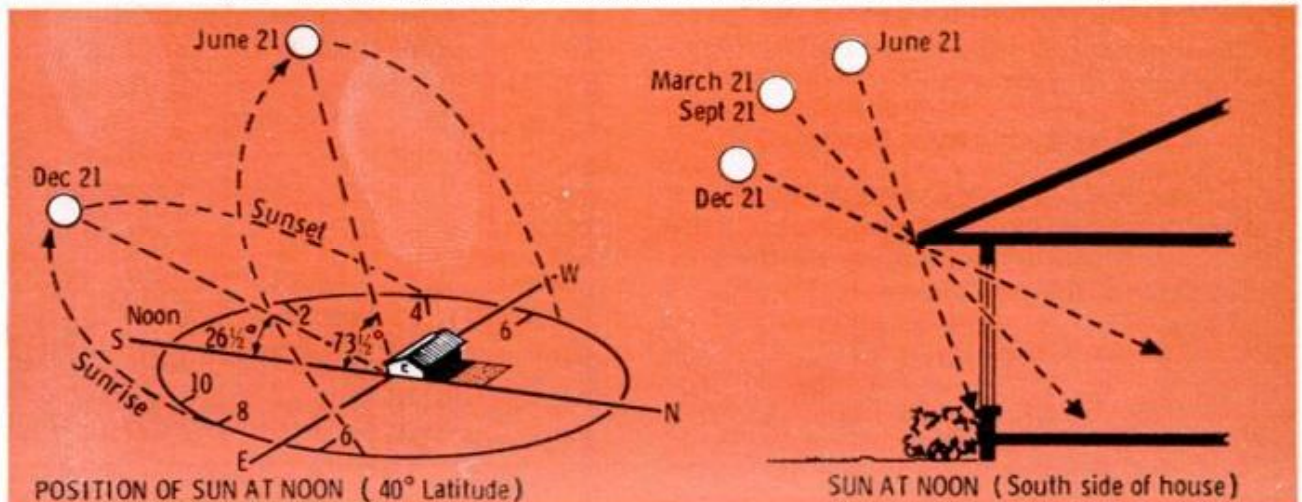
The one-story house (ranch) excels for its glorious lack of stair climbing, a boon for the parents of small children, as well as for elderly people. It's the easiest kind of house to keep clean and maintain. This not only means reduced housekeeping chores, but it also means reduced maintenance expenses.

The one-story house allows the most flexible floor planning. It opens up the advantages of indoor-outdoor living to people in every room. Though it shines best on flat land, it can be built on any terrain. Wherever it's built, though, it should hug the ground. A one-story house looks awkward and ungainly when it sticks way up out of the ground.

The main drawbacks of the one-story house have to do with its room zoning and construction. Because all rooms are side-by-side on one level, good separation between the living and working and sleeping zones is essential. A spread-out

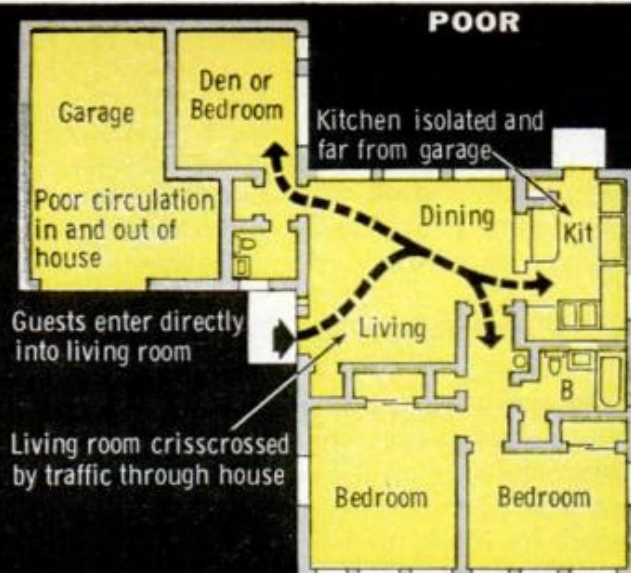
Without Getting Hooked

IMPORTANCE OF A SOUTHERN EXPOSURE for main living areas is shown below. With sun low in winter, you take advantage of its light and heat. In summer, sun is high and is usually blocked by roof overhang



HOW TO SPOT A GOOD OR BAD FLOOR PLAN

Easy access and good separation are keys to an efficient floor plan. You should be able to go from one room to another without passing through a third room. Bedrooms and baths should be shielded from entertaining areas. The plan at near right is poor because all traffic must crisscross through the living room. Both plans at far right work well because there's good separation between living and sleeping areas and good traffic flow.



plan also requires a larger site, which can raise costs on land that is expensive. And the one-story house requires more roof and basement area than a multilevel house with the same overall interior space.

The 1½-story house

This brings us to the nostalgic Cape Cod, the classic one-and-a-half-story American house. Fewer and fewer are being built because turning that raw unfinished upstairs attic into usable rooms costs more than people may think. A full two-story house generally costs no more—and usually less. Besides, the attic rooms in a Cape Cod tend to be furnace-hot in summer and icy-cold in winter because they're right under the roof. Special insulation and heating care needed to prevent this are not always provided.

Dormer windows in the roof can violate the basic lines of the authentic Cape Cod, often spoiling the looks. If there's a basement under the house, the hole necessary for the stairwell can wreak havoc with the compact first-floor plan where every square foot counts.

The two-story house

A two-story house gives a feeling of large size and permanence. It leads the field in getting the most house on the least land. It's therefore supremely feasible on high-priced land or on a tight little lot. It offers natural separation (zoning) between the downstairs living activities and the upstairs bedrooms.

Because it's compact, it can be somewhat easier to heat than a house on one

spread-out floor level. And in summer the downstairs rooms tend to be cool, though the upstairs bedrooms can get hot if the attic isn't properly insulated and ventilated.

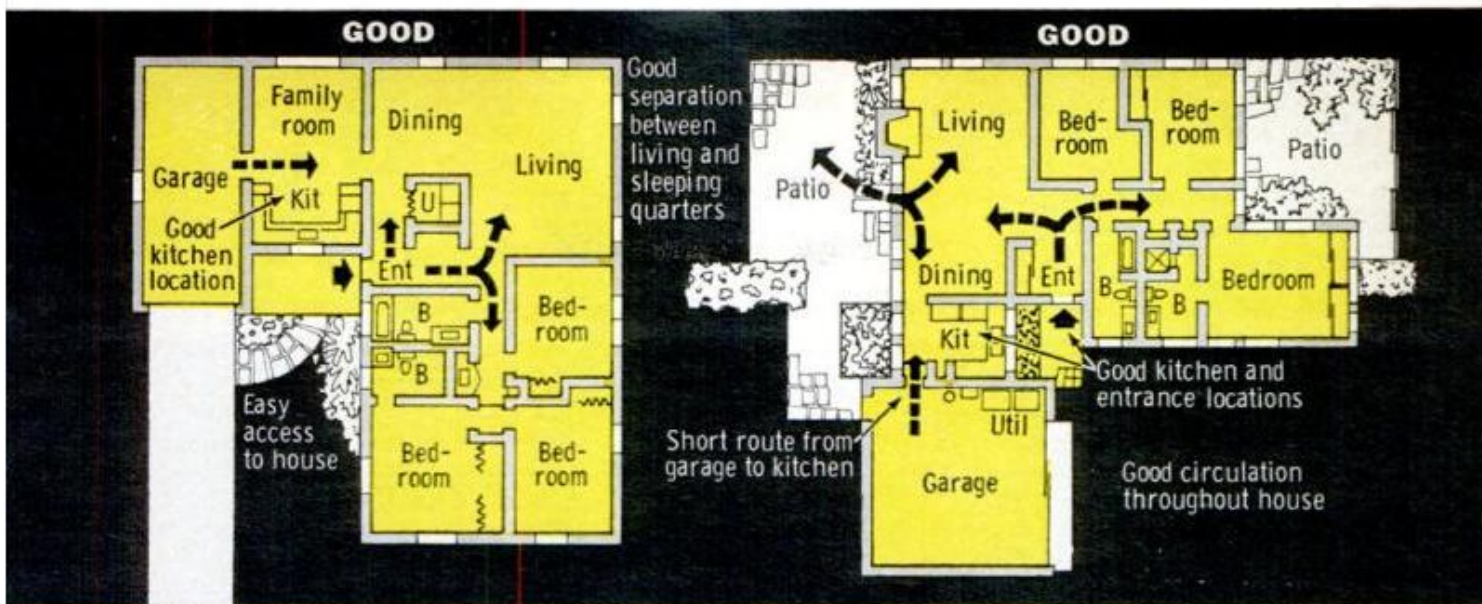
Its main drawback is stair-climbing. This makes housecleaning tough and puts a strain on parents of small children. It also restricts a family that likes to spend time outdoors during nice weather.

The split-level house

This is the house for a sloping lot, with at least two main floors having direct access to outdoors. The different parts of the house can be zoned off from each other by putting them on different levels. Properly designed, a good split can look handsome and large, with the additional advantage of short stairway climbs from one level to another.

Improperly designed, a split with numerous short stairways can be a pain in the neck (and legs). You find yourself going up and down all the time. The lowest and highest levels demand especially good heating and insulation for comfort. Some split-level houses—the no-design kind—are stuck on a dead-level lot for absolutely unfathomable reasons. The best ones built on sloping land look as if they grew out of a natural marriage between land and house.

Ideally, the main living areas and the main windows should drink in the best view, and should also face south. You can quickly tell if you will enjoy the view simply by looking out the windows when you inspect a house. All you may see is the street in front of your neighbor's



clothesline. A clothesline view is, of course, another mark of the no-design house.

The accompanying sun diagram shows why a southern exposure is ordinarily best. It's the only exposure that can let bright warm sunshine flood into your house all winter long. This not only can mean your house will be bright and pleasant; it can cut fuel bills, too.

In summer, windows on the south are easy to shade from hot sun by deciduous shade trees, which obligingly lose their leaves in winter to let the sunshine through, or by deep roof overhangs which block out the overhead summer sun but let in the lower-angled southern sun in winter.

A house that faces east or west gets the brunt of hot sun either in the morning or afternoon in summer (which is when you certainly don't want it), but much less sun during those cold days of winter. And a house that faces north not only gets the least sunshine in winter and summer: it must bear the full lash of cold winds in winter.

Naturally the best view isn't always to the south. If it is not, a compromise is in order. Some big windows can be located to receive the view, while others face south to pull in winter sun. If you're buying a development house, you ordinarily have a choice of lots, so you can pick one that combines a view with a southern exposure.

The house-site design

The house also should be sited to give you the most use from your land. Mental-

ly divide the grounds into its three main areas: the public, private and service zones. The public zone consists of the front lawn and that part of the grounds usually out front in public view. The private zone embraces that part, usually on the sides and to the rear of the house, available for your private outdoor use. The service zone includes the driveway, walks and the areas for trash cans, outdoor equipment storage, and other such needs.

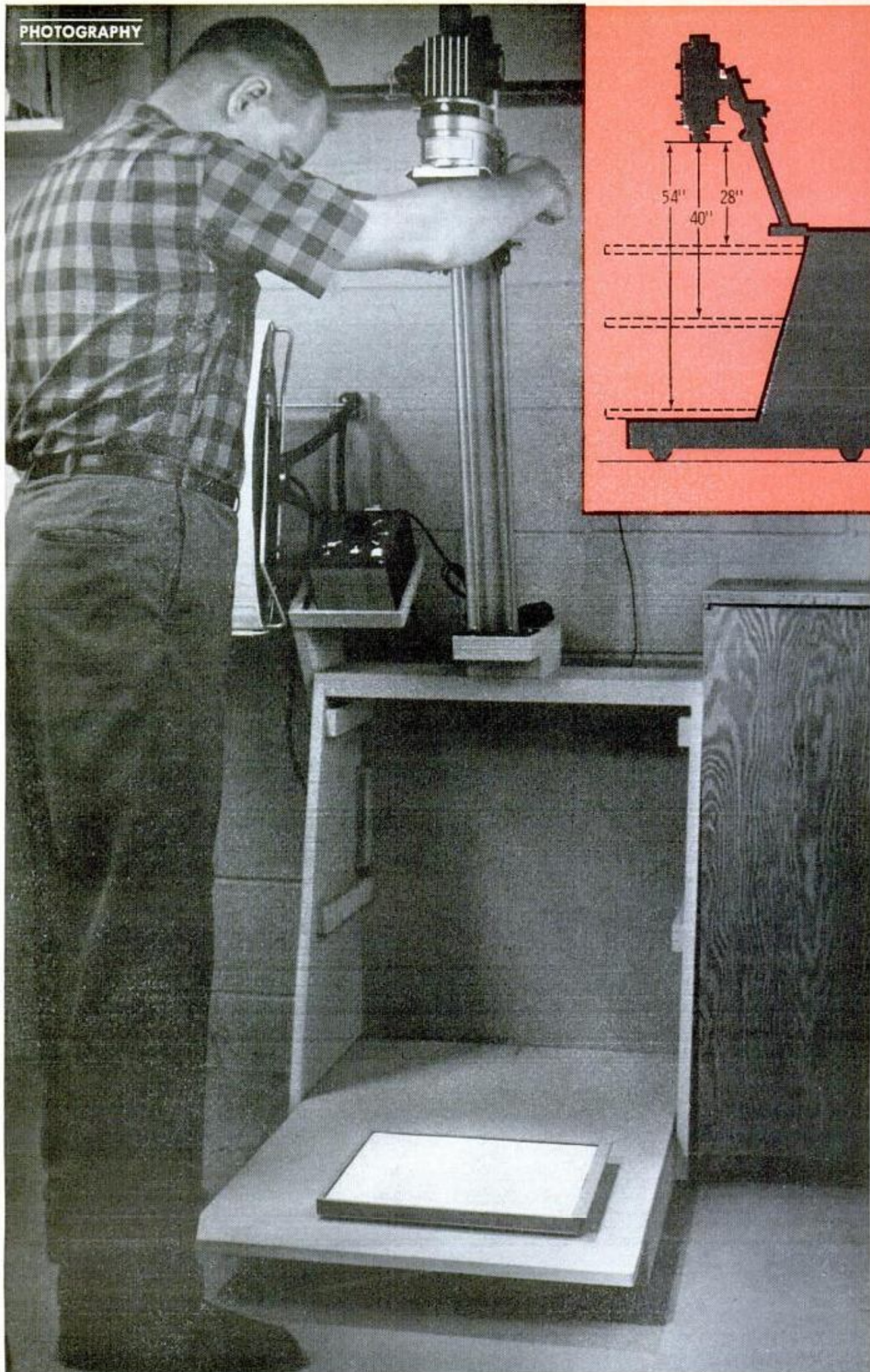
Ideally, a house should be set forward on its lot to give you the most land for your private use in the rear out of sight of neighbors and traffic. That also means a minimum of public zone in the front, and thus minimal need for lawn mowing and landscaping. The living areas inside the house should be located with convenient access to the patio or terrace, and vice versa.

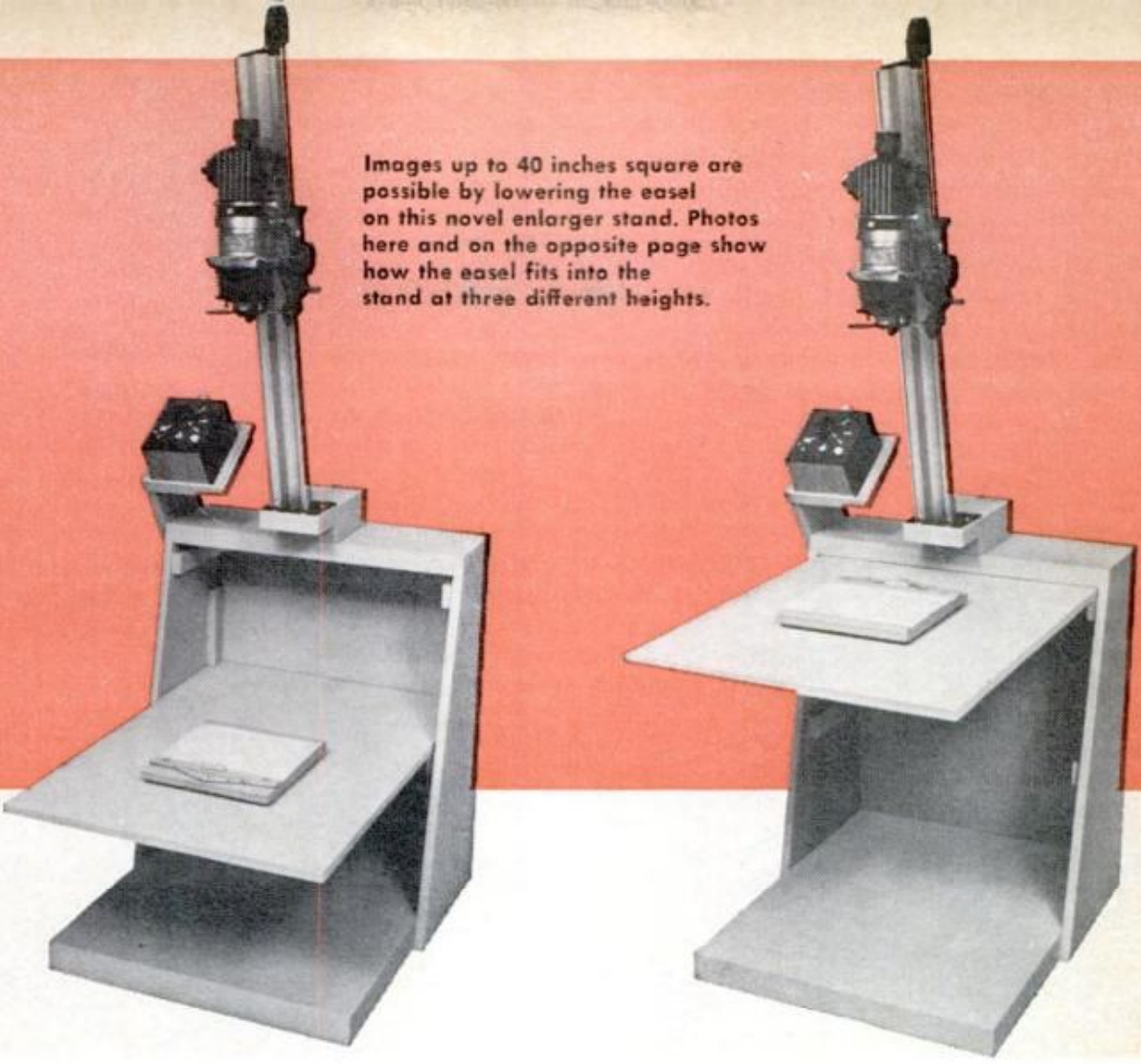
The garbled floor plan

When you enter a house, ideally you should be able to go straight to any other room without passing through a third room. If you must pass through a third room, it's a demerit. And if you must go through the living room, it's one of the biggest sins.

We know a woman whose biggest complaint about her house is its living room. Located haphazardly in the center of the house, it must be used to get from the kitchen to the front door or to upstairs. To get to the bathroom or to almost anywhere else in the house, she also must pass through the living room. She says,

(Please turn to page 214)





Images up to 40 inches square are possible by lowering the easel on this novel enlarger stand. Photos here and on the opposite page show how the easel fits into the stand at three different heights.

For ease in making jumbo blowups, build this

3-Level Enlarger Stand

Its handy slide-out easel board lets you project all the way down to the floor to make giant enlargements

By **ROBERT S. HEDIN**

LIKE TO MAKE really big blowups? This multilevel enlarger stand is ideal for the job. It does away with the old awkward and wobbly system of hanging the enlarger over the edge of a bench and trying to project onto the floor in order to get enough distance for a large image.

Instead, the stand has a slide-out easel that gives you a choice of three working levels from normal height all the way down to just above the floor. All you do to switch levels is pull the board out of one slot and slip it into another. With the

easel in its bottom position, a typical enlarger with a 3-in. lens will produce whopping images up to 40 inches square from $2\frac{1}{4} \times 2\frac{1}{4}$ negatives.

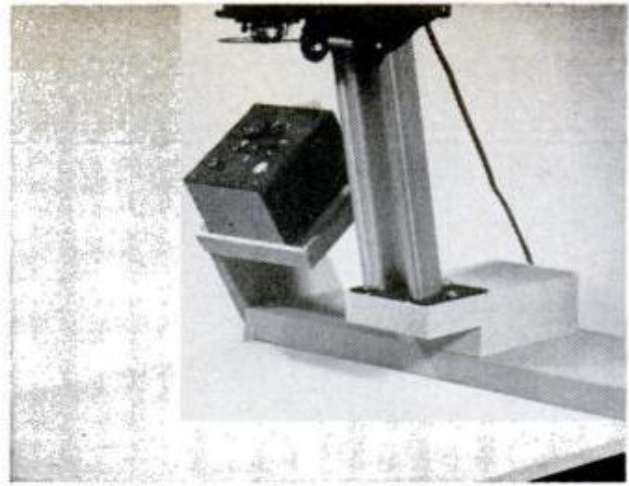
The stand has other strong points, too. It's simple to build, is rock-steady because of its box-braced construction, and rolls easily around on casters. Except for the back, all parts are cut from $\frac{3}{4}$ -in. plywood and 1-in. pine. The back can be any handy thin material.

The cleats that form the slots for the easel must be spaced to provide as snug a

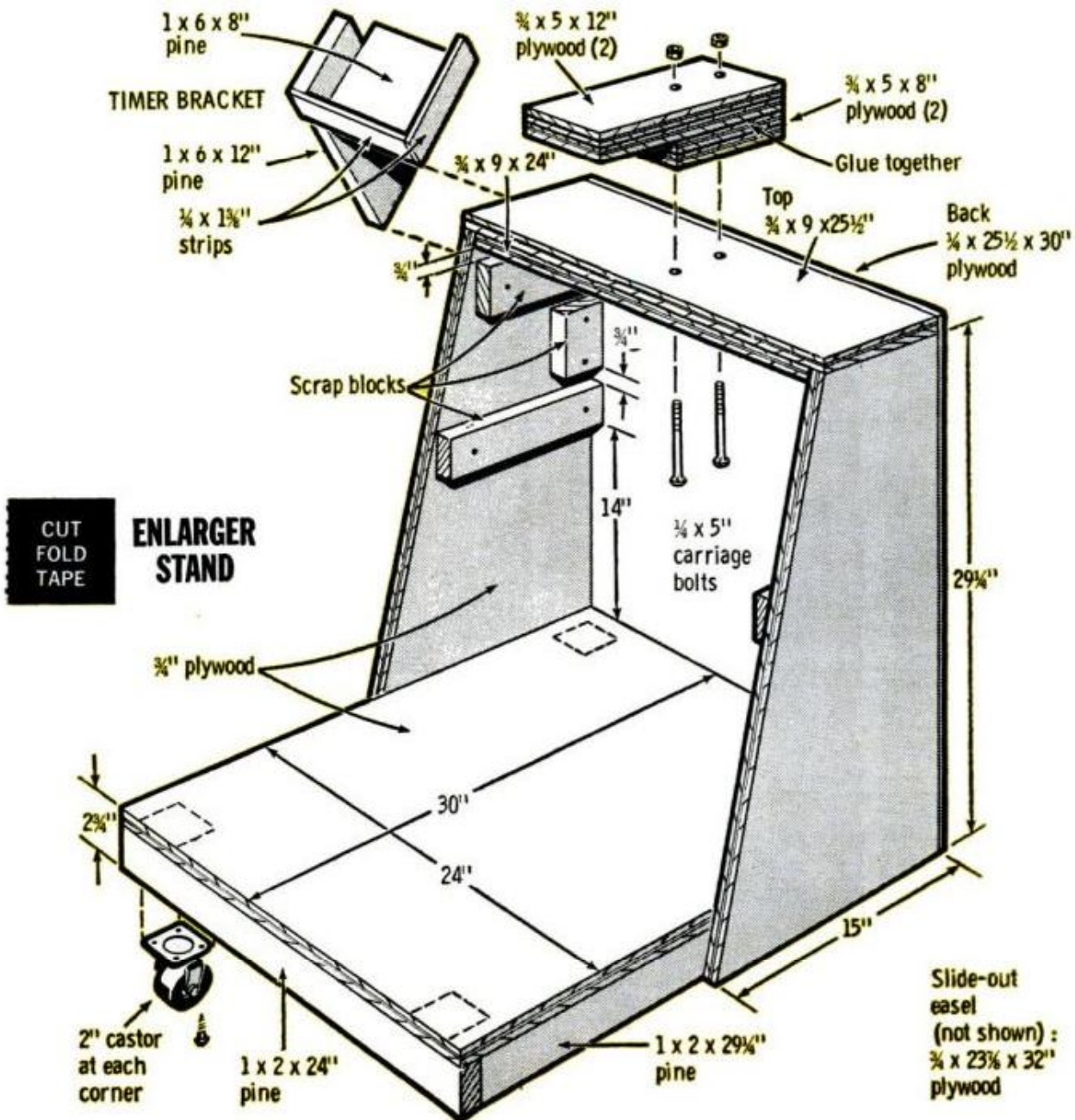
fit as possible. If the slots are loose, the easel will sag and won't be parallel to the enlarger's lens board. Make the fit as tight as you can, then wax the edges of the easel if necessary for easy sliding. If there's any detectable droop, tip the enlarger's column slightly with shims to keep the lens board parallel.

The cantilevered enlarger support arm is designed to provide a good, clear work area under it without the enlarger's column getting in the way. Its dimensions can be adjusted to suit your own particular model. An optional accessory is a sloping bracket to hold a timer right next to the enlarger.

★★★



SLOPING TIMER BRACKET, mounted next to the enlarger column, puts the control within easy reach





Teacher is a little squirt

A water-squirting truck helps train dogs to observe traffic signals in Hamburg, Germany. If the dog starts to cross a mock-up of a city street against the lights, he's squirted by the truck until he learns to obey the lights.



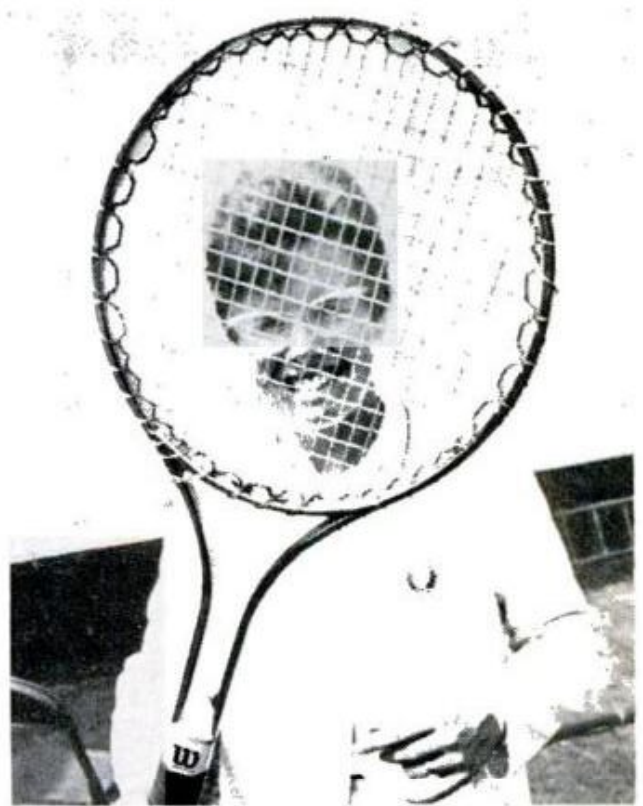
Roomful of games

Youngsters never run out of game boards when their playroom floor is covered with a new British vinyl flooring that has the games inlaid in the vinyl. Another advantage of Playflor is that there's less clutter on the floor.



New joints for divers

Unusual "rolling convolute joints" in a new stainless-steel diving suit give the diver more mobility than do the traditional ball joints, reports the maker, Litton Industries. The suit is designed for depths to 600 feet.



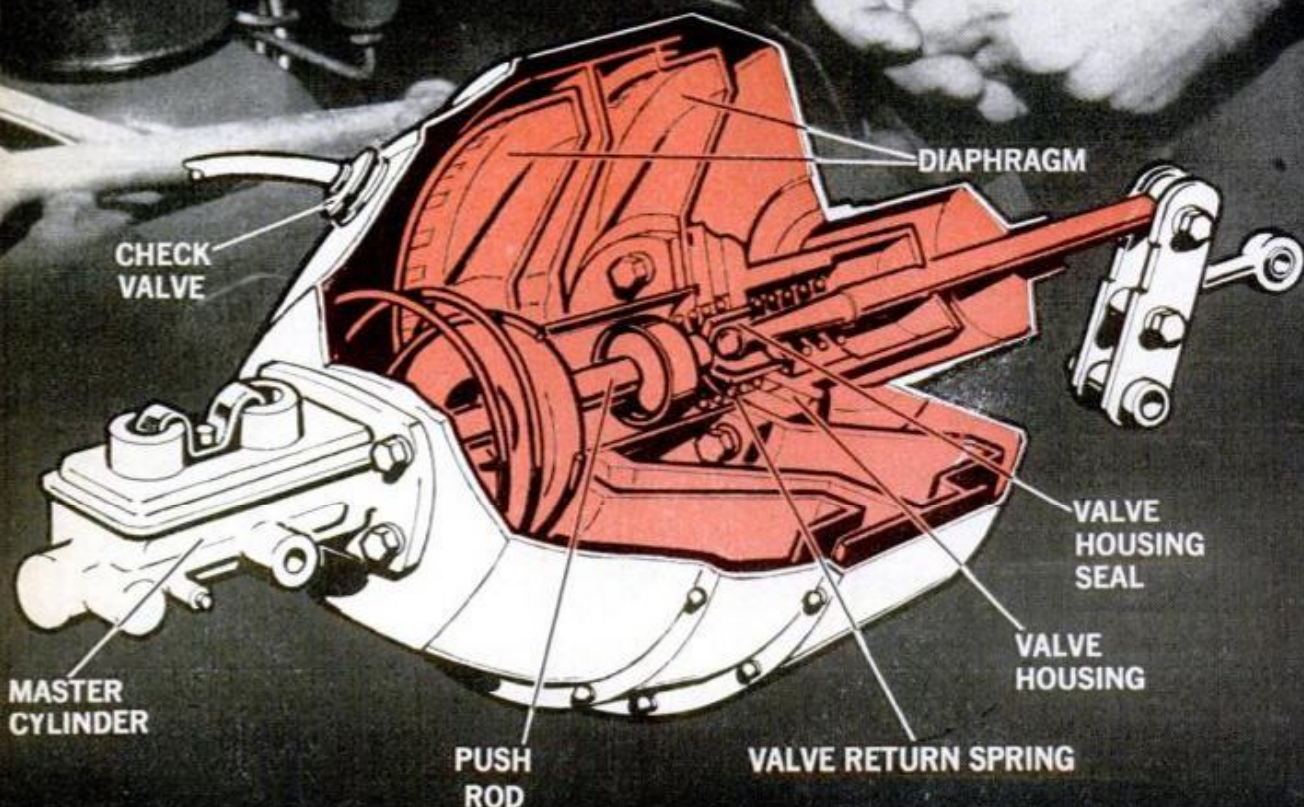
Anyone for steel?

Already used in championship play by such experts as Mrs. Billie Jean King is Wilson's new steel tennis racquet. The racquet is made of chrome-plated tubing and stainless wire and takes conventional nylon or gut stringing.

How to Keep The POWER In Your POWER BRAKES

By MORT SCHULTZ

Know how to tell when your power booster is causing your brake trouble, whether it's a vacuum or hydraulic problem and whether you'll have to rebuild or replace it.



THE PAST 10 YEARS have seen more than 20 different variations of the part that puts the *power* in your power brakes—the power booster unit. But, happily, they all have a trait in common: They require practically no servicing other than a periodic check of hydraulic fluid.

Hydraulic fluid level is checked at the master cylinder which, in a car with power brakes, is an integral part of the booster assembly. Power brakes, incidentally, are really the same as conventional brakes except for the addition of a power-assist unit. If the power-assist unit fails, you can still stop your car, although a lot of extra force is needed.

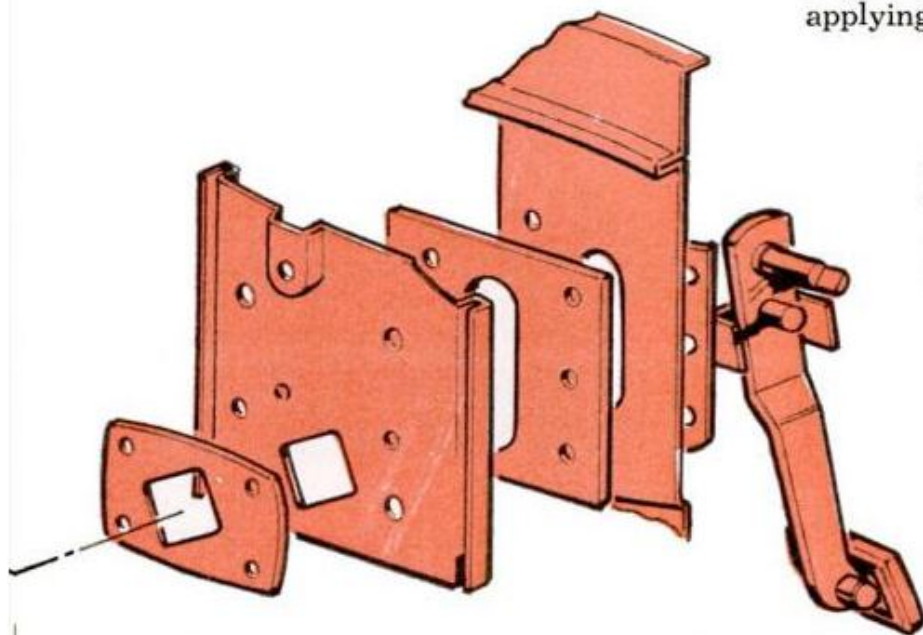
The power-assist unit, or booster, works on a principle of unequal air pressure. Engine manifold vacuum is applied to the master cylinder side of the assist unit, which is separated into two parts by a diaphragm. Atmospheric air pressure is

applied to the brake-pedal side. A force is thereby created in the direction of the low-pressure (vacuum) side—a force equal to the difference in pressure.

Sometimes, though, the brakes will grab if a power-assist unit is in trouble, the brake pedal will be slow to release, the brakes will fade, or the brakes will make noise when applied. But any one of these conditions does not necessarily signify a malfunction in the booster only. In fact, chances are good that the source of the problem is somewhere else in the brake system. This is true for all problems except lack of power.

Fortunately, there are tests that will pinpoint trouble to the power-assist unit. The nice part is that you don't need any special equipment to perform these tests.

The first test is a check for vacuum. If there is no vacuum at the forward end of the power-assist unit, there will be no supplementary force to assist you when applying the brakes.

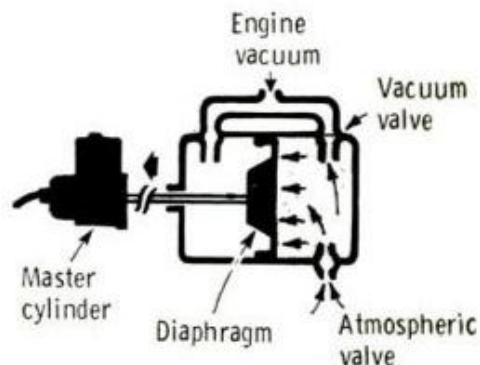


applied to the brake-pedal side. A force is thereby created in the direction of the low-pressure (vacuum) side—a force equal to the difference in pressure.

This force acts on every square inch of the diaphragm, which moves the master cylinder piston forward when you apply the brake pedal. This stronger force supplements the force of your foot on the push rod, so you don't have to do all the work. It makes brake application easier under normal braking conditions and allows you to apply more hydraulic pressure to the brake system for faster stops during panic braking conditions.

How do you know when you have a

POWER ASSIST occurs as follows: Push rod moves forward, actuating valves that introduce atmospheric pressure behind diaphragm and engine vacuum on master cylinder side. Concept is shown in diagram below. Photo shows master cylinder cover removed to check level of hydraulic fluid



The running engine supplies the vacuum. Naturally, the engine doesn't produce a complete vacuum. But it does lower air pressure inside the intake manifold to around five to seven pounds per square inch. That's a far sight less than atmospheric air pressure at sea level of nearly 15 pounds per square inch.

To test for the presence of sufficient vacuum at the booster, leave the engine off and pump the brake pedal a few times. Now stomp down solidly on the pedal and start the engine. You should feel a slight forward movement of the pedal, and you

should need less foot pressure to hold the pedal in a steady position.

If there's no pedal movement and if the pedal feels hard underfoot, the power-assist unit is lacking sufficient vacuum, maybe because of a malfunction outside the assist unit. Or the trouble could be inside the unit—perhaps a bad seal that's causing a vacuum loss.

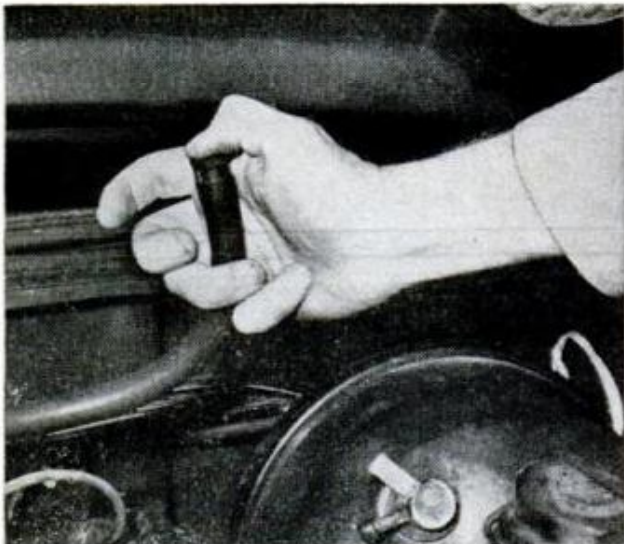
You can tell whether the trouble is internal or external by simply disconnecting the hose running from the intake manifold to the assist unit. Start the engine and hold your thumb over the hose. If you don't feel strong suction, the problem is forward of the assist unit. If you feel plenty of suction, the trouble's inside the assist unit.

Lack of suction should immediately send you to the hose itself. Make sure it makes a straight-line run from manifold to assist unit without kinks in it. Start the engine to see if the hose collapses under pressure. Eyeball it closely for cracks.

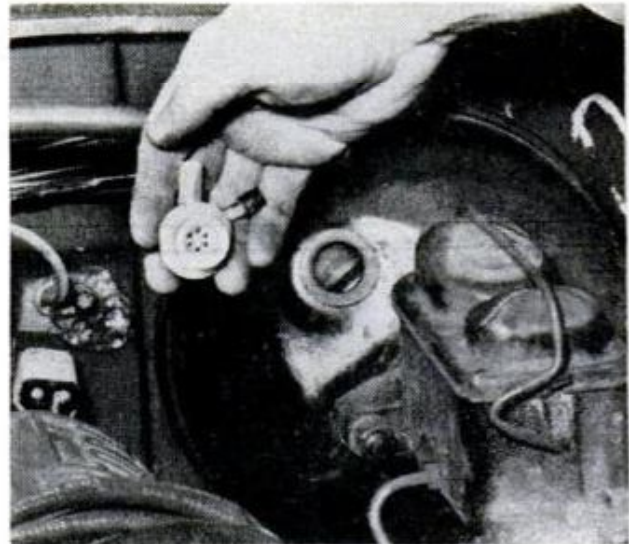
If the hose is okay, lack of vacuum is probably due to an engine problem. But before you get to that, better have a close look at the vacuum check valve. Fortunately, on most assist units, this valve is located on the outside of the sealed container. It can easily be removed for testing. In fact, with many units, when you remove the hose from the assist unit, you can remove the check valve with it.

The purpose of the check valve is to allow air inside the assist unit to be pulled

STEPS IN TROUBLESHOOTING YOUR POWER BOOSTER



DISCONNECT VACUUM HOSE at booster and you should feel manifold vacuum if it's reaching booster



REMOVE CHECK VALVE from its seat in the booster. Most valves are this accessible and easily removed



TEST CHECK VALVE simply by blowing into each end. Valve should only allow air to exit from the booster



CHECK VACUUM HOSE for hydraulic fluid, presence of which indicates defective master cylinder seals

out by vacuum in the intake manifold, thus creating vacuum inside the unit. The valve is a one-way part. It lets air rush out, but not back in.

Remove the valve and blow into the booster side. There should be no obstruction to air flow. Now, turn the valve around and blow into the hose end. There should be absolutely no air flow.

If the valve's okay, you'll have to check out the engine for vacuum loss. You may have a bad intake manifold gasket, poorly tuned engine or a sticky or burned valve.

If vacuum is being delivered to the booster, check the condition of the hydraulic system. With the engine off, pump the brake pedal a few times and then step down solidly on it and hold your foot steady. If the pedal sinks away under pressure, check all hydraulic lines and connections from the master cylinder to the wheels for brake fluid leakage. If there is no external leak, remove the vacuum hose from the assist unit and twirl a screwdriver around inside it.

A screwdriver that comes away covered with brake fluid means that fluid is being sucked out of the hydraulic system into the manifold, probably because of bad seals inside the master cylinder. You'll have to replace the cylinder. If this check doesn't indicate trouble in the master cylinder, the loss of hydraulic pressure is probably originating in a bad wheel cylinder.

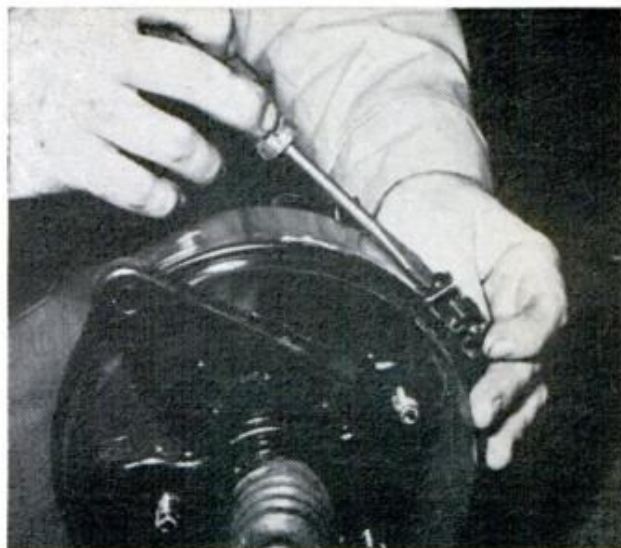
If all your tests isolate the trouble to the power-assist unit, you're faced with a decision. You can replace the booster with a new or rebuilt unit that you can buy at an auto-parts supply house or a junkyard. It will cost from \$30 to \$50, depending on the car. Or you can rebuild the unit yourself. If you do, you'll need a couple of special tools and a rebuild kit.

One tool you may need, if the two parts of the assist unit aren't held together by a removable clamp, is a strap wrench, which costs about \$4 at an auto-parts outlet. The rebuild kit runs from \$10 to \$15. Don't forget to replace the small filler that cleans the air entering the booster. Most boosters incorporate a replaceable filter.

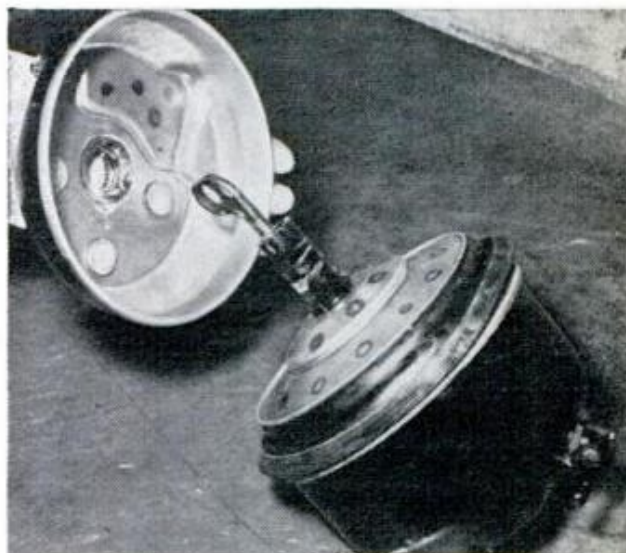
Because of variations in boosters from car to car, refer to one of the major auto repair manuals—*Motor's*, *Chilton's* or *Audel's*, for example—for specific rebuilding details. We have shown the procedure

(Please turn to page 192)

DISASSEMBLING THE POWER BOOSTER FOR REBUILDING



REMOVE CLAMP that holds split halves of booster together. On some units you'll need a strap wrench

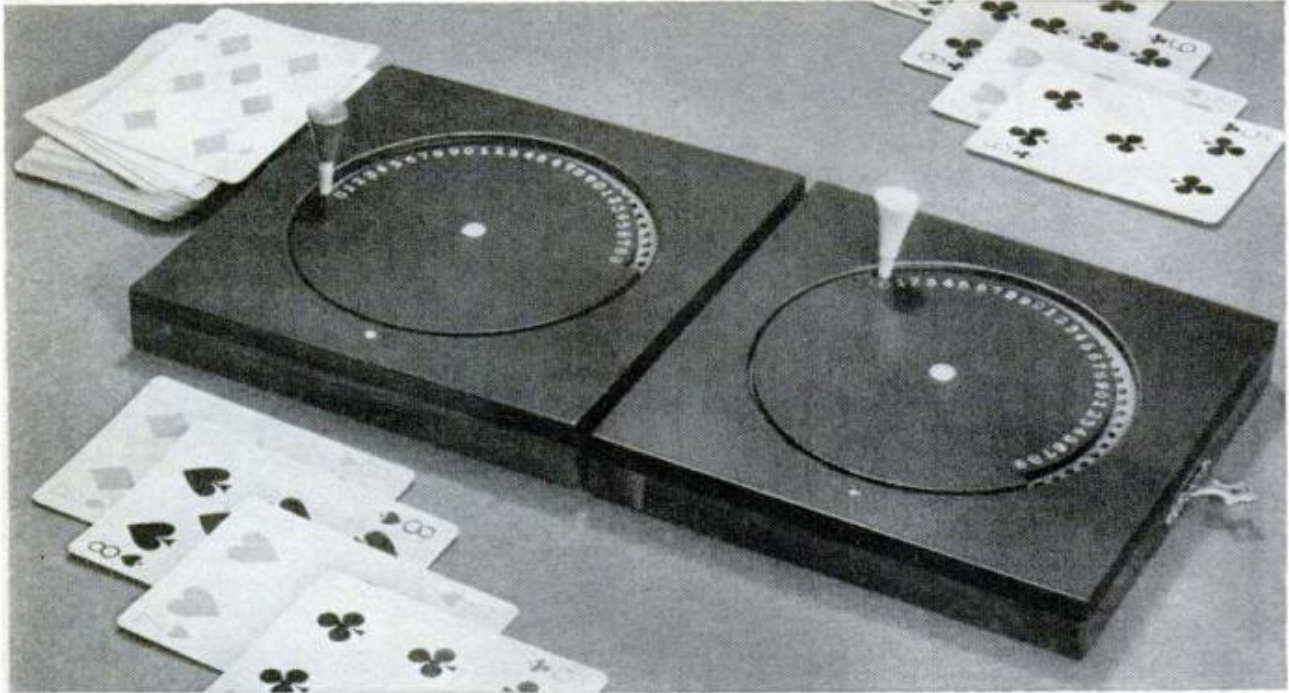


SEPARATE BOOSTER HALVES to reveal diaphragm. A bad one will not maintain the pressure differential



DISASSEMBLED BOOSTER reveals diaphragm, at right, and control hub assembly that houses the push rod

Three Weekend

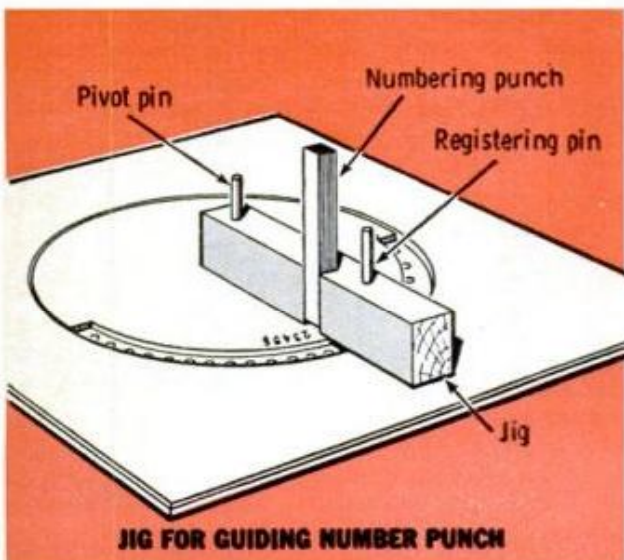


1 POCKET CRIBBAGE BOARD

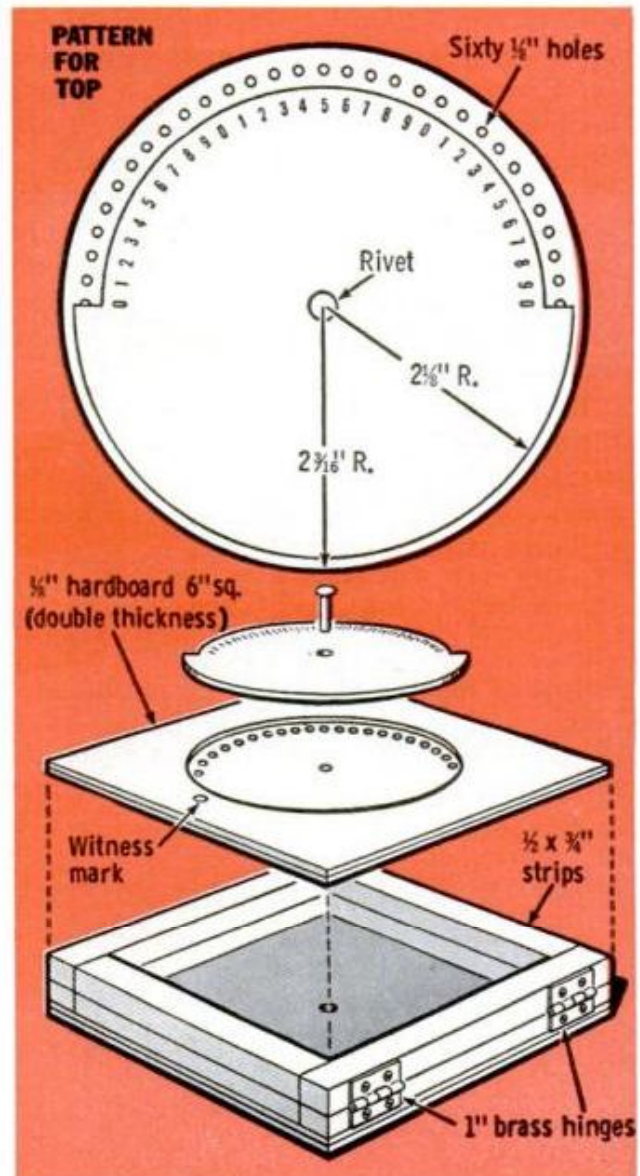
Pegging a 24 hand will be a cinch with this novel cribbage board on your card table. Just turn the revolving disc until it's against the peg (actually a golf tee) and the chalking up of any score can be done without counting each hole.

As detailed below and at the right, the board consists of two identical sections that are hinged together to form a pocket-size box in which to carry the pegs and cards. Construction is simple—you just use a protractor to index the holes 6° apart, and then use the holes to position the jig for the number punch.

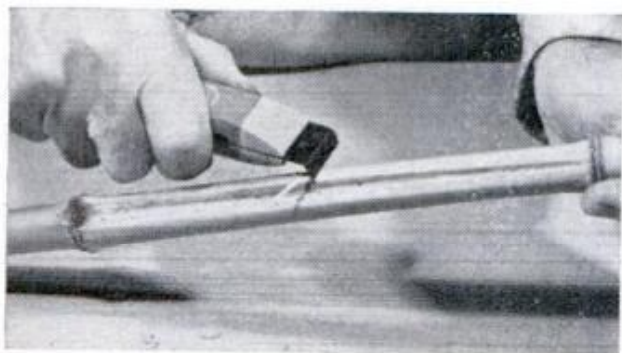
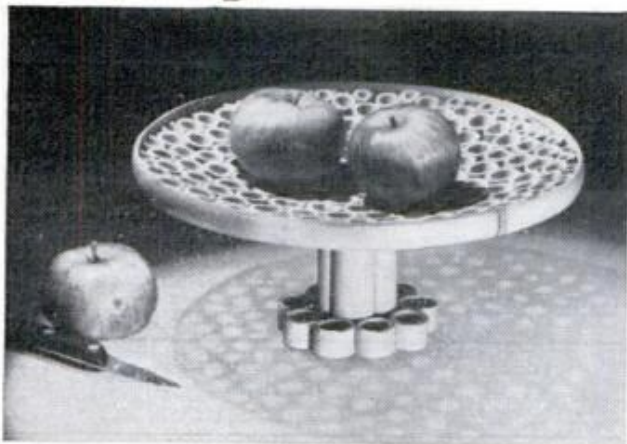
William G. Waggoner



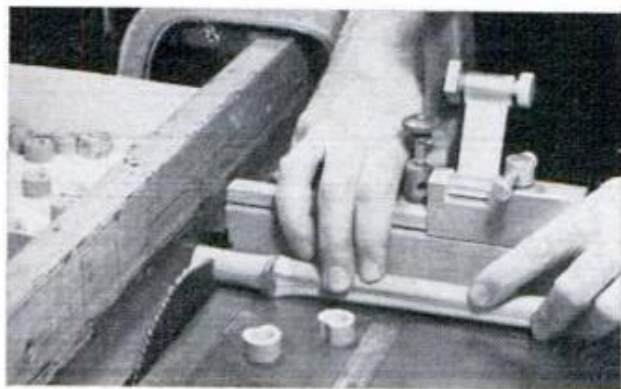
JIG FOR GUIDING NUMBER PUNCH



Projects



SCRAPE hard, brittle skin from bamboo so glue will stick. This also removes most surface discoloration



SAW RINGS approximately $\frac{5}{8}$ -in. long from pole. Discard any sections disfigured by joints or cracks



USE WHITE GLUE to join rings together. Protect contoured form by covering it with sandwich wrapping

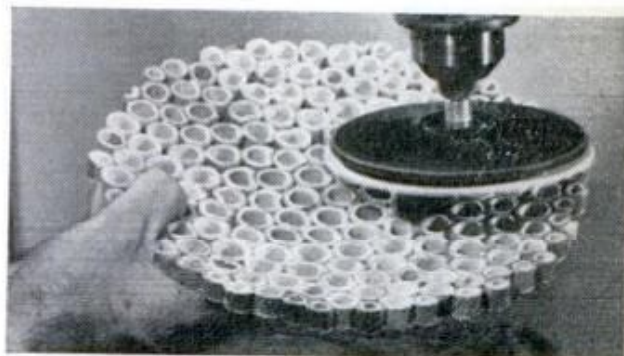
MARCH 1968

2 BAMBOO FRUIT BOWL

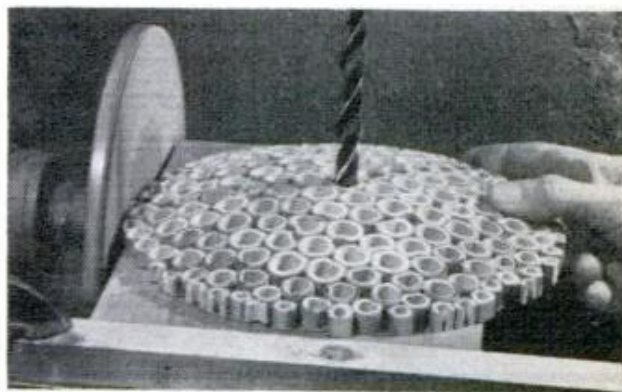
Here's how to put that old bamboo pole you've been saving to good use: Cut it into short pieces and glue these together to form a handsome see-through fruit bowl for the missus.

Scrape the skin off the pole before cutting so the glue will be able to adhere to the fresh surface. Then cover the bottom of a suitable dish or bowl with a thin layer of plastic and begin gluing the rings to each other. Use the larger rings for the center of the bowl, then complete the fancy fruit bowl by sanding and sealing with a clear, nonglossy finish.

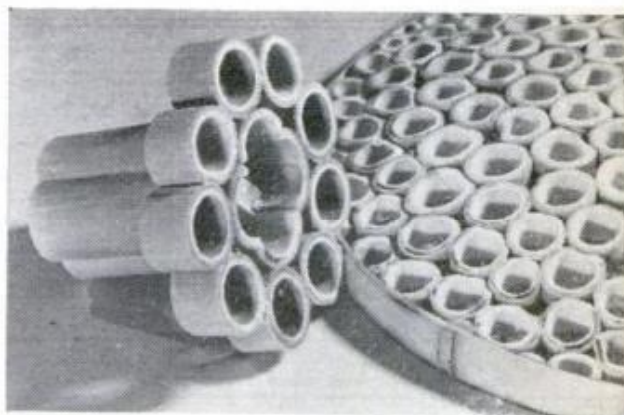
—Walter E. Burton



SAND THE CONCAVE SURFACE of the bowl with a sanding disc chucked in a power drill or drill press



TRIM TO CIRCULAR OUTLINE by sanding or cutting on a bandsaw. Add $\frac{1}{2}$ -in. bamboo strip for a rim



MAKE BASE of bowl from four long rings glued together. Surround these with smaller rings for stability



3 CRADLE-BASSINET

Serving double duty as both a rocker cradle and bassinet, this unique piece of nursery furniture is a project the father-to-be craftsman will want to have ready for the coming event. The convenience of a built-in rocking bassinet which can be lifted from its stand and carried to the car, will appeal to the new mother when baby must go along for the ride. As for space, it's ideal for the most compact bedroom.

Pine, plywood and dowels keep its cost to a minimum and help simplify construction. The ends of the stand are made alike, with legs doweled to the posts and strengthened by cleats screwed to the inside. Metal brackets used to pivot the bassinet are made from two standard door-chain guards. The chains are cut off and

(Please turn to page 204)

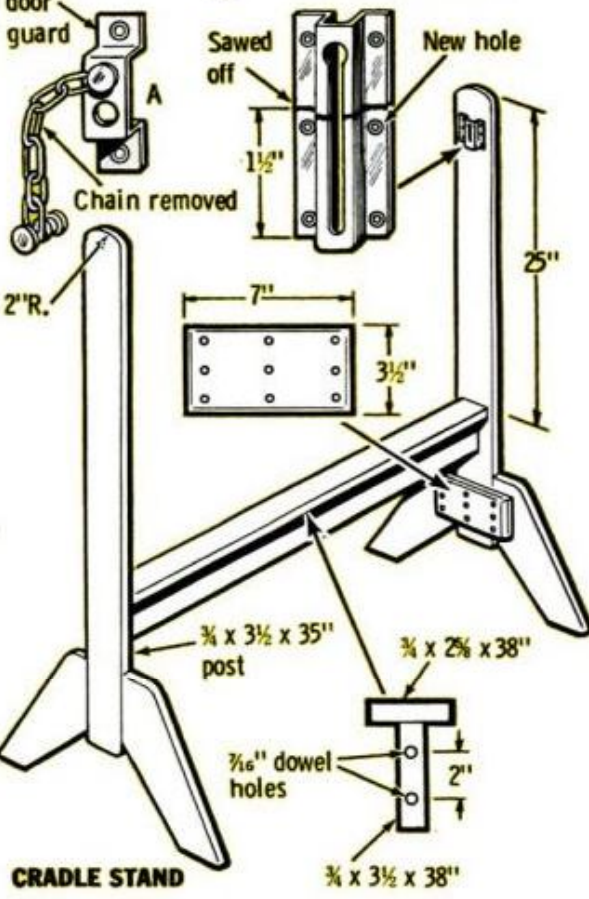
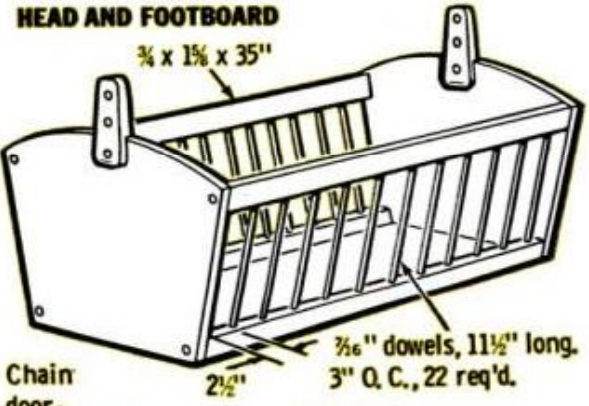
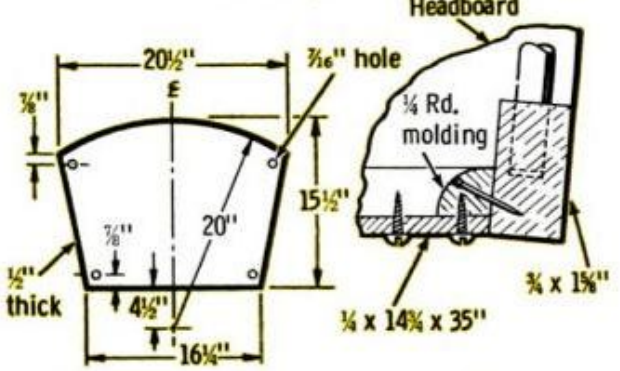
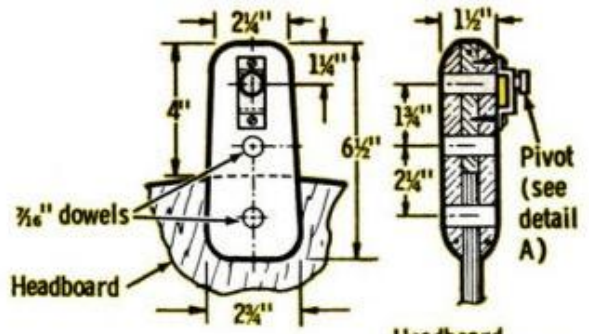
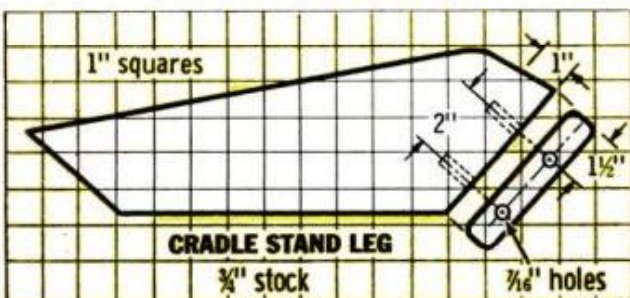
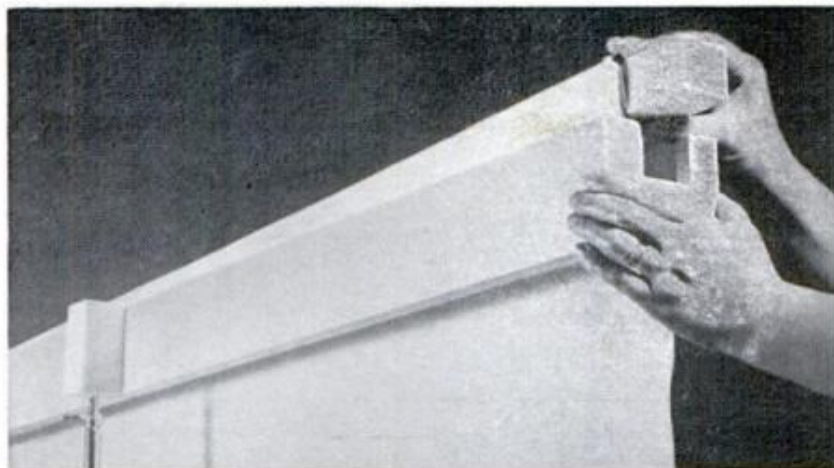
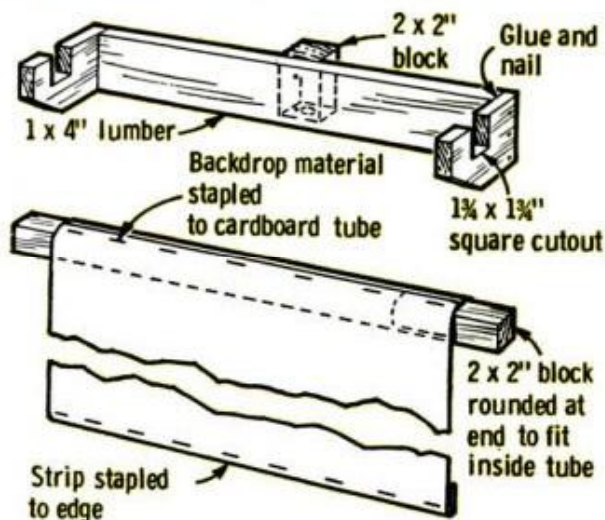


Photo Hints

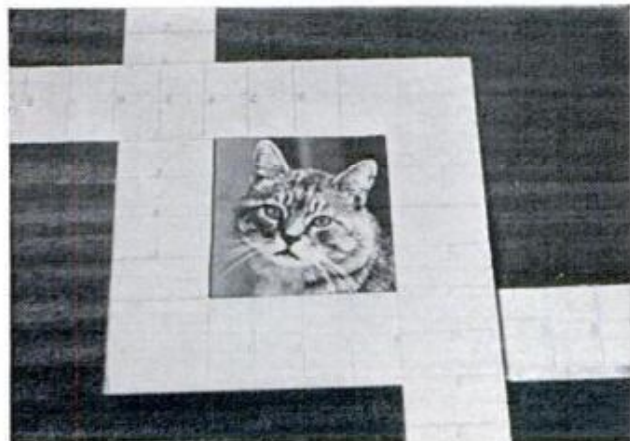


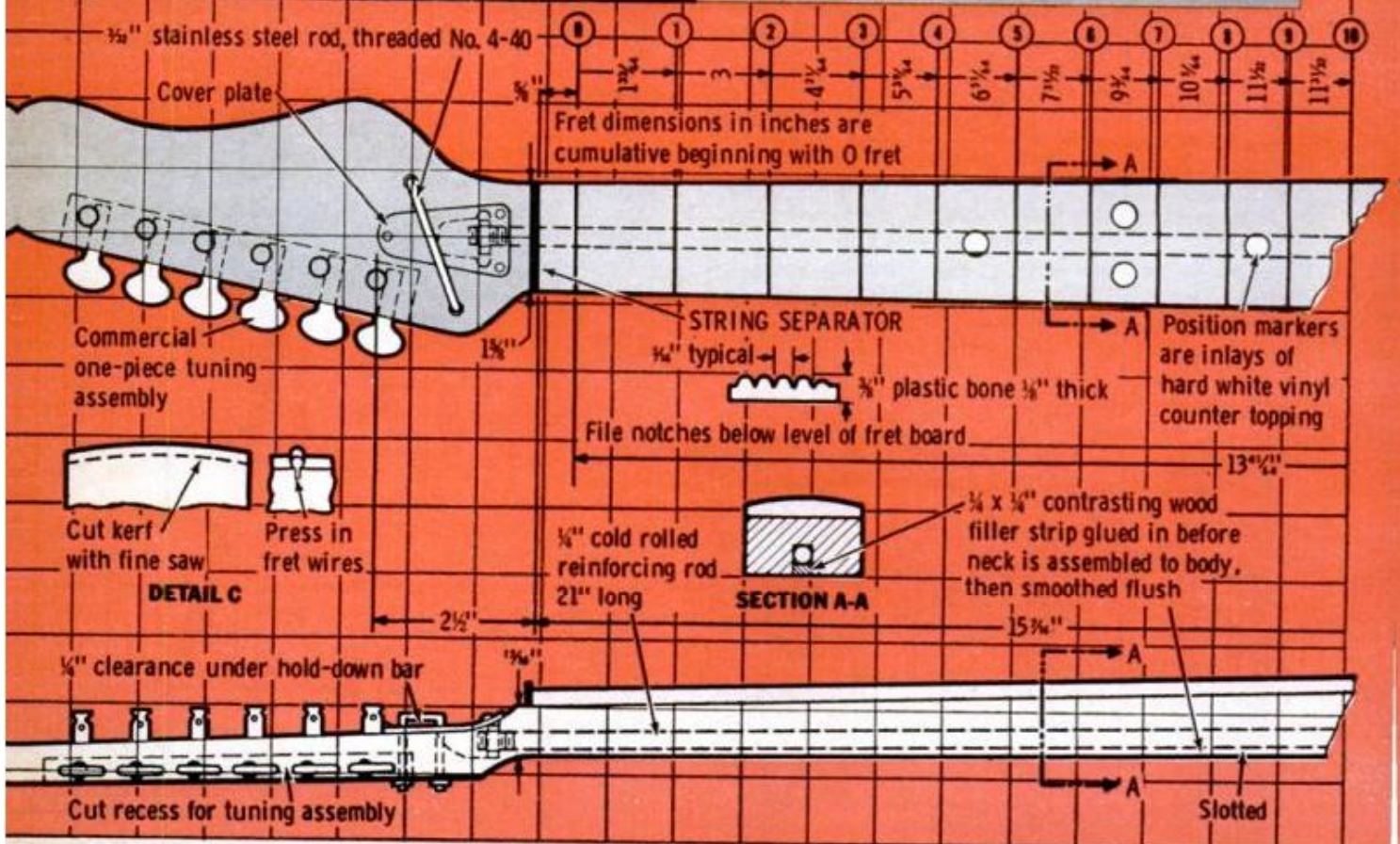
THIS PORTABLE BACKDROP takes only a minute to set up and holds interchangeable rolls of paper or fabric so you can switch backgrounds rapidly. The holder slips over the top of a regular photographic light stand and can be raised to any height desired. Each roll of backdrop material is stapled to a cardboard tube. The ends of the tube are fitted with square blocks made from a 2x2 or similar wood stock. Round the blocks at one end with a rasp and glue them into the tube. The blocks lock into square notches in the holder and keep the roll from unwinding. If cardboard tubes aren't available, you can use lengths of closet-pole stock filed square at the ends. The rolls of paper can range from three to six feet wide, depending on your needs.—R. S. Hedin



TWO BLOCKS OF WOOD fitted with small ball glides at the corners will make a simple dolly for your tripod (lower right). Drill a hole part way through each block to take the tip of a tripod leg. With the two front legs resting on the wheeled blocks, the tripod can be tipped up and rolled around easily. Once the camera is in position, merely lowering the third leg is all you need to do to anchor it securely.—Rod Moon

A PAIR OF CROPPING GUIDES makes fast work of framing the picture area you want to print before going to the enlarger. Cut the L-shaped pieces from stiff cardboard (the corners from an old picture-frame mat are ideal). Mark inch scales along the inside edges of each guide, numbering from the corner out. The scales will allow you to crop pictures to standard print sizes quickly and accurately





BUILD THIS BARITONE GUITAR...

It's easy to make and a pleasure to play

By ROY L. CLOUGH JR.

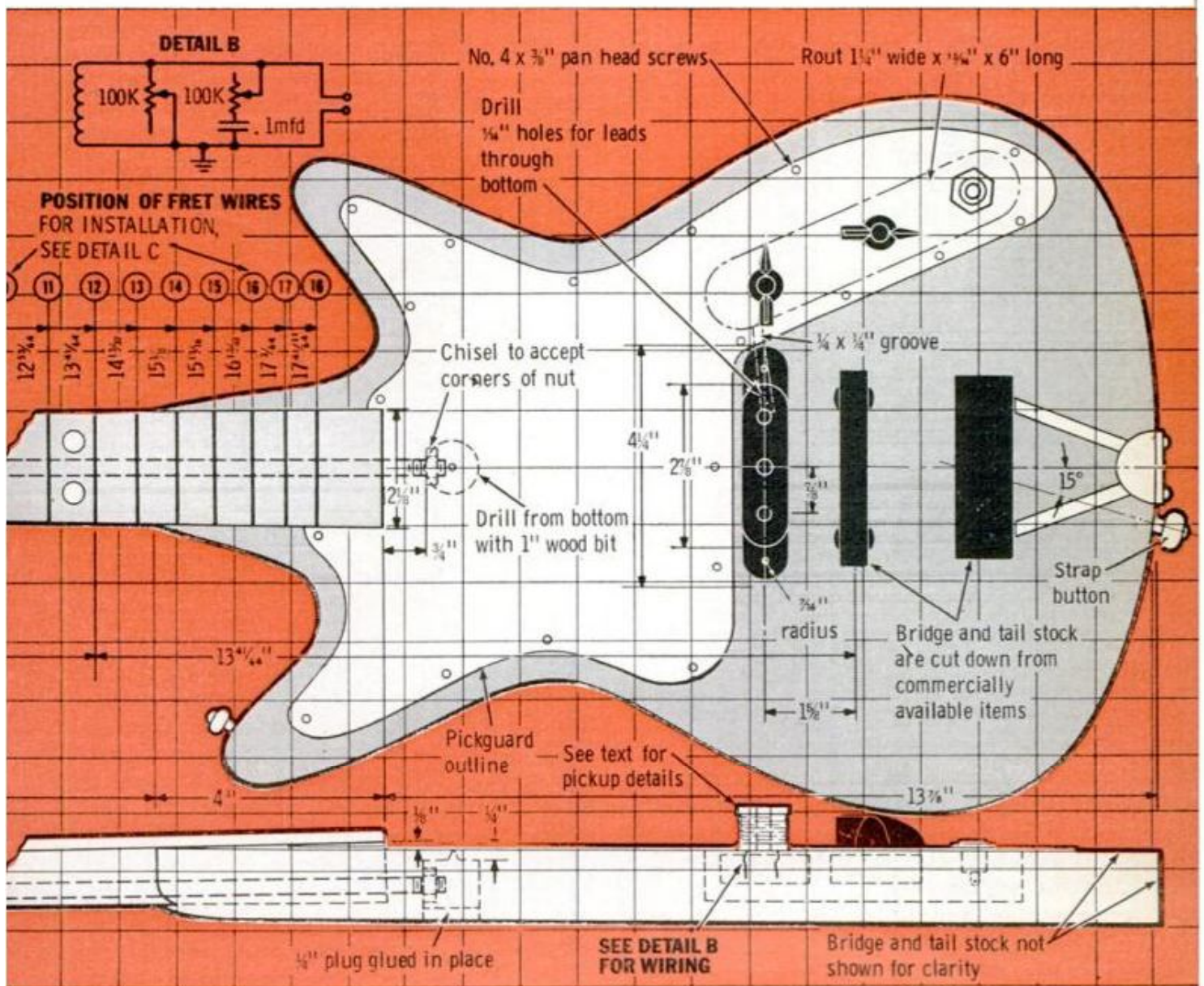
Technical Art by Graphic Presentation Services

IT'S CALLED A BARITONE because it's tuned an octave lower than an ordinary electric guitar. What's more, because its tone ranges from rich and brassy to soft and vibrant, you can use it as a solo, rhythm or bass instrument—just twist the controls to produce the desired effect.

The body of the instrument can be made of any wood that has a good-looking grain and will take a finish well. The neck, however, must be made of hardwood,

such as maple or mahogany. Bandsaw a 1-in.-thick blank to the required outline and work it down to final size with a spokeshave or surface-forming tool, and sandpaper.

Rout or mill the $\frac{1}{4} \times \frac{1}{4}$ -in. groove in the bottom of the neck, then chisel out the small opening near the top of the neck and slip the $\frac{1}{4}$ -in. diameter reinforcing rod into the groove. Add the nut at the top end of the rod, fill the groove with





CUT
FOLD
TAPE

BARITONE GUITAR

ADJUSTMENT NUT is located beneath sheet metal cover at top of neck, always should be kept tight

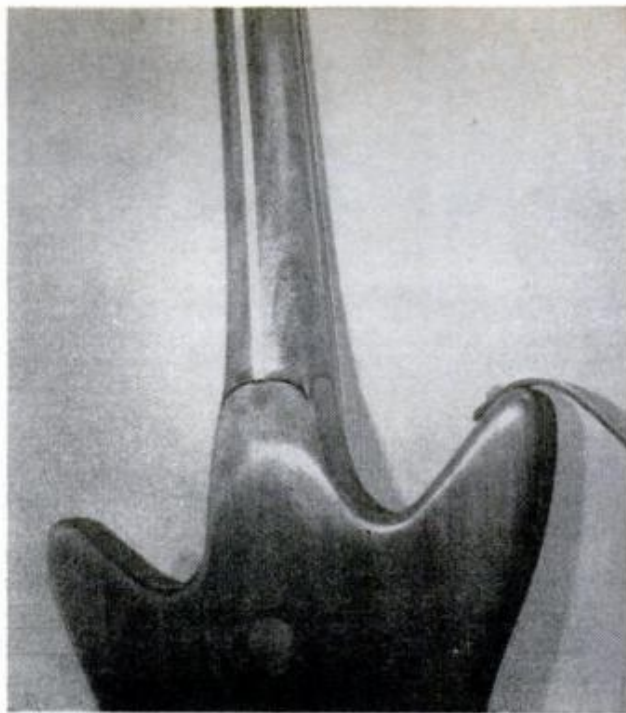
white glue and add the $\frac{1}{4} \times \frac{1}{4}$ -in. filler strip of contrasting wood. It's important here to have only a short section of rod protruding into the well; otherwise, future adjustment will be difficult.

Wipe off excess glue and clamp the filler strip to the neck along its length. Set this aside to dry thoroughly and finish preparation of the body by drilling the $\frac{1}{4}$ -in. hole for the rod and the 1-in. hole through the bottom of the body. Chisel the latter hole to accept the corners of the nut.

When the neck has dried completely, fit it to the body by applying glue at the mating surfaces, tightening the lower nut and clamping securely. Let the entire assembly dry for a day or two while working on the other details, then finish the body and smooth the joint between the neck and the filler strip.

The fret board can be made of rosewood or beech, shaped as shown in cross-sectional view A-A. Slots for the frets can be cut with a fine-tooth hacksaw or other thin blade—just be sure to locate the frets as accurately as possible.

Cut the fret wires about $\frac{1}{8}$ -in. longer than the slots in the fret board and shape them to approximate the contour of the slots. Fill a slot with a metal-to-wood glue, hammer the wire in place with a rawhide mallet, then quickly wipe off the excess glue and go on to the next fret wire repeating this step. When all frets have been installed, check carefully for



WOOD FILLER STRIP and neck of instrument should be contoured into body. Wood plug hides nut in body

any high spots and hammer them down.

Allow the fret assembly to dry, then grind off the wires flush with the board and round off their ends with a fine file. Glue and clamp the board to the neck and, when dry, smooth off the joint.

Next install the machine heads for tightening the strings. The spacing between the pegs will vary with the different makes available commercially; however, there is enough room to install individual pegs if desired. Locate the pegs about $\frac{1}{2}$ -in. from the straight edge of the head.

There isn't any advantage to using a vibrato tailstock for this heavy-string instrument, so a cut-down commercial tailstock can be used. The bridge is an adjustable rosewood type, trimmed flat on the bottom and shortened at the ends.

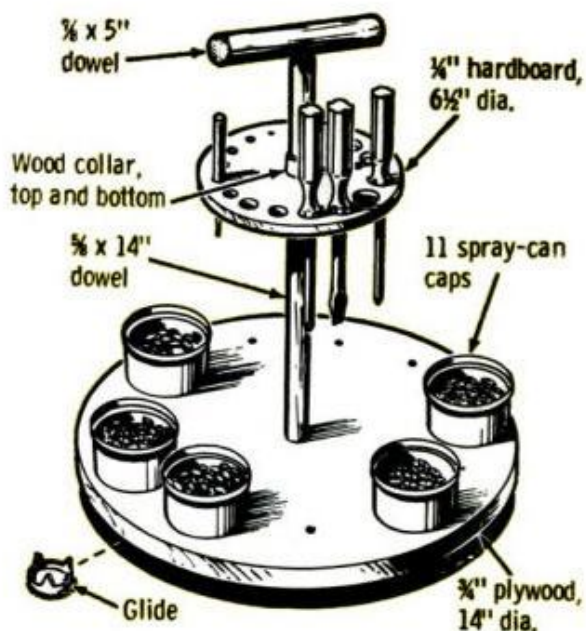
Don't try to do without the string hold-down bar. Made of stainless steel or brass rod, it prevents stray vibrations and keeps the head of the guitar free from stress.

The pickup is made of two pieces of $\frac{1}{8}$ -in. thick plastic holding three $\frac{1}{4} \times \frac{3}{4}$ -in. Alnico magnets. Cover the magnets with plastic electrical tape, then wrap them with 3500 ohms of No. 40 Nyclad magnet wire. Coat the outside of the coil with another layer of plastic tape, mount the pickup and run the outside coil lead to the shield side of the jack. Glue the string separator in place, mount a set of Fender six-bass strings and adjust the bridge for the best tonal response. ★★

HINTS FROM READERS

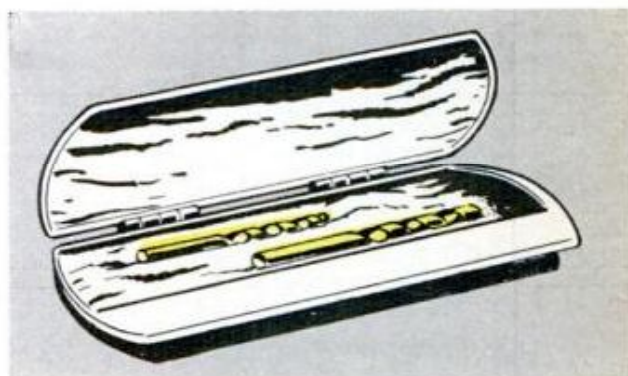
Simple caddy for tools and parts

The large plastic caps from cans of spray paints, waxes and cleaning fluids make ideal holders for small screws, nails and other items. Just screw them to a bottom disc of plywood as shown in the drawing at right, then drill the disc to accept a $\frac{5}{8}$ -in. dowel. Another disc is then drilled and fitted to the dowel to accept the shanks of screwdrivers, as well as the handles of pliers and other hand tools. If desired, you can add four furniture glides to the base so that it will slide easily.—*Eric Swanson*



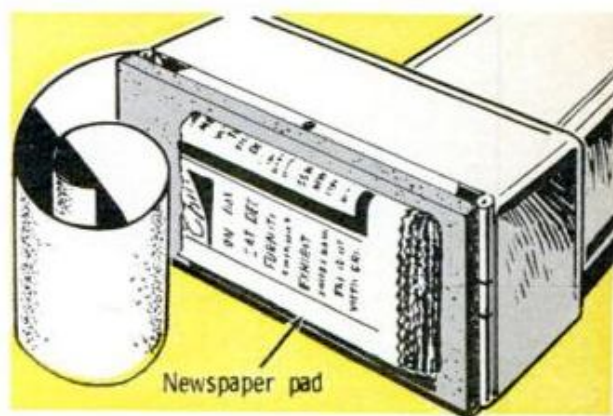
Eyeglasses-case drill holder

Keep track of small drill bits and other precision-ground tools by storing them in an old eyeglasses case. Most of these cases have a steel frame—so you can leave delicate items in a cluttered workbench drawer without scratching them or damaging their beveled edges. And you'll find that you won't be wasting time searching for each item either.—*Wilfred Beaver*



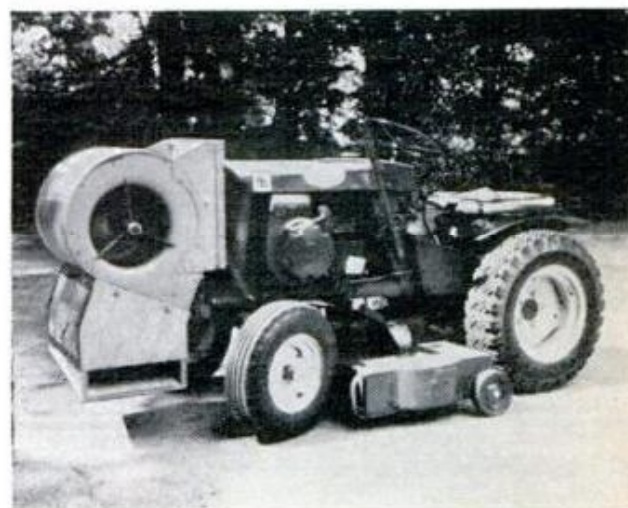
Pad prolongs life of sandpaper

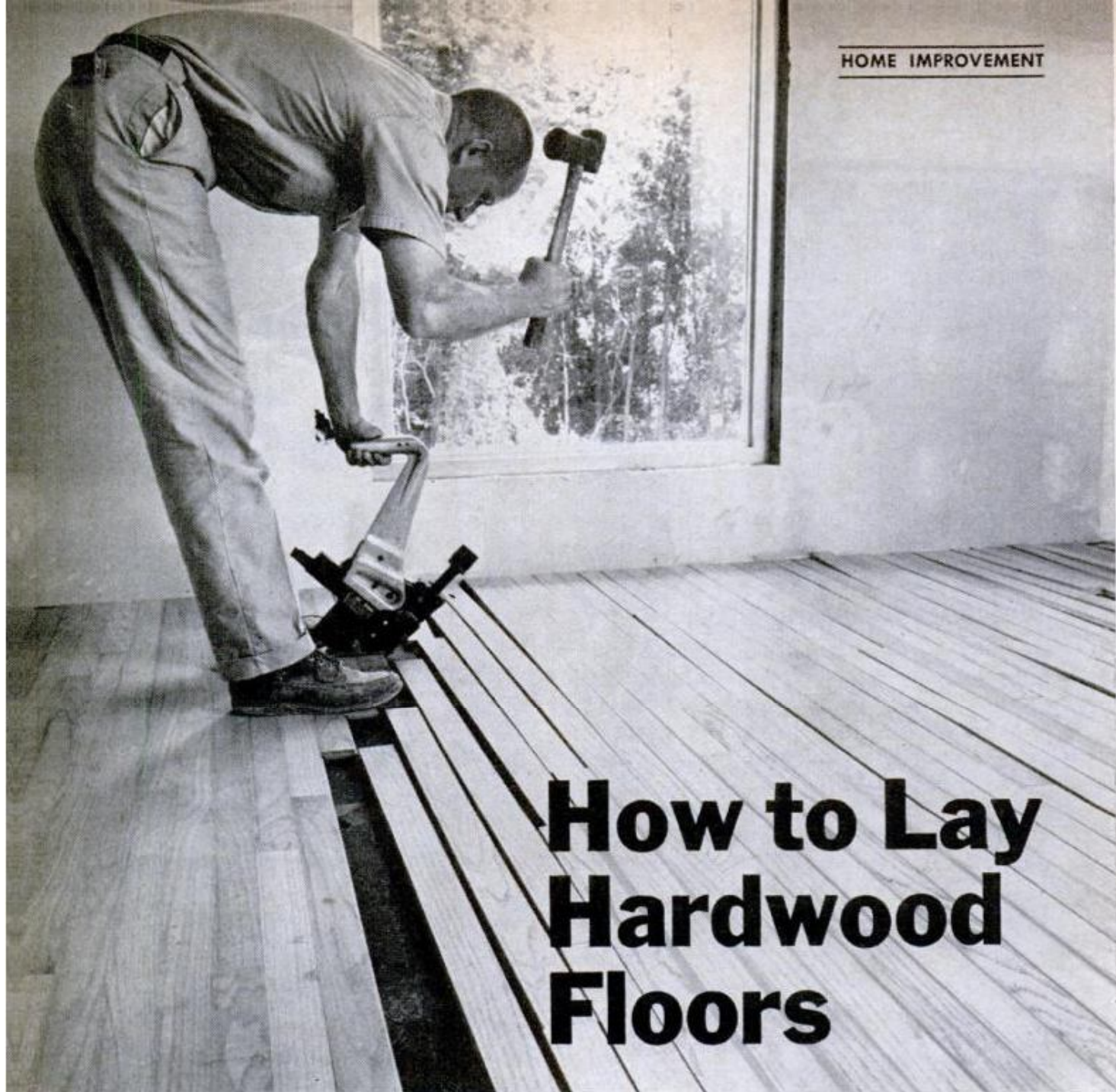
To get more use from sandpaper and also to make the sander bite evenly, slip a small thin pad of newspaper between the paper and the platen. The pad of newspaper, when placed under the center of the sheet of sandpaper, will cause the sandpaper to wear uniformly. Without it, the sandpaper will rapidly wear at the edges, while the center of the sheet retains its grit.—*Wilfred Beaver*



King-size leafblower

Equip your garden tractor with this inexpensive blower and you can blow up king-size piles of leaves with ease. The blower is actually an old unit from a forced-air furnace, fitted with sheet metal and angle iron for mounting and a simple duct of scrap wood. The electric motor is, of course, removed from the squirrel-cage blower, and the original blower pulley is belted to the tractor engine's drive pulley. If the idea appeals but you have no blower, try a nearby junkyard. Cost for just housing and blower is little.—*Carl Broman*





How to Lay Hardwood Floors

POSITION LENGTHS OF STRIP FLOORING before the actual nailing to check joint spacing, speed installation

By **JAMES P. SCHENLEY**

Technical Art by Don Evans

WHETHER YOU'RE ADDING a new room to your home or just finishing off the attic (finally), the successful way to lay a hardwood floor begins long before you pick up a hammer, saw, or nail. In fact, what you do beforehand mainly determines your later degree of success.

One important preliminary is to make certain that *all* other construction is complete. Otherwise, you'll find the new floor will be used as a work surface, leading to scratches, dents and unsightly streaks.

Once all other work in the room is completed, select the flooring material. There are three types you're likely to find in

any lumberyard: strip flooring, parquet blocks and laminated blocks.

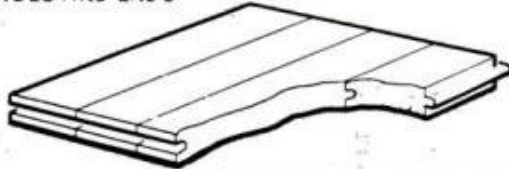
Strip flooring is the most common and has side-and-end matched tongues and grooves to greatly ease installation. Standard strip flooring is $\frac{25}{32}$ in. thick with a face width of $2\frac{1}{4}$ in. Other face sizes range from $1\frac{1}{2}$ to $3\frac{1}{4}$ in., while the length may vary from 1 to 16 ft.

Parquet blocks are actually lengths of strip flooring that are fastened together to form a tongue-and-groove block of a standard size. The most popular size is 9 in. square, although other sizes range from $6\frac{3}{4}$ to 12 in. square.

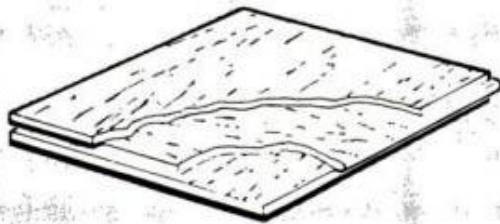
SELECT A FLOORING



TONGUE AND GROOVE
ON SIDES AND ENDS



PARQUET BLOCK FLOORING



LAMINATED BLOCK FLOORING

Laminated-block flooring consists of layers that have been bonded together in a crossgrain pattern, much like plywood, to form the same size standard blocks as parquet flooring. Thus, like plywood, this type of floor will shrink or swell less than other flooring when subjected to moisture.

A fourth material is plank flooring, which is more expensive than the three common materials already described. Available in random widths of 3 to 9 in. (in multiples of 1 in.), hardwood planks are fastened to the subfloor with screws, which are then countersunk and plugged.

There are two important factors you should consider before choosing. First, all wood flooring is available in either pre-

DETERMINE HOW MUCH STRIP FLOORING YOU'LL NEED

First calculate the room's square footage. Add to it the percentage of that figure as listed below for standard size strip flooring. The result is the total amount of flooring material needed for the room.

For 25/32 x 1 1/2"	add 55%
For 25/32 x 2"	add 42 1/2%
For 25/32 x 2 1/4"	add 38 1/3%
For 25/32 x 3 1/4"	add 29%
For 3/8 x 1 1/2"	add 38 1/3%
For 3/8 x 2"	add 30%
For 1/2 x 1 1/2"	add 38 1/3%
For 1/2 x 2"	add 30%

finished or unfinished states. Prefinished flooring may be more expensive, but it saves you effort and money by giving you a floor ready to use immediately after installation.

Second, you won't get more strength, durability or resistance to wear by ordering top-grade flooring, because flooring is graded according to appearance, *not* strength. Thus, if you're installing a floor in your vacation home and won't mind some knots, streaks or pinworm holes, don't pay the extra money for "top-grade" flooring material.

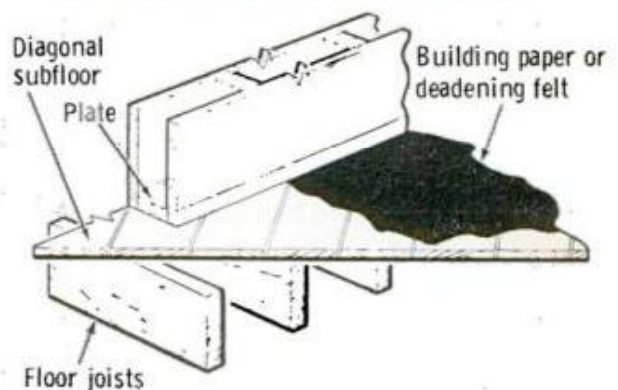
If you've decided to use strip flooring, use the chart above to determine how much flooring you'll actually need. If you're going to install a block-type floor, simply calculate the area of the room (in square feet), then convert the area of a single block into square feet and divide. Then just add another five percent for waste around the perimeter of the room.

You'll also have to order the proper type of nail. The chart at the lower left shows what nail to use with strip flooring. Commonly, however, *block-type* floors are

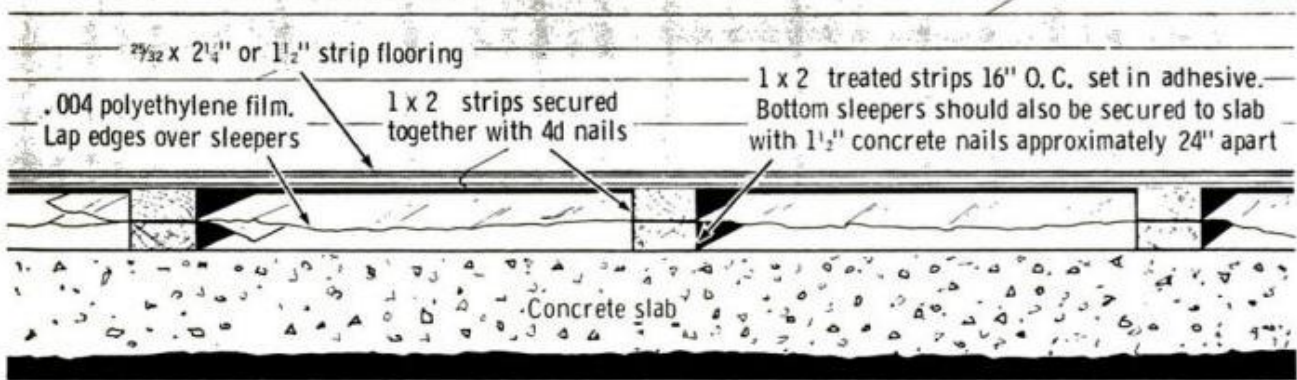
PICK THE RIGHT NAILS

Flooring Size	Nail Size	Spacing
25/32 x 3 1/4" 25/32 x 2 1/4" 25/32 x 1 1/2"	7d or 8d steel flooring or screw-type nails	10 to 12" on center
1/2 x 2 1/2" 1/2 x 2" 1/2 x 1 1/2"	5d or 6d steel flooring or screw-type nails	8 to 10" on center
3/8 x 2" 3/8 x 1 1/2"	3d or 4d steel flooring or screw-type nails	6 to 8" on center

CHECK SUBFLOOR PREPARATIONS



LAYING FLOORING ON A CONCRETE SLAB



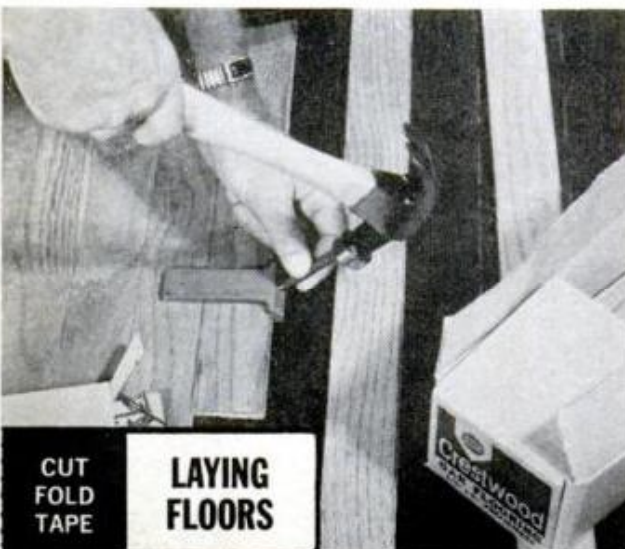
laid in a special type of asphalt mastic.

The next important consideration is the transportation and storage of the flooring material. Never have it delivered on a rainy day or stack it in a room that's recently been plastered. Similarly, do not store the material outdoors if you can avoid it. If this isn't possible, protect it from moisture by keeping it elevated and by wrapping it well with plastic or tarp.



FIRST COURSE is aligned and face-nailed in place

SIMPLE JIG helps to drive nails at the proper angle



CUT
FOLD
TAPE

LAYING
FLOORS

Crestwood
Flooring

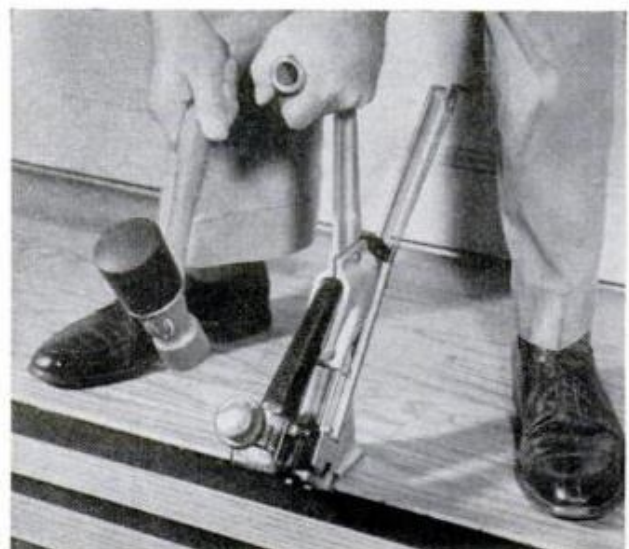
If you don't, the new floor will eventually begin to warp, buckle and twist.

Instead, open the bundles of flooring in a dry room and allow them to dry for four or five days. Strip flooring, of course, should be kept flat at all times. Laminated block flooring, on the other hand, is wrapped in individual watertight packages, and should not be opened until you're ready to lay the floor.

The condition of the subfloor also will play an important part in the elimination of squeaks and sags. To lay a new subfloor, you can use either plywood underlayment or dry lumber at least 1 in. thick and 6 in. wide. Square-edge boards are preferable to tongue-and-groove since the latter will be unable to compensate for normal expansion and contraction. Lay the boards diagonally to the joists and space them about 1/4 in. apart, using 10d nails to face-nail each board wherever it meets a joist.

Plywood underlayment, on the other hand, can be laid without any spacing since it won't expand or contract under normal moisture conditions.

NAILING MACHINE also tightens fit between boards





LAST COURSE also is face-nailed. Bar tightens fit

Before laying the new floor, drive down all protruding nails and tighten any loose subfloor boards. Sweep the subfloor thoroughly, scraping it if necessary to remove any beads of plaster or mortar. Finally, cover the subfloor with 15-lb. asphalt-saturated building paper. This is not necessary, however, if you're laying a new floor over a badly worn hardwood floor.

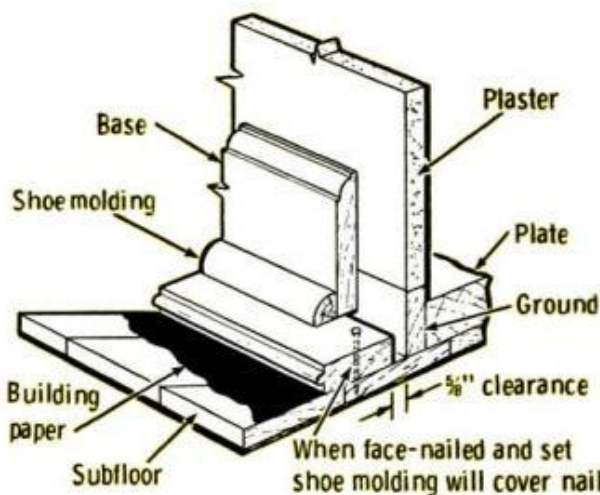
If you're laying a strip floor over a concrete slab, the drawing on the opposite page details the placement of the sleepers and plastic vapor barrier. For block-type floors, however, the sleepers aren't required because the blocks are laid directly on the concrete with asphalt mastic.

Start the first row, or course, of a strip floor by positioning the groove side of the boards about $\frac{1}{2}$ to $\frac{5}{8}$ in. away from one wall. Check that boards making up the first row are running straight (a long string does the job), then face-nail them in place. Drive the nails as close to the wall as possible so they will be hidden

NEW FLOOR over old should be laid at right angles



MARCH 1968



by the shoe molding later. Next toe nail the tongue side of the first course, countersinking the nails so they won't interfere with the grooves of the next course.

If possible, rent a nailing machine like that shown in the lower right of the opposite page. Usually available from hardware stores and flooring-supply houses, the machine will speed the nailing process, but more important, when hit by a hammer to drive a nail, it simultaneously tightens the tongue-and-groove fit of the board being nailed to the board previously laid. Without this machine, you'll have to tighten the fit between courses, using a block of scrap flooring to force the rows together without damaging the tongues.

When cutting pieces to fill in around the perimeter of the room, be sure to cut so you match tongue to groove. After face-nailing the last course in place (with the same $\frac{1}{2}$ to $\frac{5}{8}$ -in. space) nail shoe molding to the wall, not the new floor, with about $\frac{1}{32}$ -in. clearance at the bottom. ★★★

BLOCK FLOORING is commonly laid on asphalt mastic



Wall-Hung Study Center

Off-the-floor desk and storage units save space in kids' room

IF YOU CAN SAW A BOARD, you can build this wall-hung study center, for that's just about all you have to do to make it. You start out with plain flat boards and simply saw them to length, without even touching the width. The important thing is to saw the ends square.

In designing the project around standard-size boards which any lumberyard sells, David Blair, West Coast architect, not only has reached the ultimate in simplified construction, but has created a handsome, functional piece that any school boy (or girl) would be glad to have on the wall of his room.

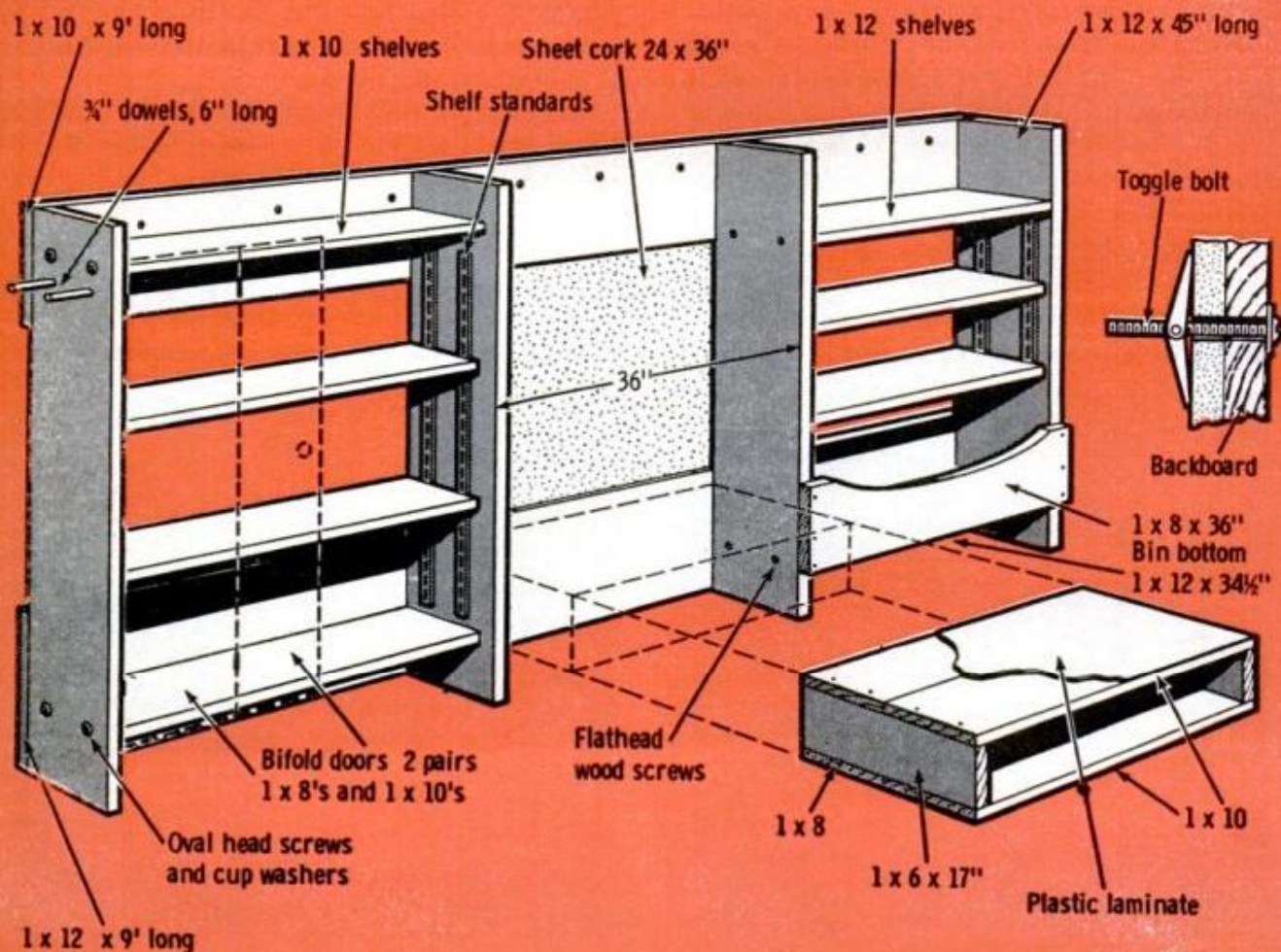
It provides an off-the-floor desk with shelf below, a cork pinup board for displaying star-studded papers, roomy shelves for reference books and a cupboard for storing all the wonderful treasures a boy collects. Pegs provide a place

for a young cowboy to hang his six-shooter. There's even a bin to corral stray toys. With a pinup lamp mounted over the desk for good vision and everything so handy, homework is bound to go twice as fast.

Remember that a 1x12 board, for example, is not a full 1 in. thick and 12 in. wide, but actually measures $\frac{3}{4}$ x 11½-in. This is true of all dimensioned lumber. Actual measurement is less than stock size.

Any solid lumber of the western pine species, such as ponderosa pine, larch or white fir, is appropriate. A natural finish (protected by a clear sealer) combined with painted cupboard doors, plus a colorful plastic desktop, will give it the eye appeal you see in the photo at right.

Nails are used to fasten the 9-ft. 1x12s to the vertical members, and they are also used when nailing the desk compartment





KNOTTY-PINE PANELING provides appropriate backdrop when given a wipe-off coat of thinned oil paint

together. All the rest of the members are joined with 1½-in., No. 10, oval-head screws which are first seated in chrome cup washers and inserted in predrilled holes in the wood. The three adjustable cupboard shelves rest on regular shelf standards and supports. Six 2½-in. toggle bolts are used to hang the unit.

Depending on the grade selected (common grades of lumber cost considerably less than clear) the wood for the complete project will run from \$20 to \$40. Hardware will come to about \$4.50, the cork, \$3.25 and the plastic laminate, \$2.75. To this you'll add the cost of glue, contact cement, paint and sealer. Total cost will vary and you may find that you can build it for well under \$40. ★★★

AFTER HORIZONTAL BOARDS are nailed to verticals, all permanent shelves are installed with screws



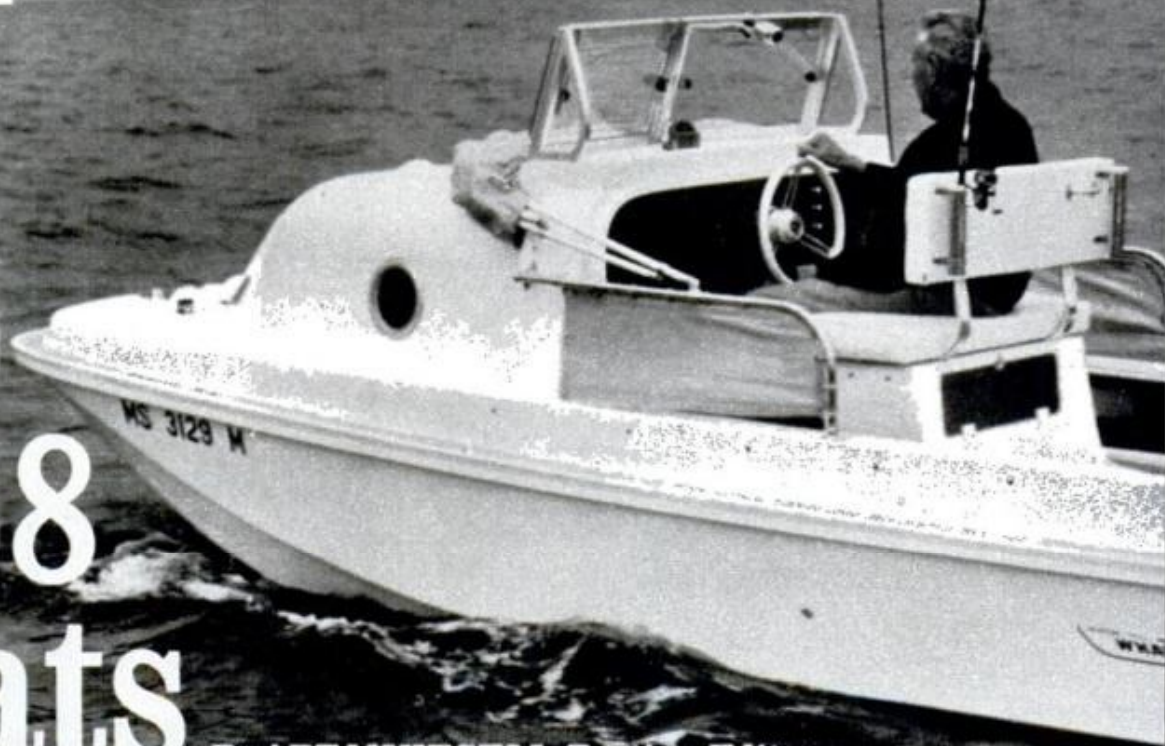
BOATING

'68

**Dozens of new super-stable tri-hulls.
Spacious new stem-to-stern cockpits.
New GT styling in runabouts.**

The 1968 Boats

By **ART MIKESELL**, Boating Editor



THE BIGGEST NEWS this year isn't a revolutionary new hull or a strikingly different cockpit design. It's plain, old-fashioned quality.

Hull designs are cleaner below the waterline, more functional topside. Space is utilized with a great deal more ingenuity. Colors are handled more skillfully. Most important, the people who count are devoting more attention to detail in design and manufacture.

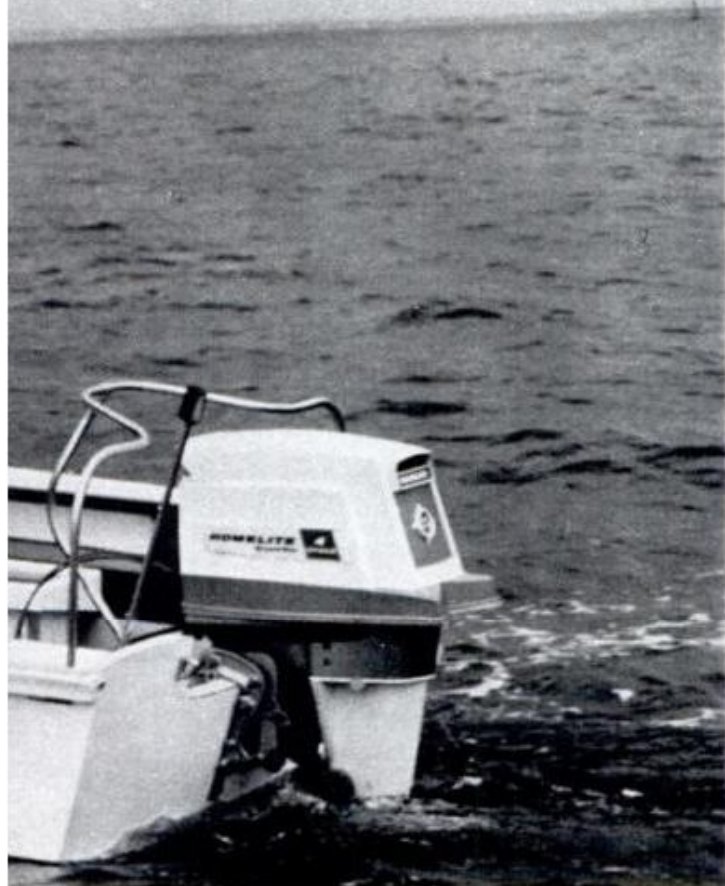
There are still a number of bad boats on the market. However, the dogs are rarer this year than at any time in the past. Just about every major boat manufacturer is upgrading, and it shows.

A parallel trend is the industry-wide move toward including formerly optional equipment as standard on '68

THUNDERBIRD is now offering an open fishing model of the 19-ft. Comanche, top left, which is equipped with icebox, bait well and two 12-gal. saddle tanks

STAMAS V-24 TARPON, left, is the first open-model sports fisherman to have an enclosed head (inside console). Price is \$5895 with a 120-hp stern drive

NEW BOSTON WHALER, a cabin version of the 16½-ft. hull, has a large clamshell fore hatch. Standard equipment includes settee-berths and head



GLASTRON SIGMA is a new 14-ft. day sailer with 94 sq. ft. of sail. It has molded-in seats for four and positive flotation. F.O.B. price of \$1099 includes sail



models. For instance, all Silver Line DeVille runabouts come equipped with built-in fuel tank, complete zippered top set, dual horns, fire extinguisher, bilge pump and engine compartment blower. Except for life preservers, a DeVille is ready to go.

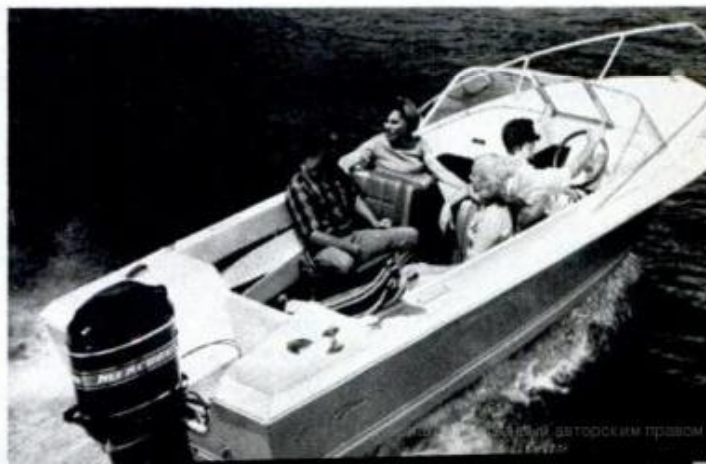
Another example is Crestliner's 16-ft. Explorer which is sold with full top, built-in cruise tank and electrical gas gauge, all extra-cost options a year ago. And the new price is \$55 less.

Larson equips its Volero line with full top, tank, gauge and the other common goodies, then throws in an adjustable driver's seat and a stereo tape player, all as standard equipment. The 17-ft. outboard model goes for \$1595.

No matter how well equipped a boat

GLASTRON VAGABOND, a unique 21½-ft. tri-hull, has swing-down stern steps and twin bunks forward so it can double as camper-trailer on way to water

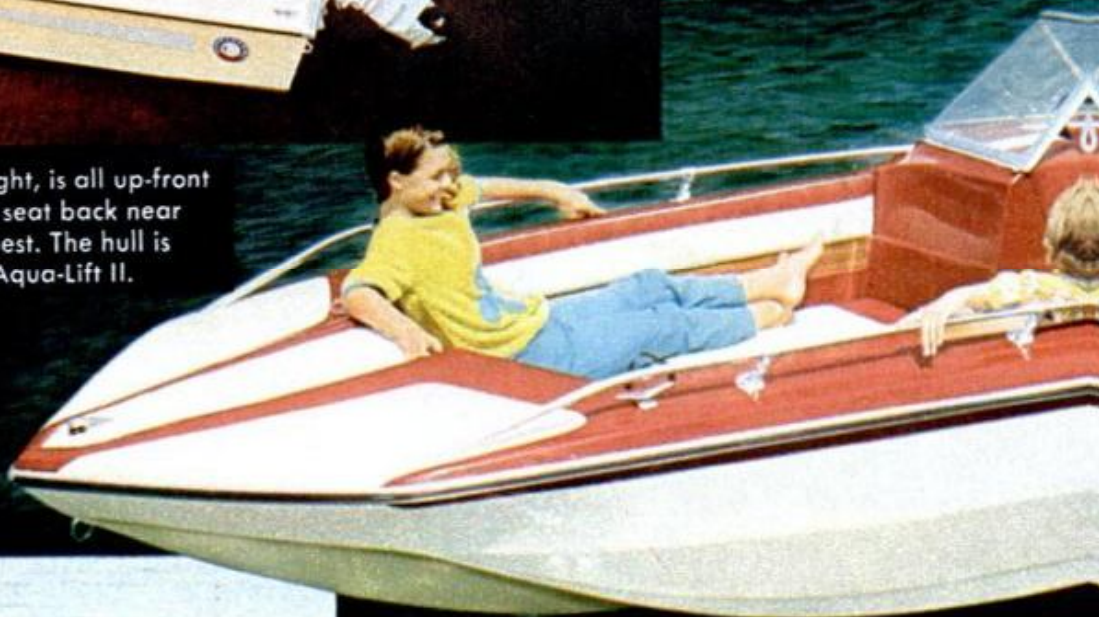
COBIA MONTE CARLO, right, is a 17-ft. runabout sold in both outboard and I-O models. Like all Cobia boats, the hull carries a full five-year warranty





CHRYSLER Hydro-Vee crew is all decked out in new colors this year. From the top, here are the 17-ft. Courier and three Chargers measuring 16 ft., 15 ft. and 14 ft. respectively. The 15-ft. Commando, an open runabout, and two 23-ft. versions round out this hull line. Chrysler also sells Modified-Vee, Deep-Vee and Quad-Chine designs as well as three fiberglass sailboats

GLASTRON GT-160, right, is all up-front cockpit with the driver's seat back near the stern where ride is best. The hull is Glastron's soft-but-fast Aqua-Lift II.



JOHNSON SEASPORT II comes with either 120-hp or 155-hp stern drive and has all sorts of luxury features like a pair of removable coolers, a Sunscreen safety-glass windshield and convertible top

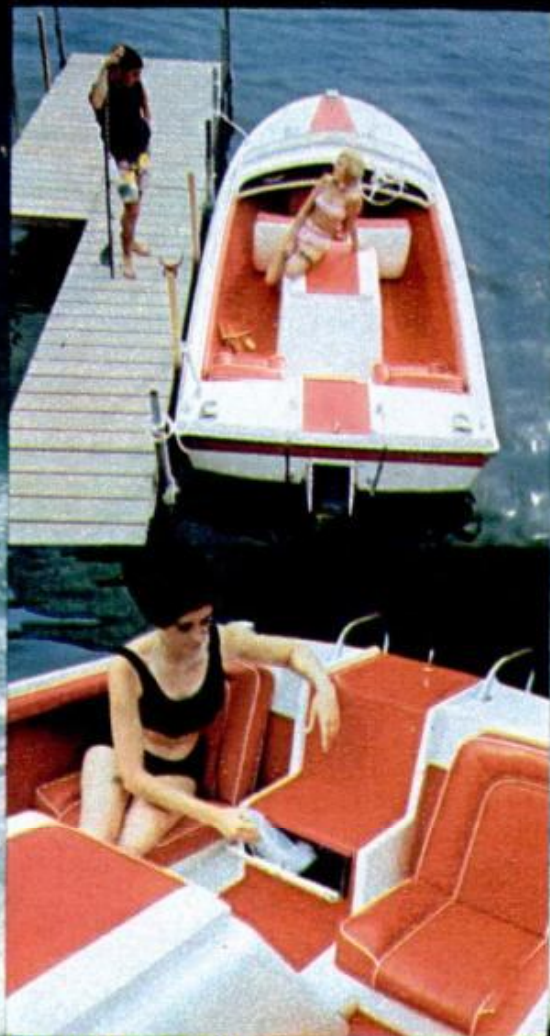
GLASSPAR CUTLAS comes in 14-ft. and 16-ft. versions, the latter with optional 120-hp I-O. The big one sells for \$1395 (outboard) to \$3695 (I-O)



LUND K-20 HOLIDAY is a tough aluminum beauty with a load capacity of well over a ton. Power is either I-O (110 hp or 120 hp) or big outboard



Runabout design goes racing off in all directions with this year's outpouring of exciting new speedsters.



BUEHLER CABALLERO, a sportboat for skiing, features boarding step over jet outlet, top, and a new "stepdown" inside, above, which doubles as a lockable glove box



MFG CHEVRON can cost anywhere from \$1595 (outboard model minus motor) to \$4295 (I-O version with 160-hp Mer-Cruiser). It's just over 16½ ft. long, has a 74-in. beam and weighs 1090 lbs. bare

CRESTLINER MUSTANG 14, a hard-chine fiberglass runabout, is priced at \$595. With 40 hp, it's a low-cost package that's economical to operate

EVINRUDE ROGUE II, new gull wing for '68, is a 19-ft., 210-hp I-O runabout with walk-through windshield and sliding hatch for easy mooring



If you're ready to move up

NEW BARGAIN CRUISERS



CHRIS-CRAFT FUTURA, a rakish new 26-ft. addition to the Cavalier line, has a bright red hull built from marine plywood. Fiberglass bottom covering is optional. With 185 hp the f.o.b. base price is \$5995



LYMAN 26-FT. EXPRESS sleeps four, has full-height toilet room, generous galley space and plenty of storage. Price with 210-hp engine and a long list of standard equipment is \$8995 f.o.b. Sandusky, Ohio

ROOMY, COMFORTABLE HOUSEBOATS



40-FT. DRIFT-R-CRUZ has all the comforts of home powered by a 210-hp Chrysler I-O. A consumer version of the only houseboat to finish the Bahamas 500 race, it sells for \$13,675 f.o.b. North Miami, Fla.



33-FT. NAUTA-LINE sleeps six in spacious comfort. It has a modern home-size galley and anodized aluminum windows and doors. Prices of \$9495 (single 210-hp I-O) and \$12,095 (twin) are f.o.b. Nashville

may be, though, few people are likely to buy it unless it looks good. In fact, with many first-time buyers, appearance may seem even more important than performance. One indication of the growing sophistication among boat companies is the new importance they have placed on styling and design.

At MFG, for example, early figures for 1968 show an 80-percent increase in sales. Marketing director Bill Pearson feels this is surely a reflection of the extensive styling efforts which went into the 1968 models, and he gives much of the credit to Thomas Kellogg, MFG design and styling consultant.

At Glastron, a gauge of the importance placed on styling and design is that President Bob Hammond is directly responsible for both the performance and appearance of anything that goes into production. In announcing the '68 line, he revealed that the company's outboard boat production had jumped 60 percent last year due to the introduction of three new Swinger models.

This year Glastron is offering eight hulls (18 models) based on the Swinger's Aqua-Lift II tri-hull bottom. The biggest surprise is the racy GT-160, a radically new approach to cockpit layout based on the original Swinger's

to something larger . . .



UNIFLITE 20 is a compact fiberglass cruiser that sleeps two in a cabin having almost 5 ft. of headroom. Standard power is a 155-hp stern-drive package. It sells for \$6595 f.o.b. Bellingham, Wash.



TROJAN 24-FT. Sport Cruiser has V-berth and galley storage cabinet in the shelter cabin. A head is optional. Powered with a 190-hp V8 engine, the boat retails for \$5345 f.o.b. Lancaster, Pa. 17604



43-FT. CARGILE QUEENLINER has private stateroom, full galley and bathroom. Finished boat, without power or furnishings, sells for \$9990 f.o.b. Nashville. Thus, buyer can tailor boat to suit his needs



40-FT. RIVER QUEEN sleeps six and comes with twin Chrysler 210-hp I-Os which will push it to 30 mph. Almost everything is included in the purchase price of \$19,750 f.o.b. the plant in Gary, Ind. 46403

open design. It's a 16-ft. open runabout with a small three-man cockpit at the stern, right where it would be on an offshore racing boat. Up front is a roomy lounge.

Not so radical, but certainly newsworthy, is the new cabin version of the Boston Whaler. The cabin is fully lined and separated from the cockpit by a privacy curtain. According to Fisher-Pierce, the boat gives "a feeling of mastery over any possible water environment which is at least partly justified." It's honesty such as this that is responsible for the tremendous loyalty Whaler owners have for this company

which pioneered in tri-hull designs.

Speaking of hull design, the perennial question of how much power a given boat can safely handle cropped up recently in connection with tri-hulls. The horsepower capacity formula used by the Boating Industry Assn. has often been criticized as being unfair to tri-hulls, since such boats are inherently more stable than conventional hulls.

With the '68 boom in tri-hulls, however, many more manufacturers had become concerned about the question. (As one company president put it, "If you haven't got a tri-hull in your line this year, then you just aren't in the

New bargain utilities...



LARSON SHARK 142, a lush 14½-ft. utility with a walk-through dash, has color-matched vinyl interior and back-to-back seats. It's priced at \$645 f.o.b. Larson Industries, Inc., 2325 Endicott St., St. Paul, Minnesota

boating business.") So BIA decided to re-examine the situation.

The organization's Boat Test Committee gathered 25 sample tri-hull designs together in Florida, packed them with instruments to measure things like bank angle, skidding and turning radius, and spent a week running them through various high-speed tests.

"We suspected that these boats might take bigger engines," said Don Reed, BIA manager of engineering, "because they are generally heavier and have a bigger beam than conventional hulls.

"We plotted the performance of the boats on a graph," he continued, "and discovered that most of the test runs fell slightly above the present horsepower curve. Some went considerably above it, but a couple of others fell slightly below."

After reviewing the test results, BIA concluded that while the present formula may be somewhat conservative for tri-hulls, the difference is not great enough to warrant changes.

This polite put-down is hardly likely to dampen the enthusiasm for triple-bow designs, though. For tri-hulls, and boating in general, 1968 is bound to be the biggest year yet. ★★★



MONARK PRO is a 15-ft. shallow-draft utility with modified-V bottom. Bow seat can easily be adjusted or removed. Bow bracket for trolling motor is standard. It's by MonArk Boat Co., Monticello, Ark. 71655



STARCRAFT STAR TREK-V 15 has novel seating layout—bow thwart plus center bench with swivel chair at the wheel. Rated to 45 hp, this 15-ft. aluminum sportster is made by Starcraft Corp., Goshen, Indiana

PENN YAN AVENGER 23 now comes in Sportsman model with flying bridge. Cabin has full galley, V berths, head and dinette that converts to double berths. It's built by Penn Yan Boats, Inc., Penn Yan, N. Y. 14527



My First Year in Boating And What It Taught Me

For me, the best teachers in the world turned out to be an old wooden boat and an out-of-tune motor. I had to learn

By WALLACE CLOUD



I SPENT a good half of last summer wondering if I had done something foolish, and all because of a bargain.

That spring I had been poking around Long Island boatyards looking for a used runabout, so I knew something about the going prices. Thus, I was amazed to come across an ad for an 18-ft. outboard cruiser with a 40-hp motor selling for only \$400. Must be either a mistake or a real hulk, I thought.

Still, there was nothing to lose by checking into it, so I called the number listed in the ad and made an appointment to take a look at the boat.

"You should have seen her before I fixed her up," said the Massapequa (N.Y.) man who met me at the dock (I'll call him Jackson). "She was some wreck."

His warning—if that's what it was—slipped out too late, for I had already fallen in love with the sturdy-looking little plywood cruiser. We climbed aboard, and when I had a chance to look around that roomy cockpit with its high sides and flat floor, I was just about ready to write a check. Then I discovered that the bilge contained about three inches of water. I didn't want to ask embarrassing questions, but the fact did seem to call for some sort of comment.

"It rained pretty hard last night," said Jackson. "She don't leak much."

The 40-hp motor was a good six years old, but when Jackson squeezed the rubber bulb in the gas line and pulled the starter cord, it started right up. (He must have been warming it up while he waited for me.) The electric starter didn't work, he explained, because some contacts had become corroded during the winter. However, he would get it working, and he agreed to deliver the boat to a boatyard farther out on Long Island if I would pay

for the trailer rental and show him the way.

I found dock space on a wide, tree-shaded "creek" leading off Moriches Bay about 75 miles from Manhattan, where I live. The charge for the season was \$3 per foot of boat length. That's about rock bottom for the area; prices range up to \$12 a foot.

When I showed up to claim the boat early one evening, Jackson had loaded her aboard a small rickety trailer. That is, most of her was on the trailer—about three feet projected off the rear. Furthermore, she had a pronounced list to starboard and was secured only by one frayed rope at the bow ring.

"Don't worry," said Jackson, "I'm not going over 30 miles an hour with this thing."

We wrestled the outboard into the



trunk of my car and got under way, with Jackson rolling along at a sedate 30 mph until we got out on the highway. Then he opened it up to a steady 60 mph.

The trailer was fishtailing from side to side. The traffic grew thicker. At one point I got crowded out and had to drop back, but I could catch occasional glimpses of the boat up ahead, still fishtailing.

At the turnoff for Center Moriches, Jackson was waiting for me. I went past and led the way through town to the boatyard. As we drove down Main Street, we were greeted by a brass band. So help

"I spent the first few weeks worrying about the boat sinking in her slip."

me. The Center Moriches High School band was giving an outdoor concert.

They're all laughing, I thought, as our little caravan rolled slowly past the crowd. In spite of my misgivings, though, we got the boat into the water without incident. And now I began to learn about boating.

I spent the first few weeks worrying about the boat sinking in her slip. It was a rainy summer, so there was always water in the bilge. I could never pump it completely dry, but for some mysterious reason the water never rose above the floorboards, even when the boat was left alone for long periods. Nor was there any increase in the amount of bilge water after the boat had been slapped around by rough weather and waves. So I decided to stop worrying about the hull.

On the other hand, I hadn't been worried about the motor. Perhaps this was a mistake. The first time I tried the electric starter—Jackson had assured me that it was now working fine—it turned the motor over once. That was all.

The mechanical starter wasn't much more encouraging. I pulled and I yanked. The motor coughed occasionally. Eventually, it started, but I had no idea why.

The motor remained hard to start and easy to stop. It had a tendency to stall at low speed, especially when I shifted gears. This added an element of surprise to close maneuvers such as backing between pilings and adjacent boats. I concluded that the motor was ready to be junked. Later, I found that I was mistaken.

Another part of my education was taken over by a Capt. Feeney, the old salt who ran the boatyard. He undertook to instruct me in the economics of boating. When I remarked one day that \$11.75 seemed a little steep for a boathook, he gave me a look of intense sympathy. "Son," he said, "always remember that a boat is a hole in the water that you have to keep pouring money into. And you're lucky to have a berth here."

Actually, I didn't spend much over a hundred dollars on the minimum equip-

ment necessary to operate the boat—life preservers, two anchors, nylon rope, a fire extinguisher, a bilge pump, a searchlight, that boathook and a whistle.

I also began reading up on navigation. I had my first experience with chart reading the first day I took my 7-year-old son and 6-year-old daughter out in the boat. With the kids in their life preservers, we headed out across Moriches Bay to the uninhabited eastern end of Fire Island where we went swimming. Afterward, we set out to cruise along the shore and do a little exploring.

We were chugging along, skirting the shallows off Fire Island, when I looked up and saw that the coast had opened up ahead. We were approaching the breakers and the ocean fell away in the distance.

I realized that we were almost in Moriches Inlet, although it should have been a mile or so farther east. (Later I found that my chart wasn't up-to-date—it didn't show the "new cut.")

Considering the size of the boat and my lack of experience, it didn't seem like a good idea to head out into open ocean, so I threw the wheel hard over and swung her around. When I tried to straighten



her out, though, nothing happened. The steering gear jammed and we began running in circles. At this point I realized that the tide was on its way out and it was carrying us slowly toward the rocks rimming the inlet. To make matters worse, the motor suddenly conked out.

Hindsight tells me I should have dropped anchor, but those rocks were making me too nervous to think clearly. Instead, I climbed up on the bow and waved both arms over my head. I still had the presence of mind to remember a distress signal.

Luckily, a small boat appeared with four fishermen aboard. They tried to give me a tow, but either their motor was too small or my boat too heavy, for we were making almost no progress against the current.

Fortunately, a Coast Guard patrol boat

"The steering gear jammed and we began running in circles."

showed up and took over. They lashed my boat alongside and we headed for the mainland.

The Coast Guard dropped us off at the gas dock of a marina, where the pump man took one look at my steering problem and fixed it with a piece of electrician's tape. It turned out that the plastic sheathing on the steering cable had worn away, and the cable had become wedged between a pulley and its bracket. Prying the cable free, he simply wrapped tape around the worn spot.

"That'll be okay for a while," he said. "But you'd better get a new steering cable." I realized I could have fixed it myself, since I had tape aboard. "Sure," he said, "or you could have unhooked the steering cable and lashed a pole—that boathook, say—to the motor as a tiller."

We made it back to the boatyard without further problems, and I put in an order to have a new steering cable rigged. I also decided I'd better see if something could be done about that temperamental motor. The importance of reliable equipment was becoming clear.

The nearest dealer who could service my make of motor was entirely too busy selling new boats and motors to bother with an old engine. I never got to talk to him—he was always out when I stopped by or called. So I decided to tackle the motor myself.

I wrote to the manufacturer for an operator's manual and a service manual. From these I learned that I had been flooding the carburetors, which contributed to the starting trouble. Adjusting the low-speed needle valves and some limit screws virtually eliminated the stalling problem and provided more reliable low-speed operation.

As I got to know the motor better, I found that it was not at all the worn-out clunker I had thought. In fact, I now think that it really is a good motor, and probably will be a good deal more powerful and reliable after it's properly tuned up this spring.

However, my most gratifying experience with the motor came while I was still having starting troubles. While marooned out on the water with a motor that didn't want to start, I was patiently searching through the operator's manual

for some help and noticed that it recommended a gap of .025 in. for the spark-plugs. I took out a plug and looked at it. The required gap translated into 1/40 in., while the gap in my plug looked more like 1/16 in. I didn't have a feeler gauge, so I took a pair of needle-nose pliers and regapped the plugs by eye. I put them back in, pulled the starter cord, and *bam!*—the motor started with a vengeance. Back at the marina, I checked the gaps with a gauge and found I'd come surprisingly close.

Another thing I've learned in my first year with a boat is that trips are much



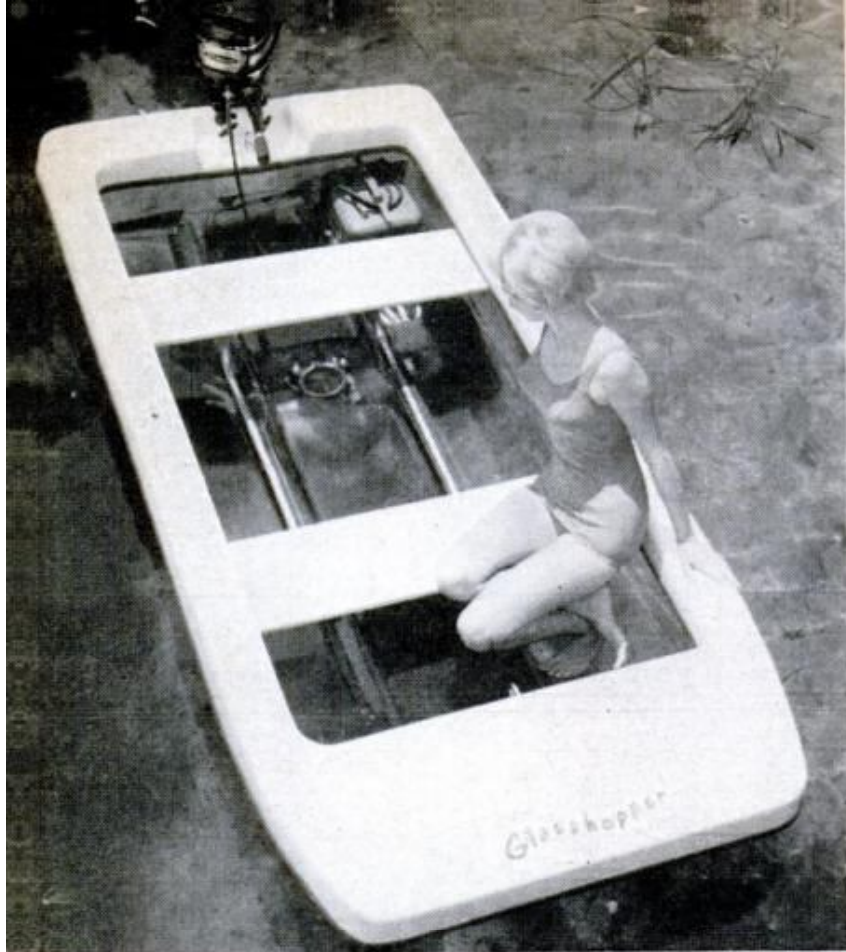
longer on water because you can't just "drive" a boat. You're working most of the time—steering to maintain a compass heading in spite of wind and waves, avoiding the wakes of other boats, keeping track of where you are.

In my area, it's particularly important to pay attention to the marker buoys, because large parts of the south shore bays are only a foot or two deep at low tide. After going aground a few times, I also learned to keep an eye on the water.

Sandbars shift, so the chart isn't always accurate, but a glance over the side reveals when the dark green of deep water is changing to the sandy color of the shallows. Then too, I've learned that smooth patches of water often mean there are weeds just beneath the surface, keeping wavelets from forming.

(Please turn to page 208)

NEW



SEE-THROUGH HULL with a special built-in well for skin diving will be added to the Glasshopper line of transparent hulls this year. While photographs of this new model aren't available as we go to press, it will be made of the same high-impact plastic as boat shown above and will also have approximately same lines. The maker is Submeronautics Ltd., P.O. Box 1749, Charlotte, N.C.



FUN-TO-FLY HYDROFOIL designed by Jim Wynne (racing champ and inventor of the I-0) and John Gill has sensors to control attitude and roll. Novel Torsionetic universals in the V-drive are concentric-wound springs permitting retractable drive line to be "bent" out of alignment



INFLATABLE HOUSEBOAT, shown with awning instead of full tent, is imported from West Germany. The slat deck rolls up so that the whole thing fits in a car trunk. Complete package, including tent and all gear, sells for \$750 f.o.b. Kayak Corp. of America, Inc., 7 East 38th St., New York, N.Y. 10016.

POPULAR MECHANICS

AND WILD FOR '68



▶ **29½-LB. CANOE** designed by a Canadian sportsman has a foam lining and detachable foam sponsons which make it virtually unsinkable. (This might possibly be the excuse for using a photograph of a man standing up in the canoe, a practice which is definitely not recommended.) The 12-ft. craft has a zinc chromate finish and is made of aircraft aluminum. It's priced at \$269.95 f.o.b. Sportspal, Inc., Emlenton, Pa. 16373



▶ **COLLAPSIBLE ALUMINUM BOAT** introduced by Fold-A-Boat weighs 125 lbs. (all but 5 lbs. of it aluminum) and folds into a compact 4-in.-thick package measuring 2x12 ft. It will take up to 15 hp and can carry four people (though seats are available only as extra-cost options). Priced at \$395, the boat is made by Loran Mfg. Co., Walnut Creek, Calif. 94596



▶ **BARGAIN INFLATABLE** is a 7-ft. two-seater selling for only \$150, complete with carrying bag, foot pump, maintenance kit, oarlocks, removable stern seat and removable motor board for outboards to 3 hp. Oars are \$15 extra. The 26-lb. Pirate is made of structural Tri-Laminate—neoprene fused to nylon—and has three separate air chambers for extra safety. Made by Nautisport, it's imported by Kayak Corp. of America, Inc., 7 E. 38th St., New York, N.Y. 10016

MARCH 1968



▶ **MIDGET HOUSEBOAT** which doubles as a travel trailer is called, appropriately enough, the Hobo. The 18-ft. fiberglass hull has an 8-ft. beam and is also available in a stripped version for do-it-yourself completion. Designed for outboards up to 40 hp, it's produced by Graham Products Ltd., Inglewood, Ont.



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New Stern Drives for '68

OMC's new 80-hp compact, Kiekhaefer's MerCruiser III heavy-duty drive unit and Perkins' beefy 160-hp diesel package are just a few of the new offerings this year

By ART MIKESELL, Boating Editor



IN SEVEN YEARS, sales of stern-drive boats have jumped from zero to 36,000 annually. And that's just I-Os in new boats. Several thousand

stern drives are sold every year to repower older boats. Why this growing popularity?

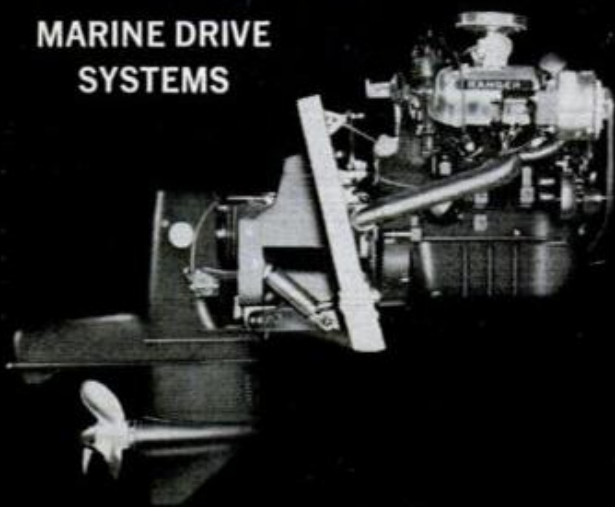
For one thing, a stern-drive buyer feels he's getting the best of both inboard and outboard, and he can make a pretty good case for this. Like an outboard, an I-O lets you swing the prop to steer with power. Also, the lower unit will ride up over underwater obstacles without being dam-

aged. As with an inboard, you can go to higher horsepower. In addition, an I-O offers the familiarity and prestige of four-cycle power "just like a car."

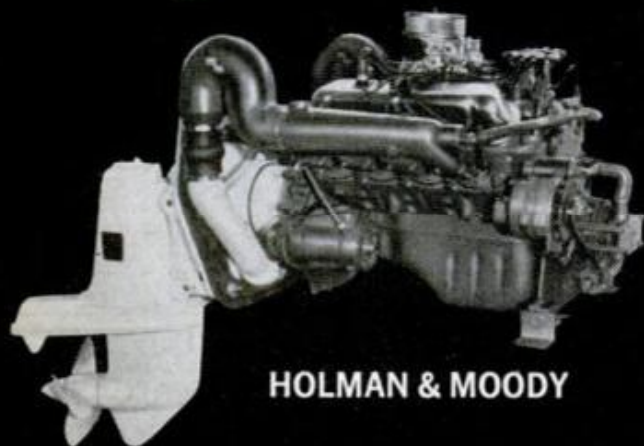
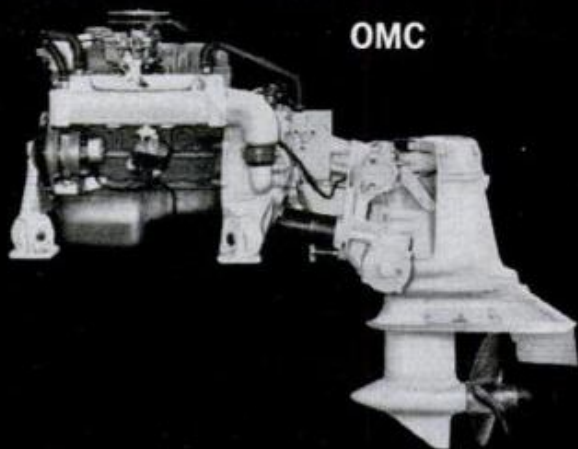
Where stern drives and outboards overlap, you'll find partisans of both. Usually, the argument boils down to two-cycle vs. four-cycle, with the outboard fans bringing up the higher initial cost of I-Os and the stern-drive crowd boasting about fuel economy. The one sure thing is that sales of both are increasing every year.

Here's a company-by-company review of the stern-drive picture for 1968:

MARINE DRIVE SYSTEMS

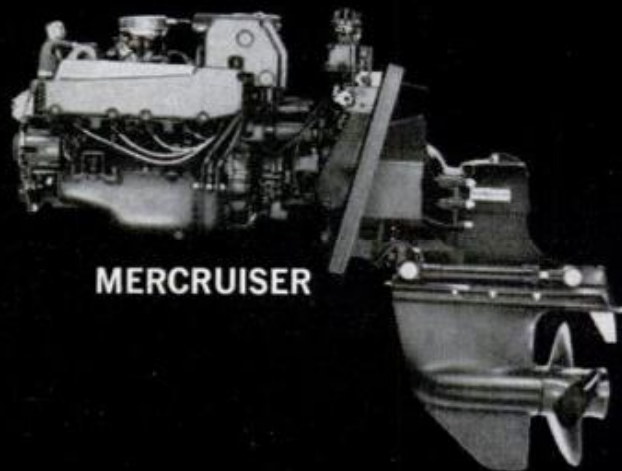


OMC



HOLMAN & MOODY

MERCUISER



Brennan Motor Mfg. Co. has been building marine engines from the ground up since 1897. Its lone stern-drive offering uses the Imp in-line-4, L-head engine rated at 40 hp. Drive is supplied separately or in an assembly with Brennan reversing gear and clutch.

Chrysler has a line stretching from 80 hp up to a big 300-hp combination, including two Volvo-based engines and a Simca. The 260-hp and 300-hp I-Os are new for '68. Commando Drive features electric lift, lockable tilt position. It can be operated at low rpm in raised position when running through shallows.

Eaton Marine has two models this year, 165-hp and 200-hp Interceptors, both based on Ford blocks. Fresh-water cooling is available as an option. Drive units have 65° electric lift as standard equipment.

Evinrude stern drives are available only on Evinrude boats. Actually they're Outboard Marine Corp. units dressed up with different paint to match the boats and different stickers to build brand loyalty. They range from a 90-hp two-cycle on the Playmate to a 210-hp V8 on the Rogue.

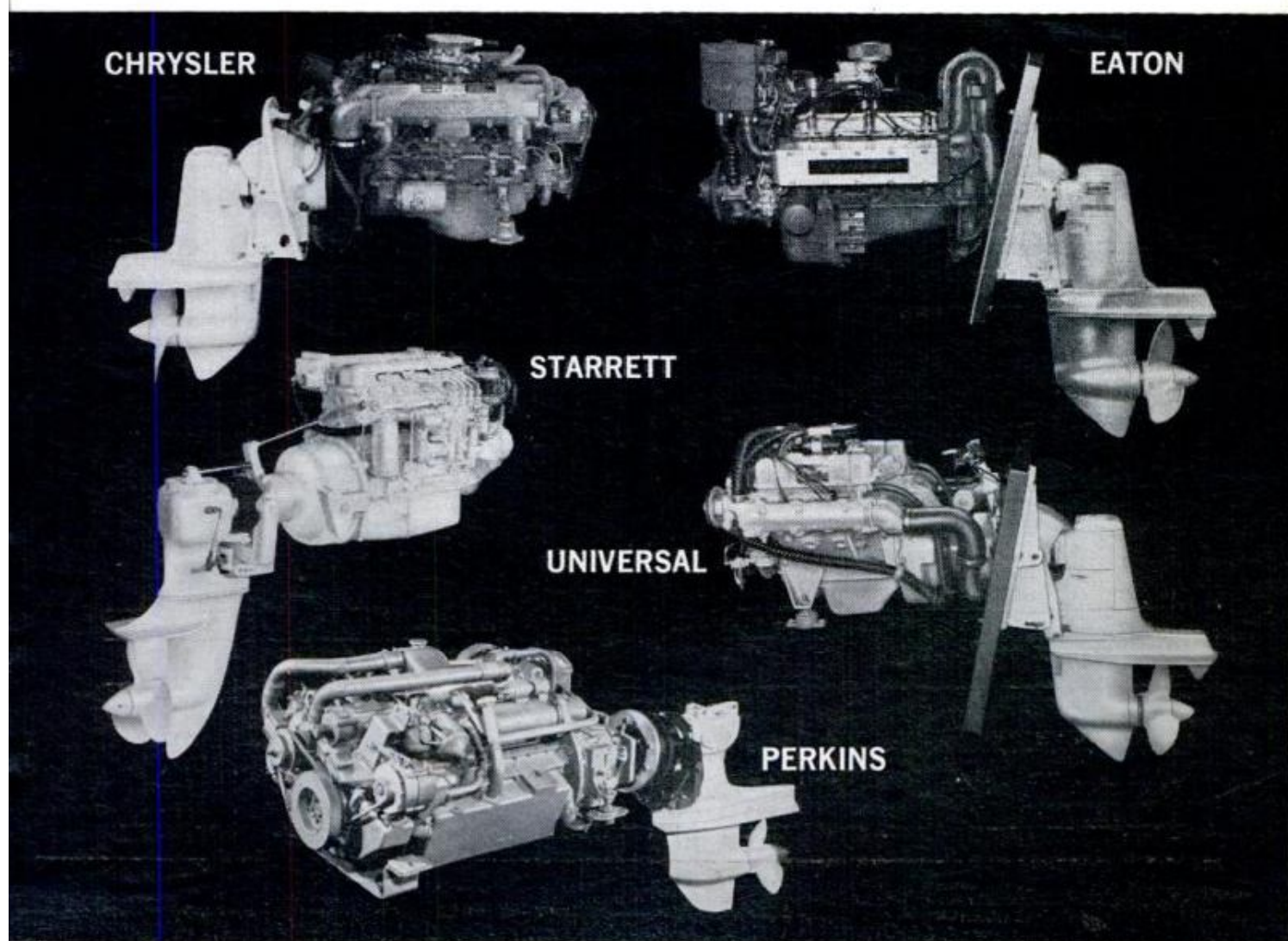
Holman and Moody, of stock-car fame,

have two packages built on the Ford 289 Fairlane, differing only in carburetion and intake manifold. A third combo, based on the same engine, but producing around 300 hp is expected to be ready this summer.

Johnson, like Evinrude, sells stern-drive boats rather than stern drives. See the table on the following two pages for a complete list.

Marine Drive Systems has two rugged Ranger Ford units, an 85-hp V4 and a 110-hp V6. Both produce more than one foot-pound of torque per cubic inch on regular fuel. Power tilt is standard.

MerCruiser is today's biggest-selling stern drive, accounting for well over half the market. Power ranges from 60 hp to 325 hp—seven engines in all, with three drive units. The new III drive designed for heavy-duty, high-performance applications has 2-to-1 rear reduction and can swing props up to 20 in. An easily accessible oil reservoir located on the inner transom plate inside the boat lubricates and cools the entire drive train. Like the I and II drives, all shift, throttle and steering controls are internal, making for a smooth,



MAKE AND MODEL		ENGINE					
		TYPE	HP @ RPM	MFR. OF BLOCK	BORE (in.)	STROKE (in.)	DISPL. (cu. in.)
BRENNAN	IMP	IN-LINE 4	40 @ 5000	BRENNAN	2.260	3.125	50
CHRYSLER	80	OHV4	80 @ 5200	SIMCA	2.96	3.26	91
	VOLVO 110	OHV4	110 @ 5200	VOLVO	3.31	3.15	109
	VOLVO 120	OHV4	120 @ 5500	VOLVO	3.31	3.15	109
	150	V6	150 @ 4000	CHRYSLER	3.40	4.125	225
	175	V8	175 @ 4000	CHRYSLER	3.65	3.31	273
	200	V8	200 @ 4500	CHRYSLER	3.65	3.31	273
	210	V8	210 @ 4000	CHRYSLER	3.91	3.31	318
	235	V8	235 @ 4400	CHRYSLER	3.91	3.31	318
	260	V8	260 @ 4000	CHRYSLER	4.25	3.38	383
	300	V8	300 @ 4000	CHRYSLER	4.32	3.75	440
EATON MARINE (INTERCEPTOR)	165	V8	165 @ 4200	FORD	4.00	2.87	289
	200	V8	200 @ 4400	FORD	4.00	2.87	289
EVINRUDE	90	2-CY. V4	90 @ 5000	OMC	3 ³ / ₈	2 ¹ / ₂	89.5
	120	IN-LINE 4	120 @ 4400	CHEVROLET	3.88	3.25	153
	155	V6	155 @ 4400	BUICK	3.75	3.40	225
	210	V8	210 @ 4400	CHEVROLET	3 ⁷ / ₈	3	283
HOLMAN & MOODY	200	90°V8	200 @ 4200	FORD	4.00	2.87	289
	225	90°V8	225 @ 4500	FORD	4.00	2.87	289
JOHNSON	90	2-CY. V4	90 @ 5000	OMC	3 ³ / ₈	2 ¹ / ₂	89.5
	120	IN-LINE 4	120 @ 4400	CHEVROLET	3.88	3.25	153
	155	V6	155 @ 4400	BUICK	3.75	3.40	225
	210	V8	210 @ 4400	CHEVROLET	3 ⁷ / ₈	3	283
MARINE DRIVE SYSTEMS	85	V4	85 @ 5000	FORD	3.54	2.67	104
	110	V6	113 @ 5300	FORD	3.31	2.37	122
MERCURISER	60	IN-LINE 4	60 @ 4800	—	2.76	3.19	67.6
	80	IN-LINE 4	80 @ 4800	—	3.0	3.19	90
	120	IN-LINE 4	120 @ 4300	—	3.875	3.25	153
	160	IN-LINE 6	160 @ 4300	—	3.875	3.53	250
	225	V8	225 @ 4200	—	4.0	3.25	327
	250	V8	250 @ 4200	—	4.0	3.25	327
	325	V8	325 @ 4200	—	4.25	3.76	427
MUNCIE GEAR WORKS	80	V4	80 @ 4800	FORD	3.543	2.629	104
	110	V6	110 @ 4800	FORD	3.31	2.37	122
	220	V8	220 @ 4600	FORD	4	3	302
	60	DIESEL 4	60 @ 4000	ISUZU	3.25	3.65	121
MURRAY & TERGURTHA	4DM-242	DIESEL 4	50 @ 1850	FORD	4.125	4.540	242
OMC	80	V4	80 @ 5200	ENG. FORD	3.187	2.864	91.4
	90	2-CY. V4	90 @ 5000	OMC	3 ³ / ₈	2 ¹ / ₂	89.5
	120	IN-LINE 4	120 @ 4400	CHEVROLET	3.88	3.25	153
	155	V6	155 @ 4400	BUICK	3.75	3.40	225
	185	V8	185 @ 4400	CHEVROLET	3 ⁷ / ₈	3	283
	210	V8	210 @ 4400	CHEVROLET	3 ⁷ / ₈	3	283
OSCO MOTORS	200FF	IN-LINE 6	120 @ 4400	FORD	3.68	3.13	200
	240FA	IN-LINE 6	156 @ 4000	FORD	4.00	3.18	240
	292CY	IN-LINE 6	165 @ 3800	CHEVROLET	3.88	4.13	292
	300FA	IN-LINE 6	170 @ 3700	FORD	4.00	3.98	300
	283CV	V8	185 @ 4200	CHEVROLET	3.87	3.00	283
	289FL	V8	225 @ 4800	FORD	4.00	2.87	289
	327CV	V8	250 @ 4400	CHEVROLET	4.00	3.25	327
	390FG	V8	325 @ 5000	FORD	4.05	3.78	390
	396CW	V8	340 @ 5000	CHEVROLET	4.00	3.90	396
	427FG	V8	412 @ 5000	FORD	4.23	3.78	427
	172DF	DIESEL 4	59 @ 2400	FORD	3.90	3.60	172
	242DE	DIESEL 4	83 @ 2800	FORD	4.13	4.52	242
	363DE	DIESEL 6	128 @ 2800	FORD	4.13	4.52	363
PERKINS ENGINES	M4-107	DIESEL 4	50 @ 4000	PERKINS	—	—	107
	M4-236	DIESEL 4	85 @ 2500	PERKINS	—	—	236
	M6-354	DIESEL 6	130 @ 2800	PERKINS	—	—	354
	MH6-354	DIESEL 6	130 @ 2800	PERKINS	—	—	354
	MT6-354	DIESEL 6	160 @ 2400	PERKINS	—	—	354
	MHT6-354	DIESEL 6	160 @ 2400	PERKINS	—	—	354
STARRETT	SD-60	DIESEL 4	60 @ 4000	ISUZU	3.25	3.65	121
STEWART & STEVENSON	3-53	2-CY. DIESEL	107 @ 3000	GM	3.857	4.5	159
	4-53	2-CY. DIESEL	141 @ 3000	GM	3.857	4.5	212
STOKES MARINE	FORD V4	V4	70 @ 4600	FORD	3.52	2.32	91.4
	FORD V6	V6	84 @ 4500	FORD	3.31	2.37	121.9
	CHEVROLET 4	IN-LINE 4	90 @ 4000	CHEVROLET	3.875	3.25	153
	FORD FALCON	IN-LINE 6	101 @ 4000	FORD	3.5	2.937	170
	VALIANT 6	IN-LINE 6	101 @ 4000	CHRYSLER	3.4	4.125	170
	BUICK V6	V6	155 @ 4400	BUICK	3.75	3.40	225
	FORD "289"	V8	225 @ 4800	FORD	4.00	2.87	289
UNIVERSAL	SSVV200	V6	155 @ 4400	BUICK	3.75	3.40	225

*TRANSOM TO FRONT OF ENGINE

SPECIFICATIONS

				OUTDRIVE			
LENGTH (in.)	WIDTH (in.)	HEIGHT (in.)	WEIGHT (lbs.)	GEAR RATIO (overall)	PIVOT RANGE	TILT RANGE	POWER TILT?
25	13	20	220	1.5:1	360°	50°	OPT.
29.1*	21.7	22.8	350†	1.48:1	60°	55°	OPT.
30.5*	22	24.7	495†	1.59:1	60°	53°	OPT.
30.5*	22	24.7	498†	1.85:1	60°	53°	STD.
37.5*	25	28.1	695†	1.59:1	60°	53°	STD.
36.3*	28	27.2	835†	1.59:1	60°	53°	STD.
36.3*	28	26.3	840†	1.35:1	60°	53°	STD.
39.2*	28	26.3	915†	1:1; 1.32:1; 1.6:1	60°	55°	OPT.
39.2*	28	26.3	920†	1:1; 1.32:1; 1.6:1	60°	55°	OPT.
49*	31.8	28.5	1205†	1.32:1	60°	55°	OPT.
49*	32.8	29.1	1240†	1.32:1	60°	55°	OPT.
37.20	27.58	27.74	675	1.59:1	60°	65°	YES
37.20	27.58	27.74	675	1.59:1	60°	65°	YES
22	22	26 1/2	290	.82	90°	75°	YES
38	22	28 3/4	568	.62	90°	75°	YES
36	29 3/4	29 1/4	710	.62	90°	75°	YES
40 3/4	26 3/4	29 3/8	810	.86	90°	75°	YES
43	28 5/8	19 3/16	750†	1.59:1; 1.35:1	60°	65°	YES
43	28 5/8	19 3/16	750†	1.59:1; 1.35:1	60°	65°	YES
22	22	26 1/2	290	.82	90°	75°	YES
38	22	28 3/4	568	.62	90°	75°	YES
36	29 3/4	29 1/4	710	.62	90°	75°	YES
40 3/4	26 3/4	29 3/8	810	.86	90°	75°	YES
21	27	28	320	1.33	60°	65°	STD.
26	27	28	390	1.33	60°	65°	STD.
23 5/8*	17 5/16	22 5/16	252	1.64:1	60°	54°	OPT.
25 1/8*	18 3/16	26	253	2:1	60°	54°	OPT.
32 3/2*	21 3/16	27 5/8	410	2:1	60°	54°	STD. ‡
41 1/2*	23	28	485	1.78:1	60°	54°	STD. ‡
41 3/8*	33	29	741	1.33:1	60°	55°	STD. ‡
43 1/8*	29	29	935	2:1	60°	55°	STD. ‡
46*	32 1/2	30 1/2	1125	2:1	60°	55°	STD. ‡
20.76	24.54	22.92	238	1.88:1	90°	50°	OPT.
20.78	25.31	27.72	322	2:1	90°	50°	OPT.
31	27.5	28.5	500	1.33:1	90°	50°	STD.
27.75	20	24	430	2:1	90°	50°	OPT.
54	28	43	800	3.28	360°	175°	NO
31	23	24	420	.497	90°	75°	YES
22	22	26 1/2	290	.82	90°	75°	YES
38	22	28 3/4	568	.62	90°	75°	YES
36	29 3/4	29 1/4	710	.62	90°	75°	YES
40 3/4	26 3/4	29 3/8	810	.86	90°	75°	YES
40 3/4	26 3/4	29 3/8	810	.86	90°	75°	YES
31 3/4	16	26	620	1.102:1; 1.544:1	90°	80°	NO
36 5/8	19 1/2	28	730	1.102:1; 1.544:1	90°	80°	NO
36 3/8	19	27 3/4	735	1.102:1; 1.544:1	90°	80°	NO
36 5/8	19 1/2	28	740	1.33:1	90°	80°	NO
30 1/4	36	28	710	1.33:1	90°	80°	NO
26 3/4	25	26	690	1.33:1	90°	80°	NO
30 1/4	36	28	720	1.33:1	90°	80°	NO
31 3/4	31	29	960	1.33:1	90°	80°	NO
33 3/4	33	28	983	1.33:1	90°	80°	NO
31 3/4	31	29	988	1.33:1	90°	80°	NO
—	19	27	690	1.102:1; 1.544:1	90°	80°	NO
—	22	33	810	1.102:1; 1.544:1	90°	80°	NO
—	22	33	1225	1.33:1	90°	80°	NO
26 1/8	23	16 1/16	475†	1.1, 1.3, 1.6:1	135°	55°	YES
34 1/4	23 1/4	21 7/16	880†	1.1, 1.3, 1.6:1	135°	55°	YES
38 1/4	28 3/4	23 5/8	1180†	1.1, 1.3, 1.6, 2.1:1	135°	55°	YES
39 7/8	36 1/8	18 1/2	1220†	1.1, 1.3, 1.6, 2.1:1	135°	55°	YES
38 1/4	29	25	1350†	1.1, 1.3, 1.6, 2.1:1	135°	55°	YES
37 1/4	37 3/4	18 1/2	1350†	1.1, 1.3, 1.6, 2.1:1	135°	55°	YES
28	21	24	520	1.54:1	30°	30°	YES
33 1/2	30 5/16	44 5/16	961	1.59:1	60°	60°	YES
42	30 5/16	44 5/16	1110	1.59:1	60°	60°	YES
20 1/2	—	26 3/4	350	1.102:1; 1.544:1	90°	50°	OPT.
28 1/2	—	26 3/4	375	1.102:1; 1.544:1	90°	50°	OPT.
31 3/4	—	26 3/4	525	1.102:1; 1.544:1	90°	50°	OPT.
30 3/4	—	26 3/4	425	1.102:1; 1.544:1	90°	50°	OPT.
30 3/4	—	26 3/4	560	1.102:1; 1.544:1	90°	50°	OPT.
31	—	26 3/4	550	1.102:1; 1.544:1	90°	50°	OPT.
28 3/4	—	26 3/4	625	1.102:1; 1.544:1	90°	50°	OPT.
35 7/16	27 1/4	24 2 3/32	600	1.59:1	60°	62°	YES

† INCLUDES OUTDRIVE

‡ MERCURISER POWER TRIM

clean appearance. Power Trim permits the drive to be run at any throttle setting in the normal trim range and under part throttle at extreme tilt positions.

Muncie Gear Works announces four new MGW stern-drive packages this year—three four-cycle gas and a 60-hp diesel. In addition, the company sells seven FD Flexidrive units for packaging with marine, industrial and automotive engine conversions through 350 hp. The FD-901, for instance, will take props to a diameter of 21 in.

Murray & Tergurtha sells one model—a 242-cu-in. diesel rated at 50 hp. The lower portion of the drive turns a full 360°. Power tilt isn't available.

Outboard Marine Corp. offers six models from 80 hp (new this year) through 210 hp, each with "stabilized power cradle" engine mounting system which is explained in the drawing at right. OMC's Fastback drive pivots a full 90° from port to starboard. The electric power tilt raises it 75° at the flick of a switch.

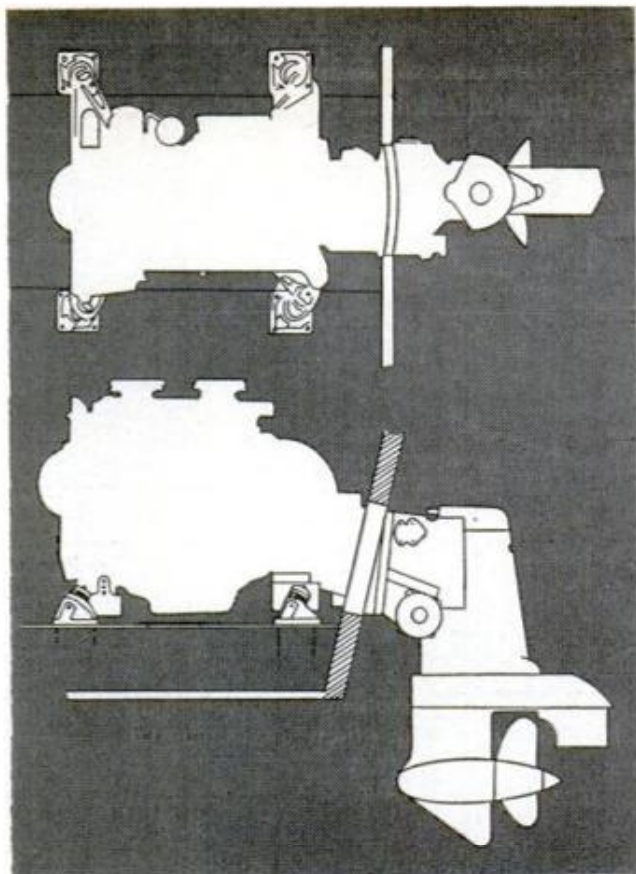
Osco Motors, with 35 years' experience in manufacturing marine engines and conversion equipment, lists a baker's dozen engines with Muncie Gear Works stern-drive units. Among the other drives sold by Osco are direct-mounted V, transfer, direct-mounted reduction, angle and jet—something for everyone.

Perkins Engines Inc. is the U.S. affiliate of Britain's Perkins Engines Group, world's largest manufacturer of diesels. The firm's '68 line of marine diesel stern drives includes six models from 50 hp to 160 hp. The 160 is billed as "the biggest diesel-driven stern drive unit available in North America." The prop for this big-wheel drive measures 20 in. in diameter and has an 18-in. pitch. It's for houseboats, work boats and large cruisers.

Starrett has one model, a 60-hp diesel based on an imported block.

Stewart & Stevenson, advertised as the world's largest distributor of diesel engines, has two diesel-drive installations using GM Detroit Diesel two-cycle engines. Both are sold with full power tilt.

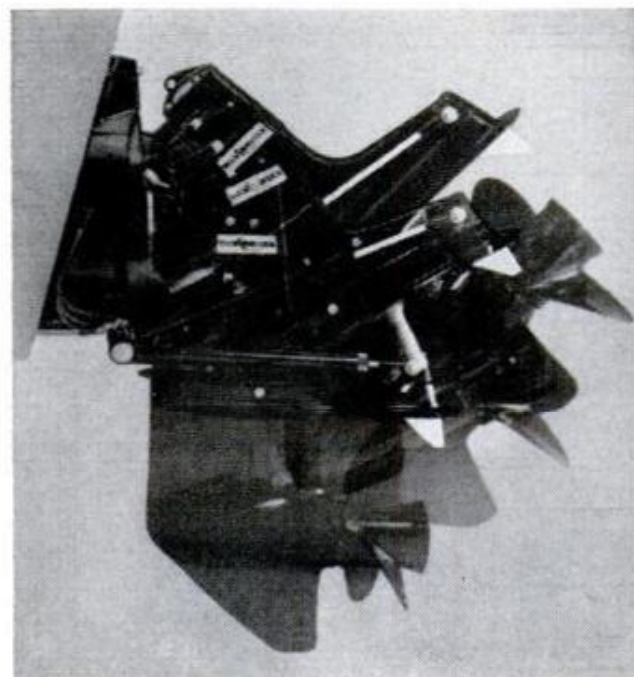
Stokes Marine does a good business in new and rebuilt marine motors, conversion parts and reverse gears. They also sell seven of their engines with Muncie Flexidrive. New addition this year is a Ford Cardinal V6 rated at 84 hp. With drive unit, the weight is 375 lbs.



OMC ENGINE MOUNTING damps vibration and noise with rubber. It comes in floor or transom-floor types

Universal sells a complete line of marine engines, the best known being that little 30-hp Atomic Four which is today's most popular auxiliary. However, the company has only one stern-drive model, the 155-hp Super Sabre V6. Electric tilt is standard equipment. ★★★

TRIPLE EXPOSURE of MerCruiser shows advantage of stern drive—the ability to "kick up" over obstacles



10 New Ideas to Take The Work Out of Boating



WHY USE MUSCLE to haul your boat up on a trailer when Powerwinch will do the job with electricity? It runs off the car battery and sells for \$109.50 from Powerwinch Corp., 184 Garden St., Bridgeport, Conn.



DUAL-PURPOSE MOUNT for your trailer spare also serves as a dolly, making it easier to jockey boat and trailer around the driveway or yard. Priced at \$7.31, it's from Golden Rod (Dutton-Lainson), Hastings, Neb.



PUMP ACCESSORY for your 1/4-in. drill handles 6 gal. per min. Just chuck the impeller shaft into the drill and you're set to go. It's \$14.95. From Huber Industries, Inc., 4960 Hillside Ave., Cincinnati, Ohio 45233

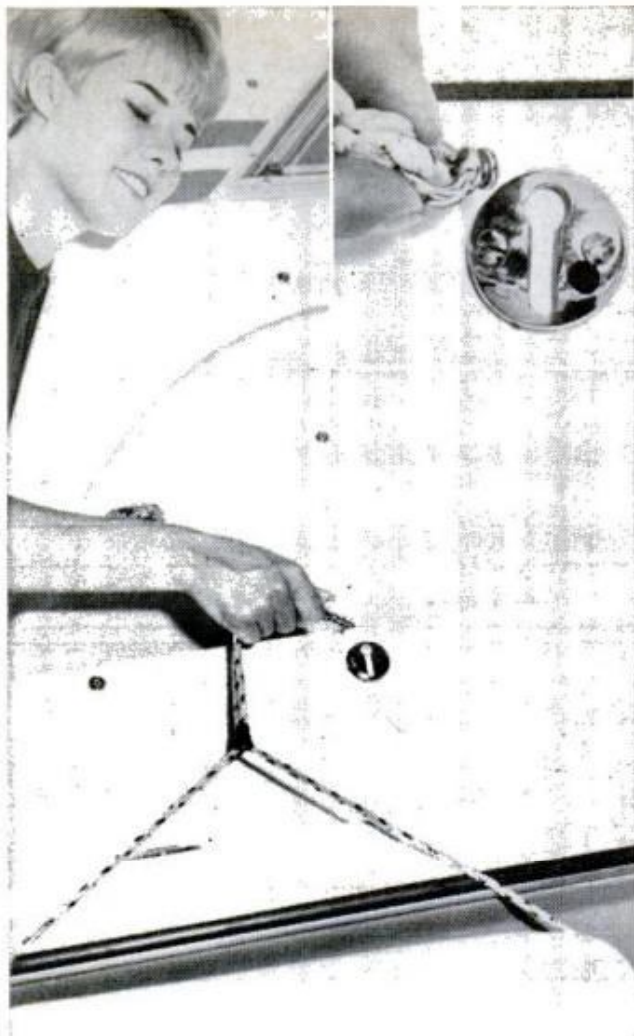
MARCH 1968



ALL-PURPOSE BAILER from Rubbermaid has contoured lip that flexes to provide uniform contact and get the job done faster. It can double as a 2-qt. litter bin when hung from a bulkhead. The price is \$1.98



VINYL-COATED ANCHOR CHAIN can't scratch decks. Called Anchor Rite, it comes in 6-ft. lengths of $\frac{1}{4}$ -in. (\$13.95) or $\frac{5}{16}$ -in. (\$14.95) steel. From Serv-A-Car Products, Inc., 2530 Morgan, Parsons, Kans. 67357



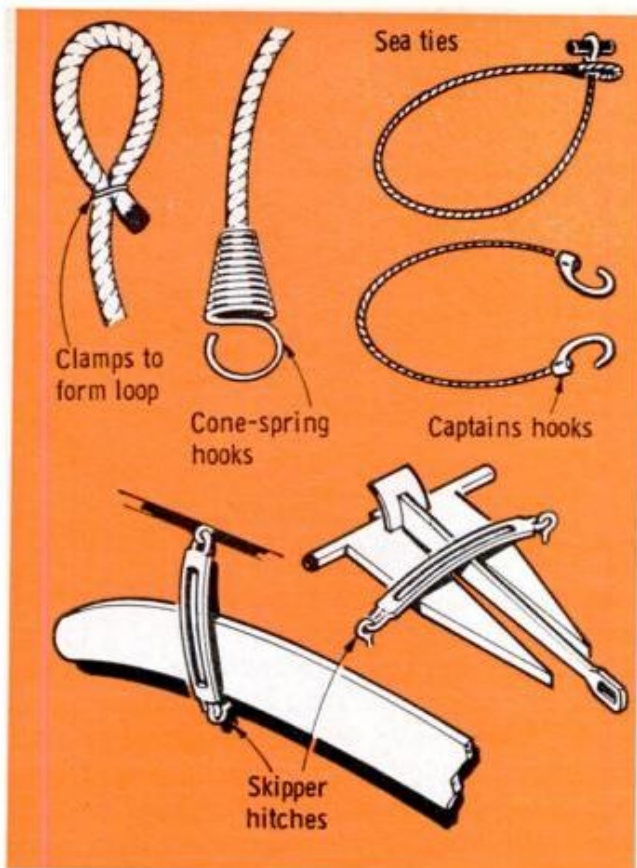
FENDER LOCKS provide a quick way to put out or take in fenders or bumpers, eliminate need for bulky fender cleats. They're priced at \$1 per set from Perko, 16490 Northwest 13th Ave., Miami, Fla. 33164



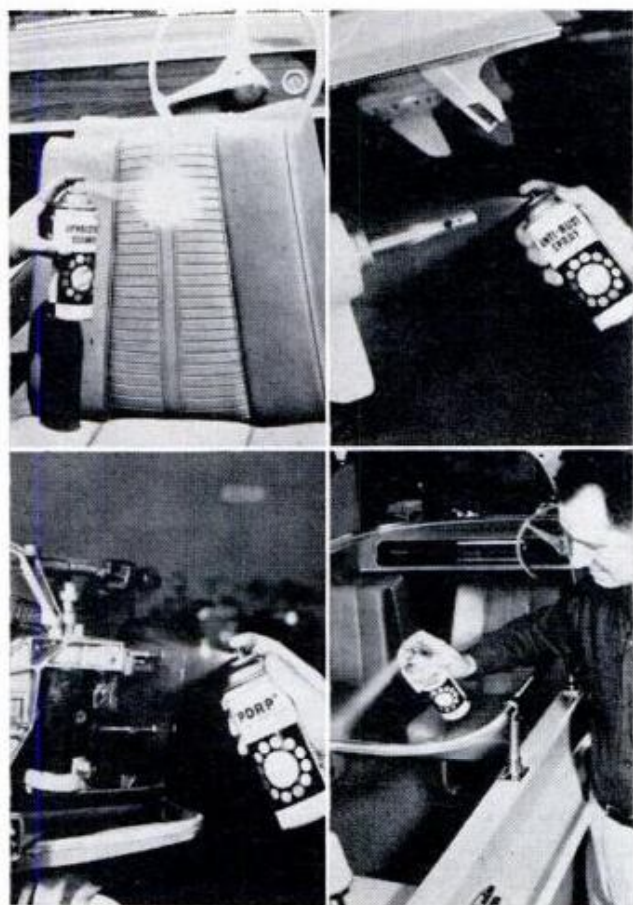
WHIP-END DIP liquid plastic sets to produce a tough, flexible whip-end on a line dipped into it. A 4-oz. can retails for \$2.98 from Marine Development & Research Corp., 381 Park Ave., New York, N.Y. 10016



AUTOMATIC DRAIN PLUG has removable flapper section which can be replaced with a cap to provide positive seal during storage. It's \$3.75 from Tempo Products Co., 6200 Cochran Rd., Cleveland, Ohio 44139



STRETCHY TIE-DOWNS, most of them made of shock cord, have all sorts of end fittings to suit about any job. You'll find a good selection in catalog from the Crow's-nest, 360 Madison Ave., New York, N.Y. 10017



ANYTHING IN SPRAY CANS is a work saver. Tempo's complete line of aerosol products includes upholstery cleaner, anti-rust spray, "PDRP" (penetrant demulsurant rust preventive) and even a silicone spray



New Sears Fishing Motors Have Built-In Battery Packs

Highlighting the 1968 line of Sears, Roebuck and Co. outboards are two electric-start fishing motors equipped with built-in nickel-cadmium battery packs.

The new 3.7-lb. "Ni-Cad" pack can be found under the hoods of both the Ted Williams 7.5 and 9-hp models. According to Sears, it's not only 21 lbs. lighter than the standard lead-acid battery, but also has the ability to recharge quickly and won't deteriorate as rapidly.

With electricity available, the company has crammed in all sorts of other convenience features besides electric starting. For instance, each motor has two lights—a stern light for safety during twilight operation and a panel light to illuminate the controls and provide light for handling tackle after the sun goes down. There's even a cigarette lighter.

Both the 7.5 and 9-hp motors have full gear shift and twist-grip throttles as standard equipment. A "power tilt drive" feature makes it possible to operate the motor in shallow water without damaging the prop. These motors also have an "auto-bail" that can pump 5 gals. of water per minute.

Sears' 1968 line of outboards includes 12 models ranging from 3.5 to 75 hp. The company also offers three electric trolling motors. ★★★

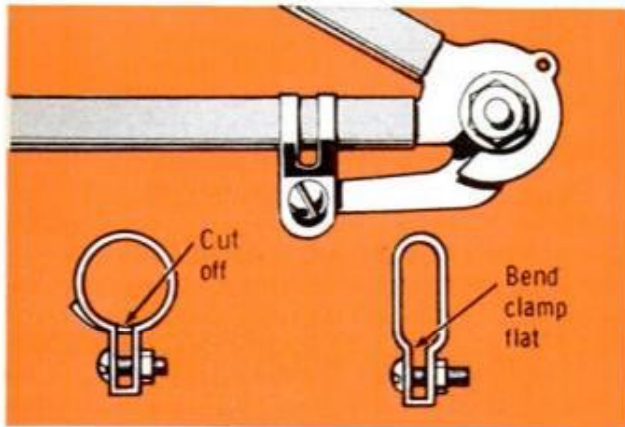
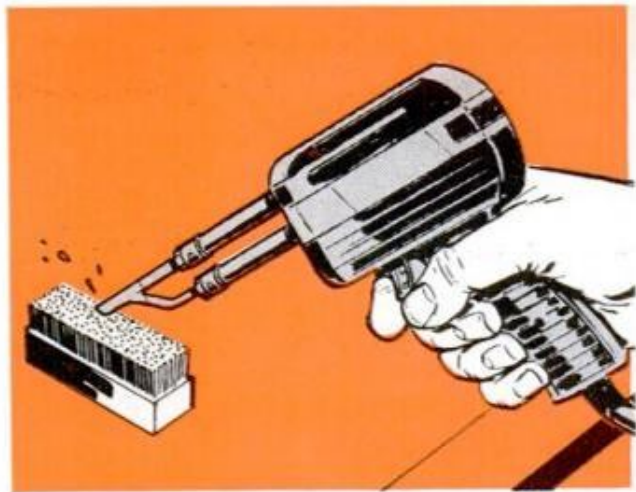
HINTS

FROM READERS

Suede brush aids soldering

A brass-bristled suede brush mounted on your workbench is a handy soldering aid. By wiping the tip of your soldering iron across it occasionally, you can remove any scale that's present and keep the iron operating at top efficiency. A couple of screws will hold the brush in place.

—Wilfred Beaver

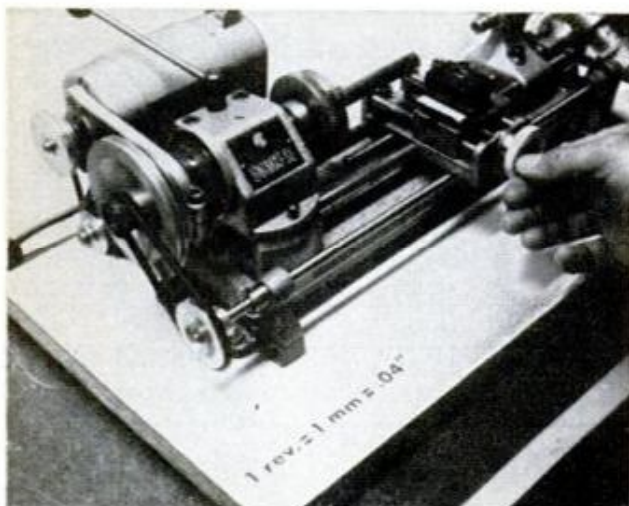
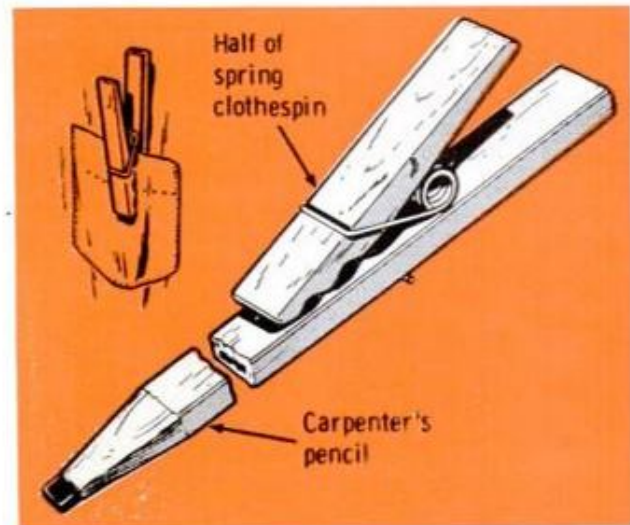


Bracket for bike brake

If the sheet-metal bracket holding the coaster brake of a bicycle to the frame should be broken accidentally, you can make a perfect substitute by flattening a heater hose clamp to match the shape of the frame bar. Cut the small prong from the clamp before you bend it, and install this improvised replacement just as you would the regular bracket. It's especially handy if you happen to break the clamp on a Sunday.—Dennis Richardson Sr.

Clothespin clip holds pencil

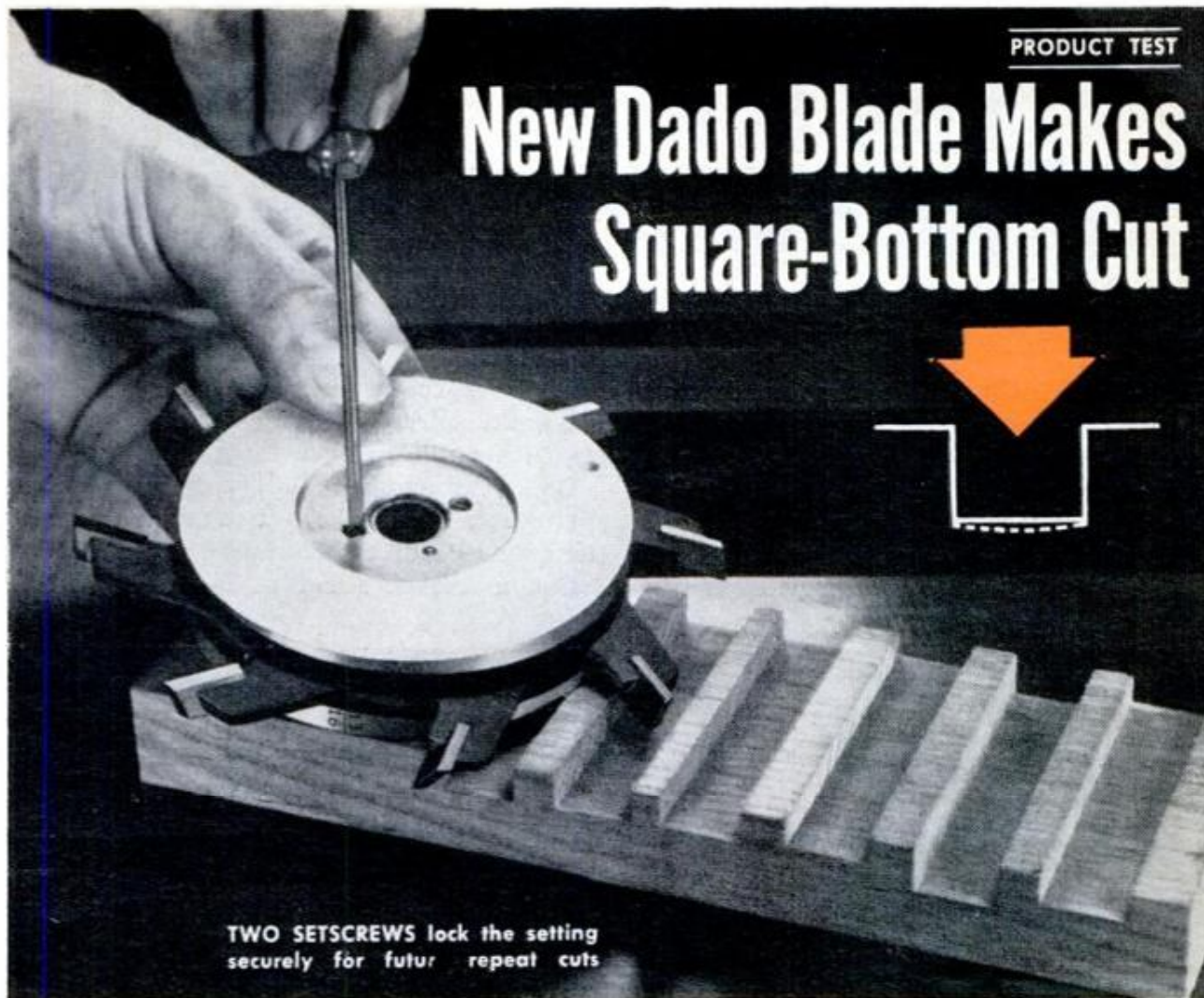
You won't have to worry about that flat carpenter's pencil falling out of your pocket if you equip it with a homemade pocket clip. To make such a clip, just pull out one half of a spring-clamp clothespin and slide the pencil under the clamping wire in the desired position. To be sure that this wire will stay in place, cut a shallow notch in the pencil to hold it. When you have worn down the pencil so that only a stub remains, it's time to transfer the clip to a new one notched the same way.—Albert T. Pippi



Cure for poor memory

If you have a hard time remembering settings, conversion tables and similar information, you might take a hint from a reader who owns a European-made lathe. Both the longitudinal and cross-feed handwheels are calibrated in millimeters. Since he was always having to check the distance the carriage was advanced by one turn of the wheel, he made a permanent note of the information directly on the workbench, using press-on letters. These easy-to-use letters are available at most art supply stores.—Bert Stanhoff

New Dado Blade Makes Square-Bottom Cut



TWO SETSCREWS lock the setting securely for future repeat cuts

IF YOU'RE THINKING of buying a dado head for your table saw or radial saw, Rockwell has just come out with an adjustable one that's a honey. It's the new 6-in. Tru-Cut and it does a superb job. To set it, you just loosen the arbor's nut, dial the width of cut you want by aligning the markings on the tool's rotating sections and tighten the nut. The finished groove will be right on the button. It will cut a groove from $\frac{1}{4}$ to $1\frac{1}{16}$ in. wide and up to $\frac{3}{4}$ in. deep.

But what's even more important is the way it cuts. While the dado's eight razor-sharp teeth "walk" from one side of the cut to the other as the dado is spinning, you wind up with a clean, square-bottom cut—something you can't do with the so-called wobble saws. Thus you can produce perfect-fitting joints.

Still another plus over wobble saws, as well as dado saws which consist of individual blades, is that you can retain the setting for future repeat cuts by locking it with a pair of setscrews.

This means you can remove it from the saw arbor at will and later replace it with



TO SET THE DADO, first loosen the arbor nut. Then you can rotate the center section with one hand while holding the outer movable section with the other

the assurance that it will make exactly the same cut. It will fit both $\frac{5}{8}$ and $\frac{3}{4}$ -in. arbors, comes packaged in a neat plastic storage case and sells at your dealer's for \$24.95.—Wayne C. Leckey

How to Make a Rickshaw For the Juvenile Set

By D. L. RICHARDSON

Technical Art by ZIK Associates, Ltd.

TAKE A HACKSAW to that antiquated bike cluttering up your garage and you're halfway toward completion of this junior-size rickshaw.

Just cut the bike at the rear yoke and front fork and straighten the fork (heating it will make it bend easily). Position the

two pieces 18 in. apart on the steel bars and weld, spinning the wheels while welding to keep them from burning.

Bolt the conduit to the bars, weld a spring latch to the end of the conduit, and the frame of the rickshaw is complete.

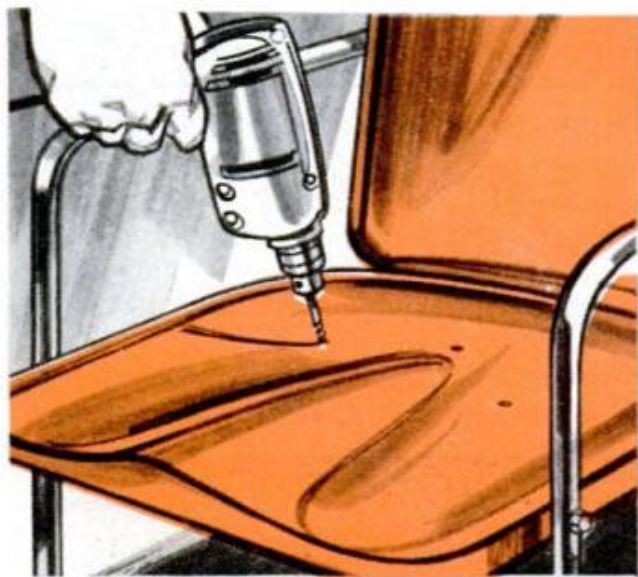
Cut a 2x4-ft. sheet of $\frac{3}{8}$ -in. plywood



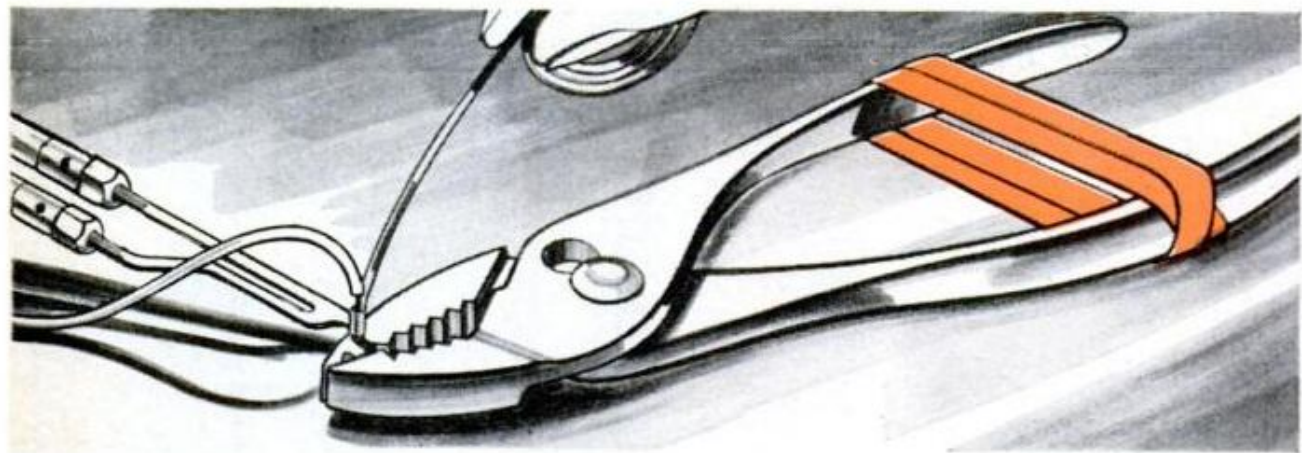
Solving home problems



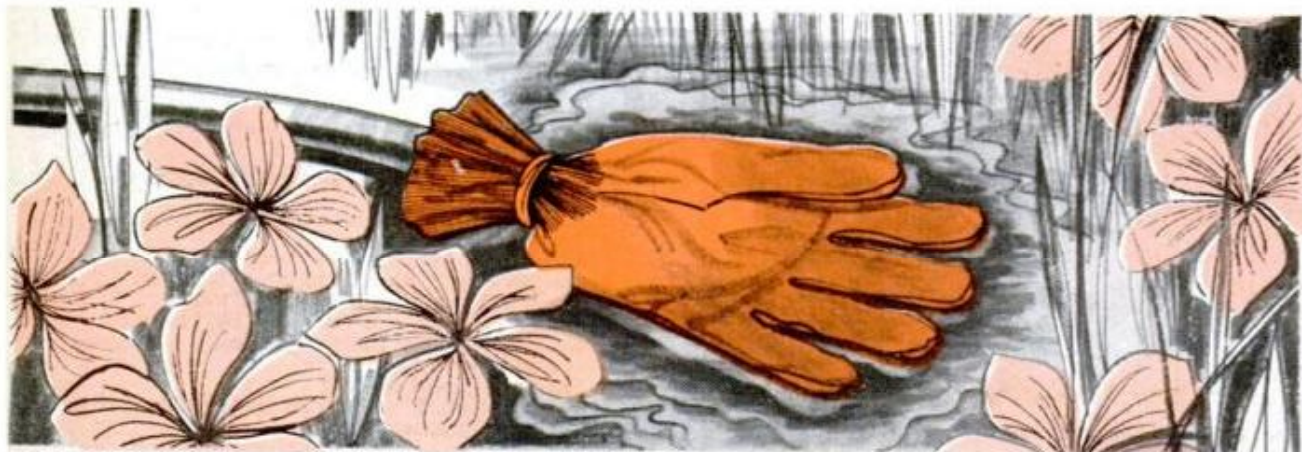
STURDY HANGERS for heavy pictures or mirrors can be made from window-shade brackets. Simply hammer angled portion flat and attach it to the mirror backing with short screws, then bend bracket outward



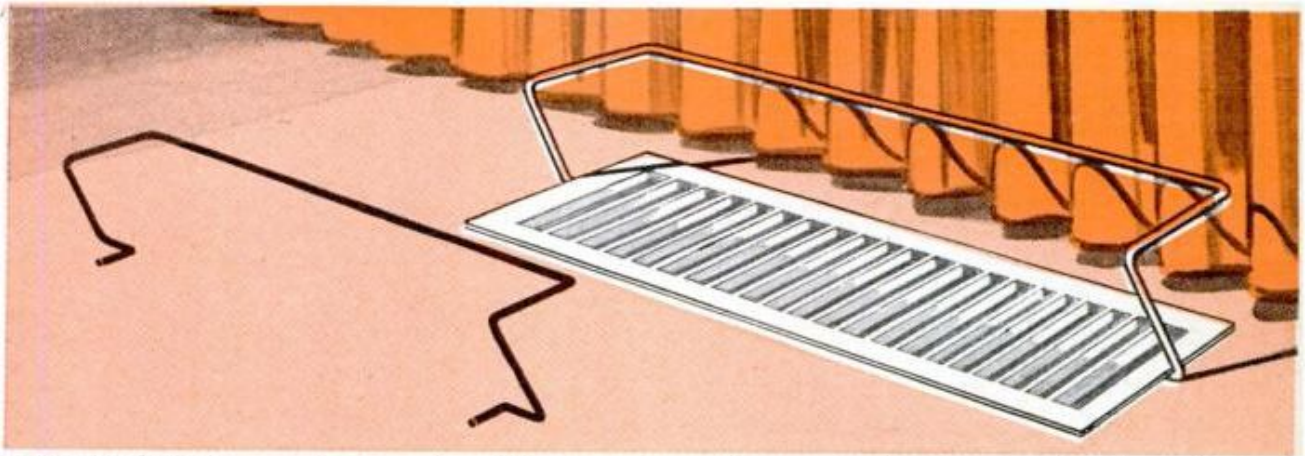
TO PREVENT WATER from collecting in the seat of a metal lawn chair after a rain, drill three or four drain holes in the lowest part of the seat near the back. Once water drains, the chair will dry rapidly



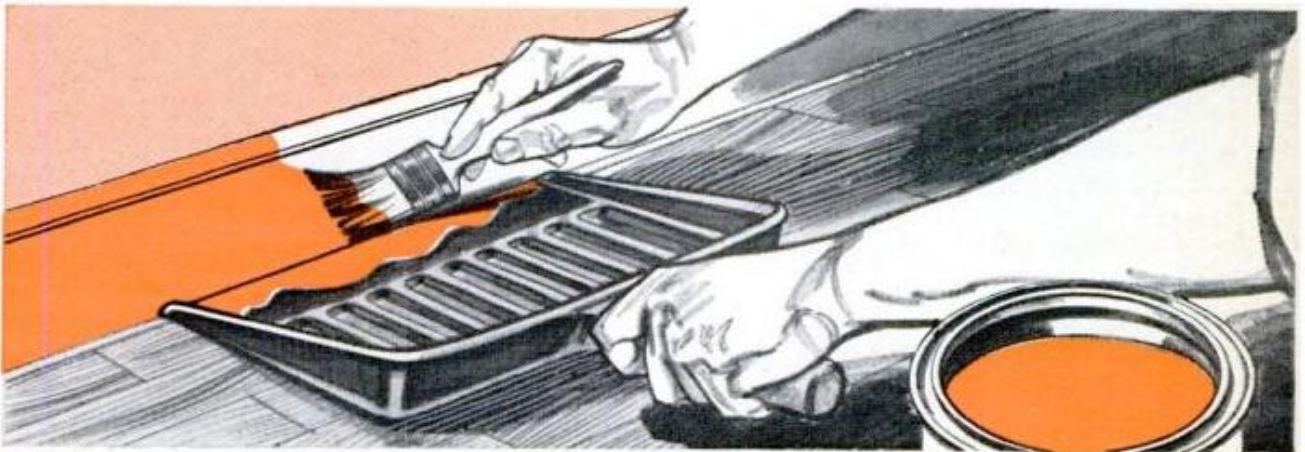
THIRD-HAND VISE for holding small parts during soldering is just an ordinary pair of pliers with a heavy rubber band slipped over the handles to provide "grip." For more pressure, loop band over handles twice



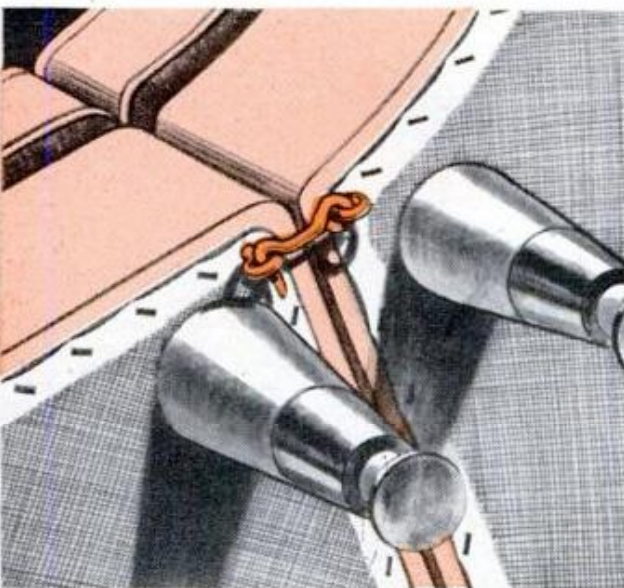
SAFE WAY TO SOAK A FLOWER BED without the risk of washing away plants is to attach an old cotton workglove over end of hose with twine or rubber band. This breaks up stream of water and protects plants



DRAPERY GUIDE to prevent drapes from billowing out over floor vents of a forced-air heating system can be made by bending a coat hanger as shown. Angle the ends so that they will fit under flange of the vent



TO PROTECT FLOOR when painting the baseboard, push a dustpan up flush against the baseboard and move it along the floor as work progresses. To prevent smearing, wipe lip frequently with turpentine-soaked rag



FURNITURE LOCKS hold sectional furniture firmly together when in use; can easily be disengaged for cleaning or moving. They're small hooks and eyes mounted under edges of sections wholly out of sight

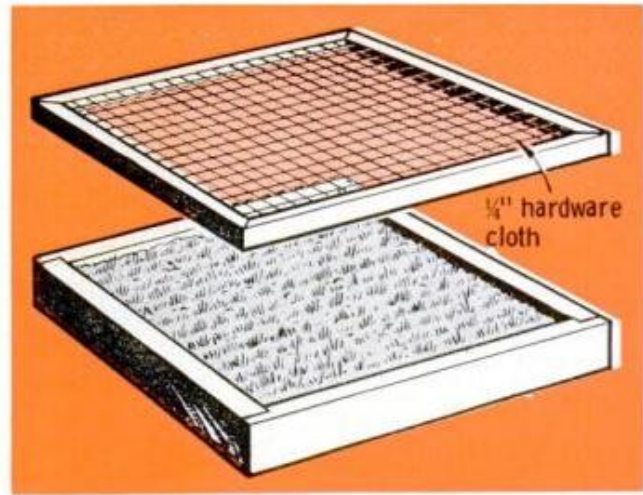


BIG SPREADING JOBS involving application of glue over a large surface will be no problem if you use a rubber kitchen spatula. It's flexible enough to spread a thin coat, stiff enough for good control

HINTS FROM READERS

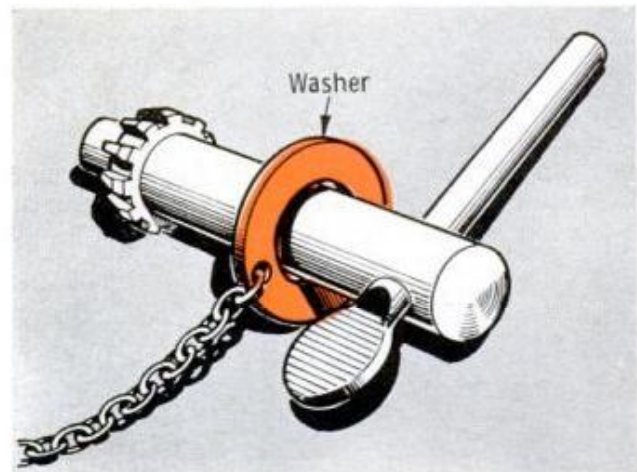
Sprouts for laying hens

For a continuing supply of oat sprouts for a small poultry flock, fill a shallow box with soil and sow the oats in it. When the grain begins to sprout, cover the box with a removable wood frame over which is tacked a section of screening. New sprouts will poke through the mesh where they can be eaten; roots will be protected from scratching.—*G. E. Hendrickson*



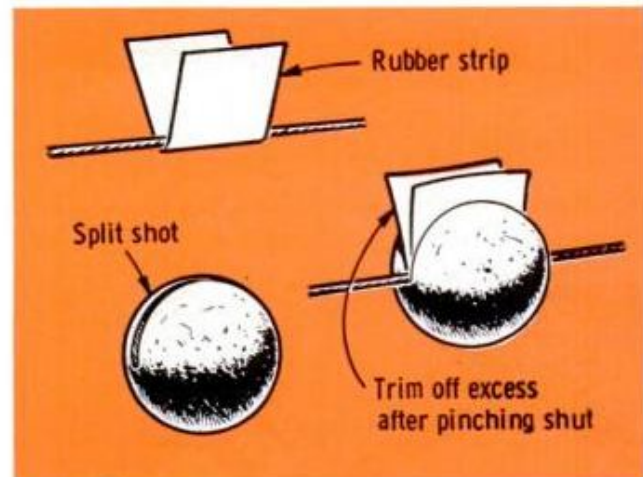
Chain collar for chuck key

One efficient way to attach a chain to a chuck key is to drive out the handle and slip a loose-fitting washer over the shank, then drive the handle back into place. The chain can be attached to the washer through a hole drilled near the outer edge, as shown in the illustration. With the key tethered to the drill press in this manner it won't stray, and yet it can be turned in the chuck without having the chain wrap around the key.—*Wilfred Beaver*



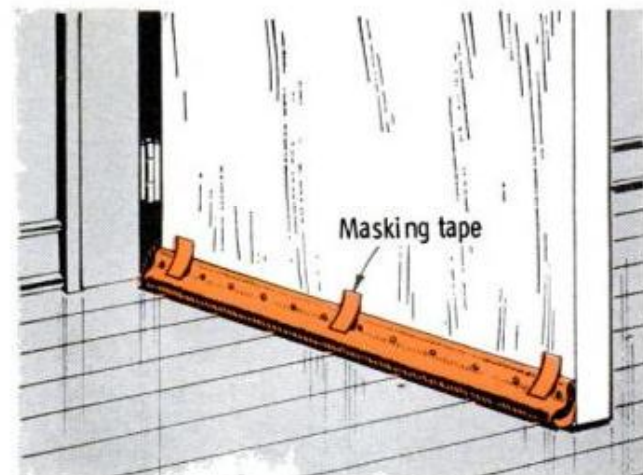
Stop sinker slipping

No matter how tightly it's pinched on the fishline, a split-shot sinker has an annoying tendency to slip. One sure way of holding it in place is to lay a strip of thin rubber across the split—a broken toy balloon is a good source of such rubber—then put the line over this strip, push it into the opening and crimp the shot tight with pliers. The rubber, which is finally trimmed off flush, provides a nonslip grip to keep the sinker from slipping.—*John Krill*



Tape holds for nailing

When installing something like door-bottom weatherstripping, which must be accurately aligned before it's fastened in place, you'll find that a few short strips of masking tape will do a fine job of holding the weatherstripping until it can be secured permanently with nails or screws. With a door-bottom strip, three pieces of masking tape will usually be sufficient to align and support it. It's a good idea first to drill pilot holes in the door for the screws.—*G. E. Hendrickson*





Make This Utility Trailer For Your Garden Tractor

By G. R. JOBE

Technical Art by Don Evans

YOU'LL HAVE A SURE CURE for those backaches caused by heavy back-yard chores with this functional utility trailer that can be constructed of common materials to fit most any make of garden tractor.

The versatility of the trailer is mainly a result of the flexible arrangement of interlocking slatted sides and a removable rear panel. The trailer can be used with its four slatted sides, as shown above, to haul shrubs, small trees and other tall items; or it can be converted quickly to a three or four-sided flatbed type for moving sand, gravel and other materials.

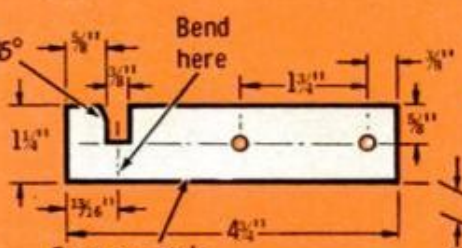
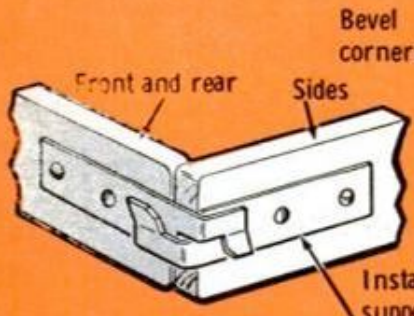
Made of four horizontal and two vertical strips of $\frac{3}{4}$ x $2\frac{3}{4}$ -in. fir, the slatted sides slip into retainers of 16-ga. cold-rolled steel (CRS) permanently mounted to the four side panels of $\frac{3}{4}$ -in. exterior plywood. Attached to the top slats of each side are supports of 12-ga. CRS that hook onto each other and greatly strengthen the corner joints while allow-

ing quick and easy removal of the sides without the need for any tools.

The main section of the trailer consists of a three-sided plywood enclosure mounted on a steel frame. The fourth side (rear panel) slips into the channel formed by the lengths of 1x1 and 2x2 angle that are screwed to the inner and outer surfaces of the side panels.

The frame or chassis of the trailer is made of $1\frac{1}{8}$ -in.-square steel bar, although steel pipe, square or round tubing, angle or channel also could be used. Regardless of which material you use, however, make certain that all joints are securely welded together with fillet welds.

Almost any type of pneumatic tire and wheel assembly can be used, as long as it is at least 12 in. in diameter. Suitable wheels often can be salvaged from wheelbarrows, boat trailers, golf carts or lawnmowers. Go-kart wheels are probably the best choice, especially if they are equipped with tapered roller bearings. The inner



CUT FOLD TAPE

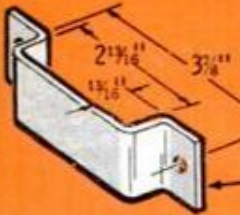
GARDEN TRAILER

Install supports with 3/16-1" roundhead screws and nuts

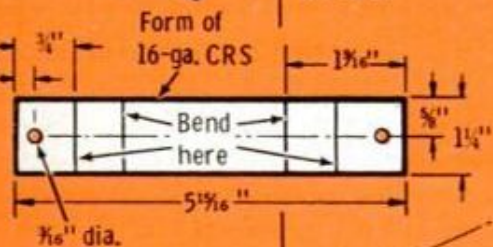
Form supports of 12-ga. CRS, bend 2 right-hand pairs, 2 left-hand pairs

Slats and vertical supports are 3/4 x 2 1/4" fir

Front panel is 12 x 38 1/2"



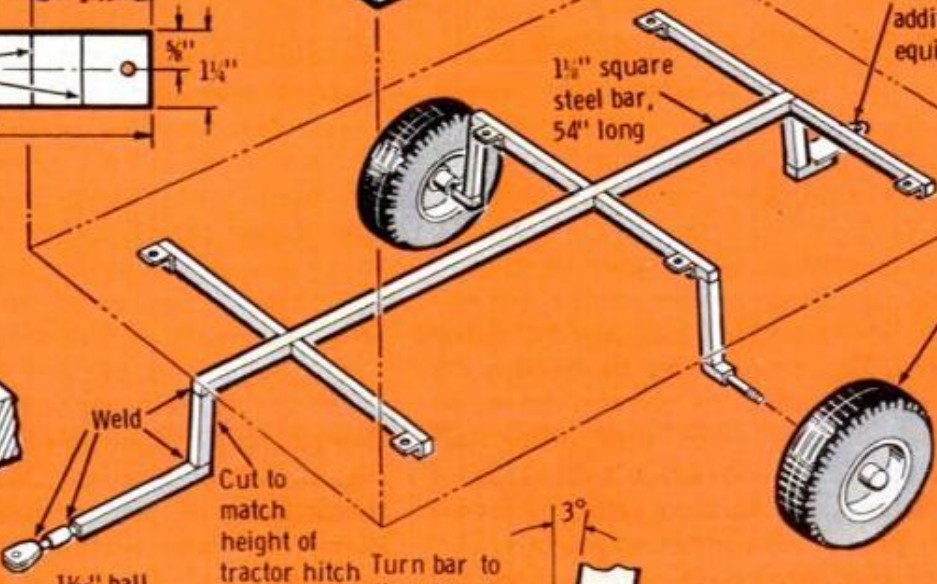
Retainers 16 req'd.



Form of 16-ga. CRS



Angle welded to bars accepts screws for plywood bed



1 1/2" square steel bar, 54" long

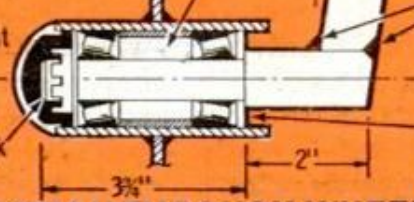
Optional rear hitch for additional equipment

6" radius go-cart wheel with 3/4" bore, Timken bearings



1 1/8" ball

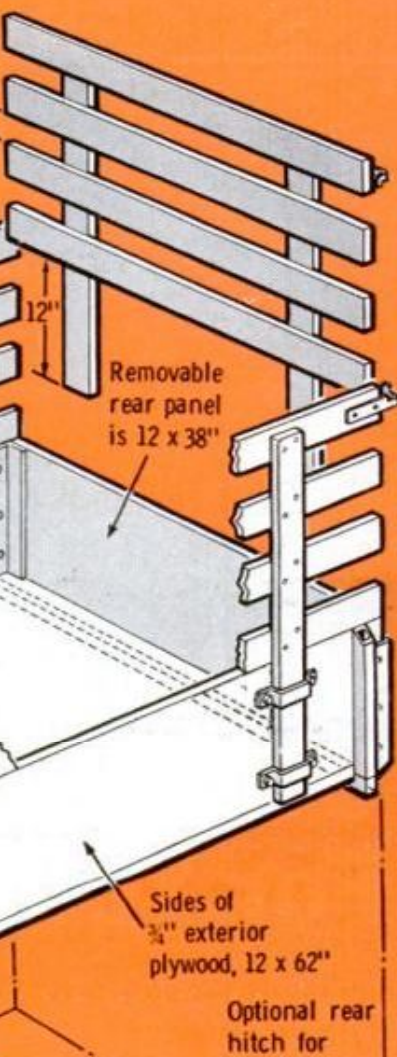
Relieve front of socket for 15° movement



SECTION THROUGH WHEEL

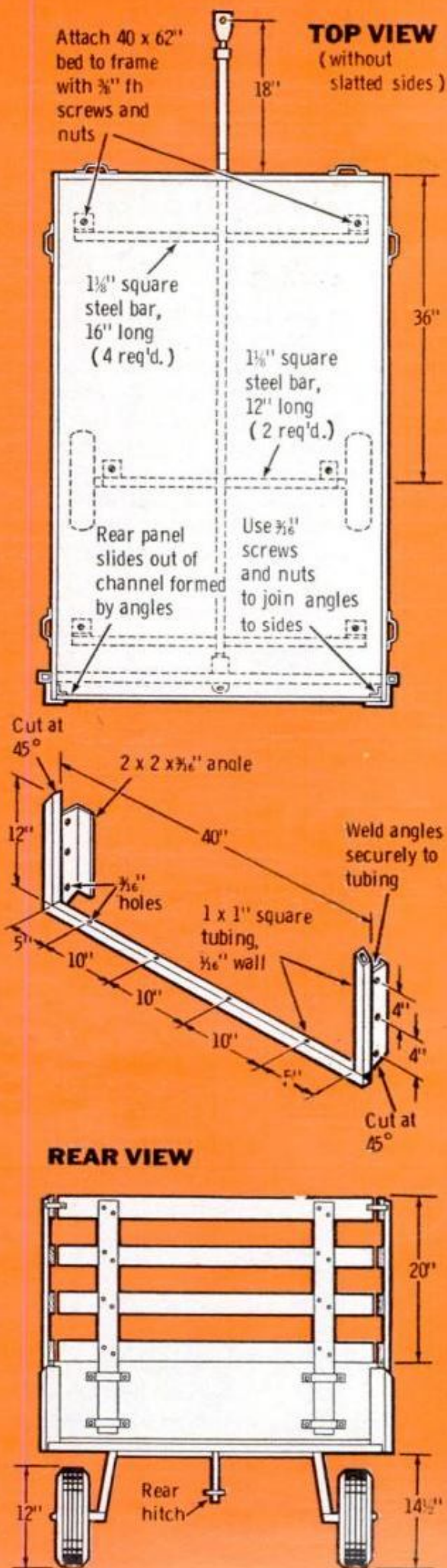
All joints should be welded with fillet

1/8" thick washer acts as dustshield



Removable rear panel is 12 x 38"

Sides of 3/4" exterior plywood, 12 x 62"



diameter of the bearings should be at least $\frac{3}{4}$ in.

Ball bearings (sealed or nonsealed) or sleeve bearings will work equally well. However, provisions must be made for lubricating and sealing any hubs not fitted with sealed, prelubricated bearings.

The spindles are turned from the square steel bar to accommodate the wheels and bearings selected. The turned length should equal the spacing between bearings, plus the space required for a grease seal, flat washer and nut. The end of the turned spindle also can be threaded and drilled for a castellated nut and cotter pin.

An alternative method to form the spindles is to weld a headless bolt in a hole drilled in the supporting arm of the chassis. Be sure, however, that the wheel will clear the arm of the steel chassis.

Construction sequence

The steel frame and wheels should be assembled first, then fitted to your tractor so the proper vertical position of the hitch can be determined. The length of the horizontal bar connecting the hitch to the frame may also have to be modified slightly since the turning radius of your tractor might be smaller than that shown.

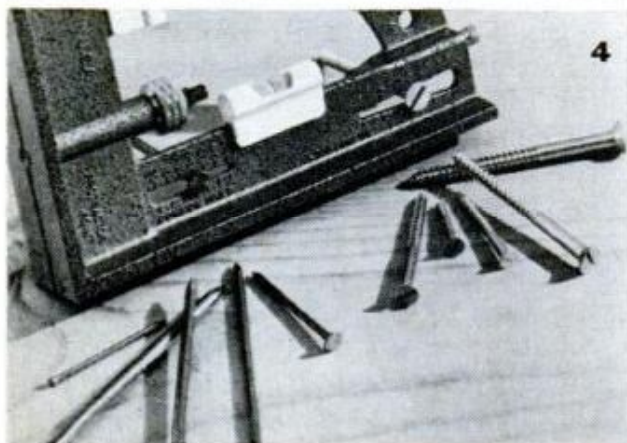
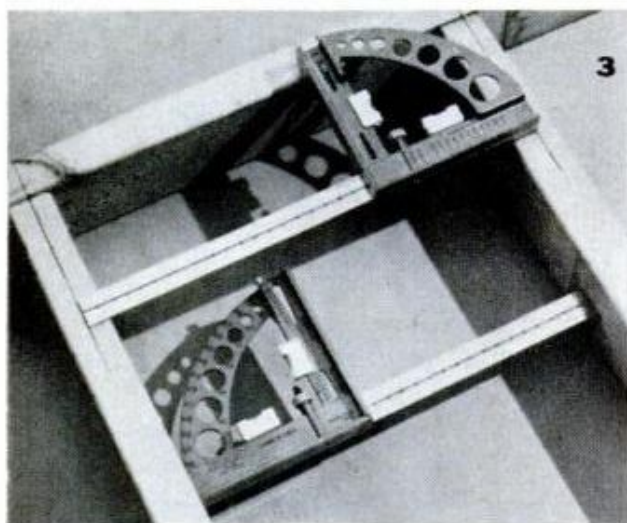
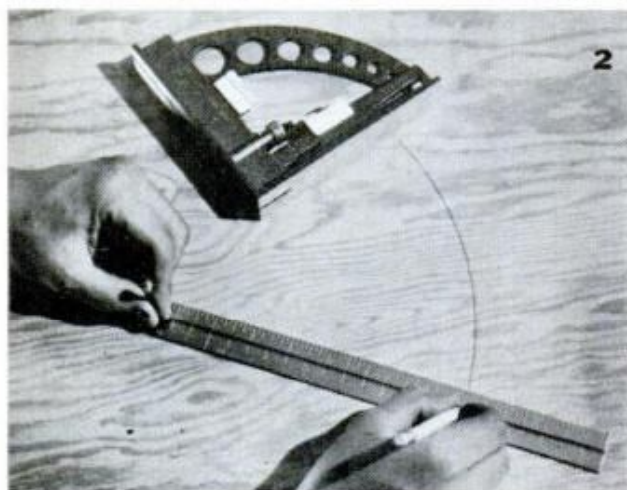
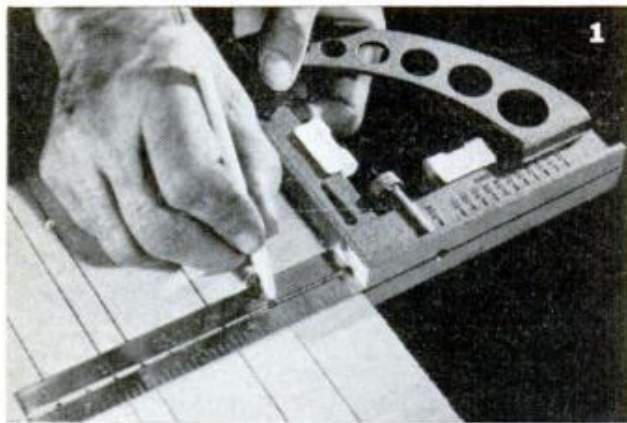
When completed and tested, the frame should be fitted with six short sections of angle drilled to facilitate the mounting of the bed to the frame. Then clean all welded areas, removing the slag completely, and give the frame a protective coat of zinc chromate primer.

The bed of the trailer is built upside down on a level surface. All joints should be made with waterproof glue and secured in alignment with $1\frac{1}{4}$ -in. finishing nails. Then drill and drive in No. 8 $1\frac{1}{2}$ -in. wood screws every 10 in. and allow the bed to dry before adding the U-support at the rear.

Six 3-in. blocks of scrap wood are used as spacers to insure the proper positioning of the slats on the vertical supports. Make certain the vertical supports are spaced the same distance away from the ends of the slats before gluing and screwing the sides together.

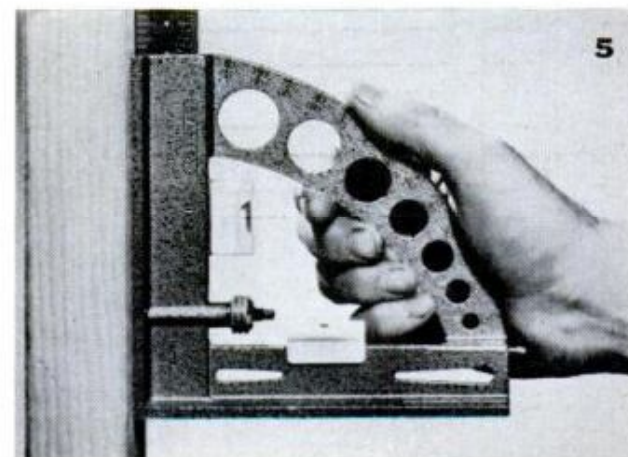
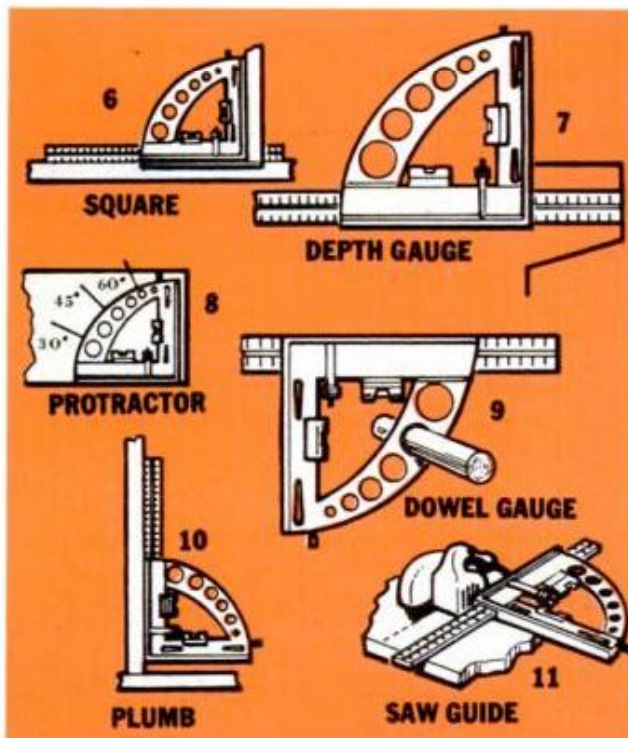
When all glued joints have dried, screw the bed to the frame. Then secure the retainers to the side panels and the locking supports to the corners of the slatted sides. Finish by painting and trimming the trailer to match the tractor's colors. ★ ★ ★

Meet Stanley's One-Tool 'Workshop'



TALK ABOUT a one-man band: Here's one of the most versatile hand tools yet. It's Stanley's new All-N-One measuring tool, which is a workshop in itself—there are no less than 11 (count 'em) different things you can do with it.

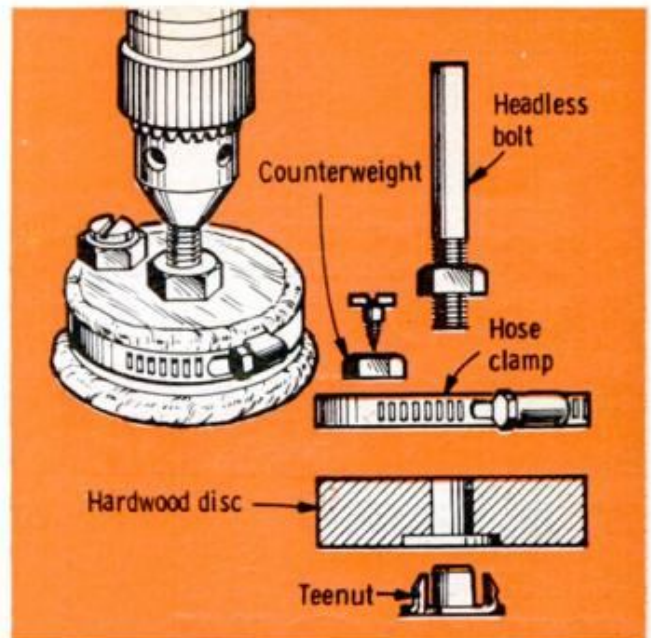
In addition to being an adjustable square, it has a row of holes in the blade so you can use it as a marking gauge as well as a beam compass. With it, you can space studs 16 in. on centers and take direct inside measurements. A tapered slot permits checking nail and screw gauges, and a series of holes lets you check dowel sizes. Bubble vials make it both a plumb and a level. And, it's a protractor, depth gauge and crosscut guide for a portable electric saw. Your dealer has it for \$4.98.



HINTS FROM READERS

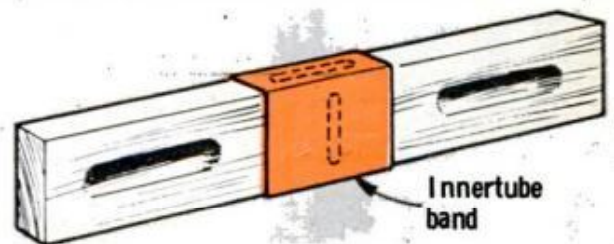
Drill-press polishing pad

Small flat items can be polished on your drill press with the easy-to-make polishing pad detailed at the right. The pads themselves should be large enough so that their edges can be folded up around the sides of the disc and held in place with the hose clamp. To balance the polisher, add a counterweight on top of the disc on the side opposite the hose-clamp screw. This will insure smooth operation.—*Peter Legon*



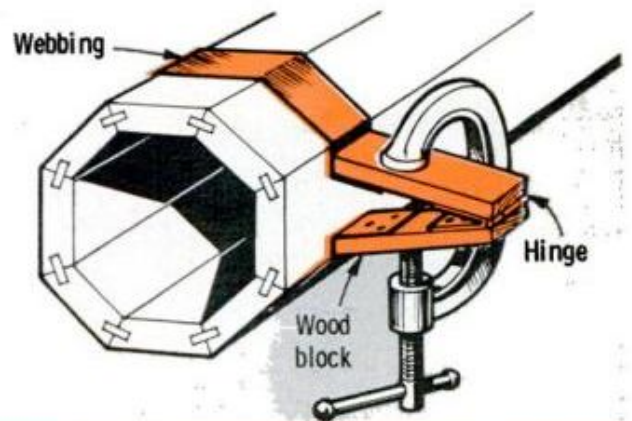
Rubber guard for level vials

Before chucking a level in your toolbox, make a protective cover for the vials by cutting a wide section from an old bicycle inner tube. Slipped over the level, it will prevent breakage.—*Wilfred Beaver*



Homemade web clamp

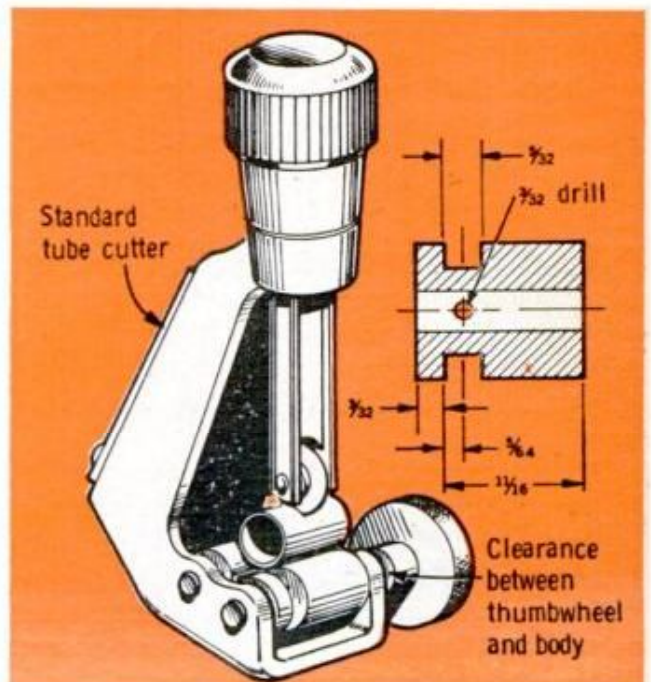
If you don't have regular web clamps when it comes to gluing the splined beveled joints of octagonal or hexagonal-shaped work, you can make your own in a few minutes as shown in the detail at the right. Lengths of strong furniture webbing are tacked to the ends of hinged blocks. Then the webbing is pulled tight around work by drawing blocks together with a C-clamp. —*Milton J. Hancock*



Cutter cuts short lengths

Being able to rotate the tubing instead of the cutter makes it possible to cut extremely short lengths of tubing with a standard tube cutter—something that ordinarily can't be done. To modify the cutter, remove the front roller by drilling out its rivet axle and replace it with a roller turned from medium-hard urethane. Fit the new roller with a $\frac{3}{16}$ -in. axle and enlarge the original rivet holes in the cutter to accept it. Crosspin the roller to its axle and then add a 1-in. knurled knob to the end.

In use, the friction of the urethane roller against the tube, when turned by the knob, rotates the tube against the cutter wheel.—*Robert D. Corwin*



What You Should Know About GROUND FLAT STOCK

By JOHN BURROUGHS



When you need a premium-quality raw material for metalworking, specify ground flat stock—it's a precisely ground soft steel that can't be beat

EACH STANDARD LENGTH has own wrapper

WITH A LENGTH of ground stock in hand, you can fabricate almost any tool or machine part simply by sawing the steel to the required outline, then smoothing the edges and heat-treating as necessary.

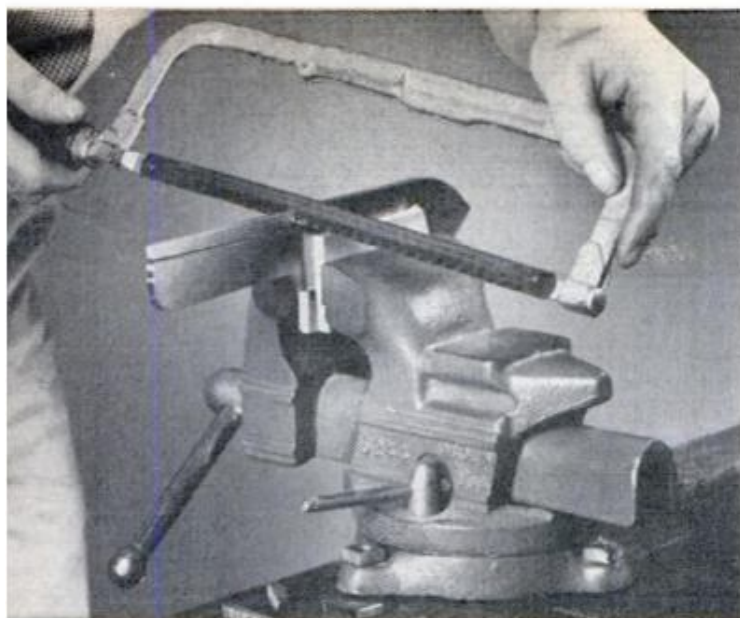
Thus, ground flat stock is the perfect material for making jigs, fixtures, chisels, cutters, punches, gauges, leaf springs, brackets, instrument bell cranks, typewriter parts—and even replacement blades for Great-Grandfather's old spoke-shave.

Ground flat stock is actually steel that's

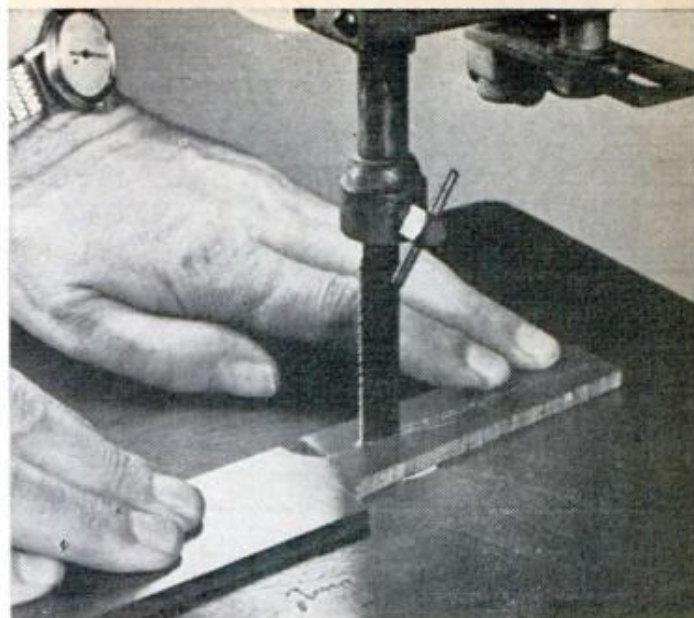
been finely finished by grinding. There are three kinds: tool steel, die steel and low-carbon steel. All are available in standard-length bars and plates, and in almost any thickness-by-width size you're likely to need. Each length is machine-ground to precise dimensions, with all faces and edges perfectly true, parallel and square. Most important, however is that all three stocks are soft (the tool steels are furnace-annealed) and, therefore, quite workable.

Where to get it. Several leading tool

POPULAR MECHANICS



THREE TYPES of ground flat stock are soft and, therefore, are quite easy to saw, even by hand



FIT A JIGSAW with a 5-in. length of tungsten-alloy hacksaw blade to make cutting ground stock easier



COATING STOCK WITH BLUE DYE makes scribed lines easy to see and helps simplify complex layout work



FOR SMALL PIECES that won't be hardened, use low-carbon steel. It's the cheapest and is easy to braze

manufacturers (Starrett, Milford, Nicholson and others) supply precision-ground steel through the larger hardware outlets and industrial-supply firms. In their catalogs they list standard sizes (there are more than a thousand), as well as per-length prices. Usually, local distributors will have most of the commonly used sizes in stock, or will place a special order for an uncommon size (a length $7/32$ in. thick by $1\frac{1}{4}$ in. wide, for example).

As you might expect, ground steel costs considerably more than the unfinished material, but prices aren't completely prohibitive. The cheapest of the three stocks, low-carbon steel, costs about \$1.50 per lb., while tool-steel stock is priced at about \$2 per lb. Thus, the small pieces you're likely to be ordering for common jobs probably

won't cost more than a few dollars at most.

Working with tool steel. Your best bet for cutting tools or flat springs is a high-grade, chrome-tungsten-vanadium tool steel that's oil-hardenable. You can get either 18 or 36-in. lengths in thicknesses from $1/64$ through 2 in., and in widths up to 14 in.

Tool steel heat-treats easily, hardening when heated to 1500° F. and quenched in warm (125° F.) light oil. The hardened steel then requires tempering (reheating to a lower temperature to relieve internal stresses) to make the steel less brittle. Cutting tools made from oil-hardening stock should be tempered at 300° to 350° F.; cold chisels at 400° to 450° F., and leaf springs at 750° to 800° F.

If you use a torch to heat the steel, be



TOOL STEEL CAN BE HARDENED by heating red hot, then quenching it in a container of warm light oil



QUENCHED TOOL STEEL will scratch glass and is very brittle. Relieve brittleness by tempering in oven

HEAT TREATMENT

Quench from 1475° - 1525° F. in quenching oil of about 125° F. temperature. Use higher temperature for thicker sections. Draw

Temperature	Rockwell C. Hardness
As Hardened	.....63-65
300 F. ....	.....63-64
375 F. ....	.....61-63
400 F. ....	.....61-62
500 F. ....	.....58-60

TYPICAL ANALYSIS

(SAE type O1)

Carbon .....	.95	Chrome .....	.50
Manganese.....	1.20	Tungsten.....	.50
Silicon .....	.25	Vanadium .....	.15

INSTRUCTIONS FOR TREATING TOOL STEELS and breakdown of metal's composition will be found on the label



TO IDENTIFY UNMARKED SCRAP, touch it to a grinder and compare the sparks with those from known metal

sure to heat it evenly to prevent warping. Never quench oil-hardening steel in water—a drastic quench will crack it. Always temper quenched steel before grinding.

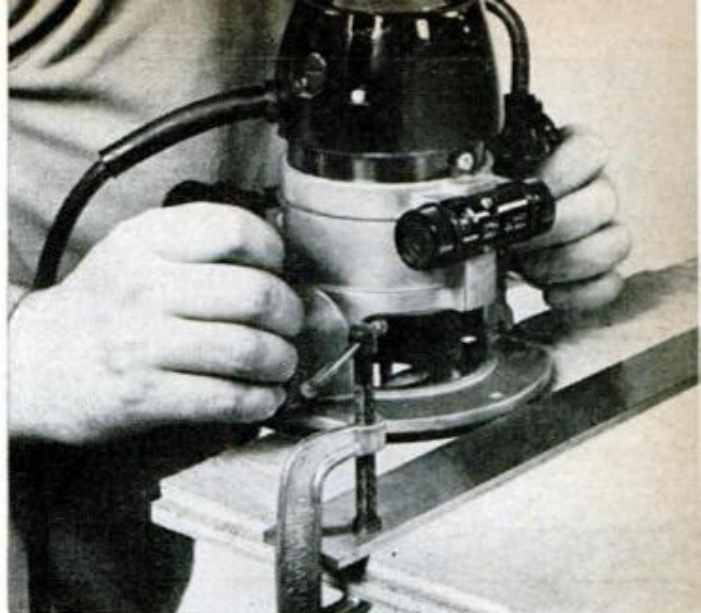
Working with die steel. For tools that must resist wear (punches, gauges or gun action parts, for example), 5-percent-chrome die steel is your best choice. It's also available in lengths of 18 and 36 in., with thicknesses of 1/16 through 2 in., and widths up to 12 in.

To harden die steel, heat it to a bright cherry red (1700° to 1800° F.) and let it air-cool. Temper it right after hardening (gauges at 300°, punches at 400° F.).

Since it hardens with a gradual air quench, die stock isn't likely to crack or become distorted when heat-treated. It is, however, difficult to anneal.

Working with low-carbon stock. This is a fine-grained, 18-point-carbon steel suitable for any parts that needn't be hardened, such as fittings, fixtures, machine parts and patch plates. Available only in 24-in. lengths, low-carbon steel comes in thicknesses ranging from 1/16 through 2 7/8 in., and in widths up to 16 in.

This mild steel is the ground stock you'll use most often, since it's very easy to saw, file, drill, tap or weld. Because parts cut of low-carbon steel are ground perfectly square, you'll also be able to screw sections together to form solid assemblies.



KEEP A LENGTH OF STOCK in your wood shop. You'll find it useful for guiding your router, portable saws

Should it be necessary, you can case-harden low-carbon stock by heating it red hot, and then dipping it in carburizing compound (such as Kasenit) before quenching it in water.

With all three grades of ground flat stock, the individual wrappers for the more than a thousand standard lengths do more than just protect the surface finish—they also identify the metal by composition and additionally list the methods you should use to heat-treat and temper the material. Follow the directions and you're sure to find that ground flat stock is one of the best shop materials around. ★★

NEXT MONTH IN SHOP AND CRAFTS

EIGHT PAGES OF VACATION HOMES FOR CAREFREE SUMMERS. Whether you're planning your "second home" at the seashore, in the mountains, on the lakeside or amidst the tall evergreens, one of these vacation homes will fill the bill beautifully. They've been specially selected for their ease of construction—and their cost—so that a summer home this year needn't be just a topic of conversation, but a center for relaxation.

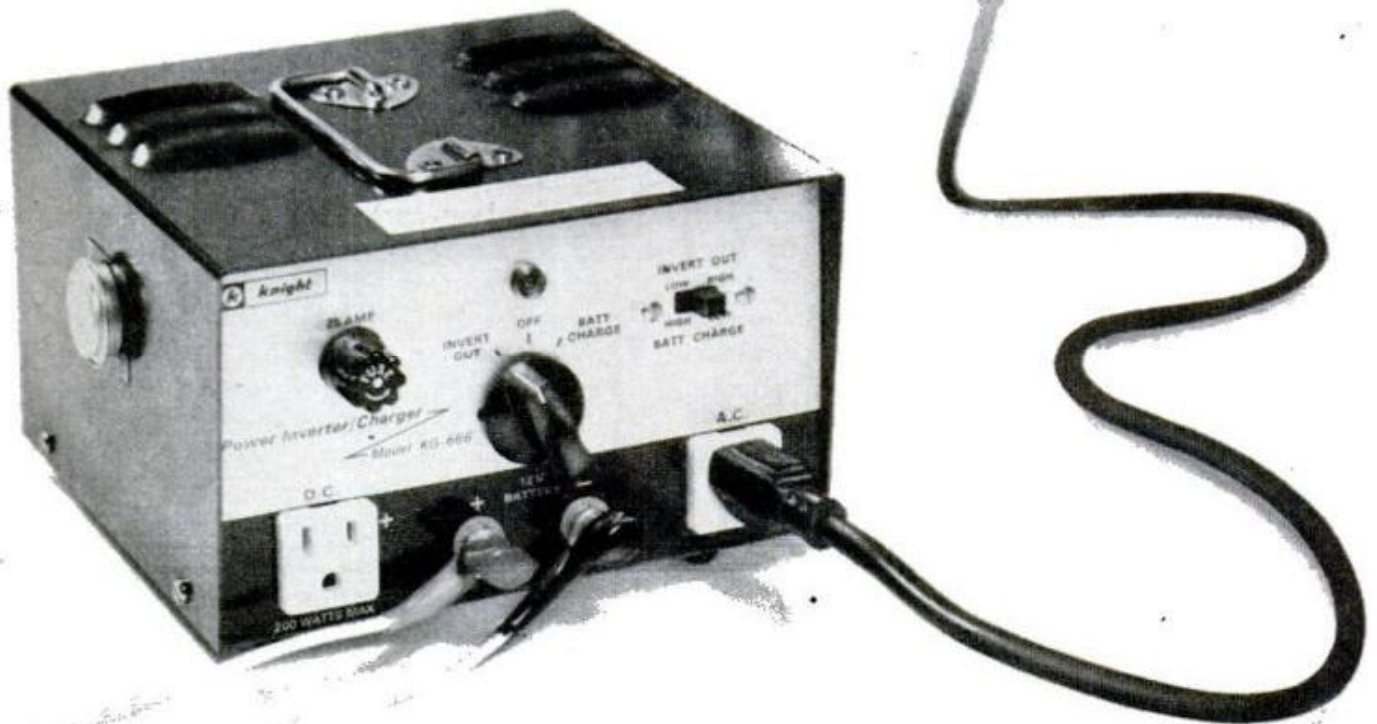
UNIQUE AQUARIUMS YOU CAN BUILD. The latest contributions from *PM's* active staff of do-it-yourselfers are two novel aquariums that you can either duplicate or use as inspiration for your own design. Presented in full color, the first aquarium is in the form of a hexagonal coffee table, while the second is a "living picture" built into the wall of a family room. Complete plans, construction methods and the filtering systems used also will be detailed in depth.

WHAT THE NEW PLYWOOD GRADING SYSTEM IS ALL ABOUT. Revised and updated, the new grading system at first glance seems quite complicated, yet it will be a cinch to understand after reading next month's informative article. With its tables and charts, the story is sure to be one you'll want to clip and save.

PLUS MUCH MORE: Build an in-a-wall bookcase (in color); the lowdown on clamps for your shop; getting your mower ready for spring; how to install a garage-door opener; weekend projects for weekend homes. All in April's *PM*.

KIT BUILDERS REPORT:

Knight-Kit KG-666 Inverter/Charger



New combination kit provides 200 watts of a.c. power from 12 volts d.c. and charges 12-volt batteries with tapering, self-regulating output

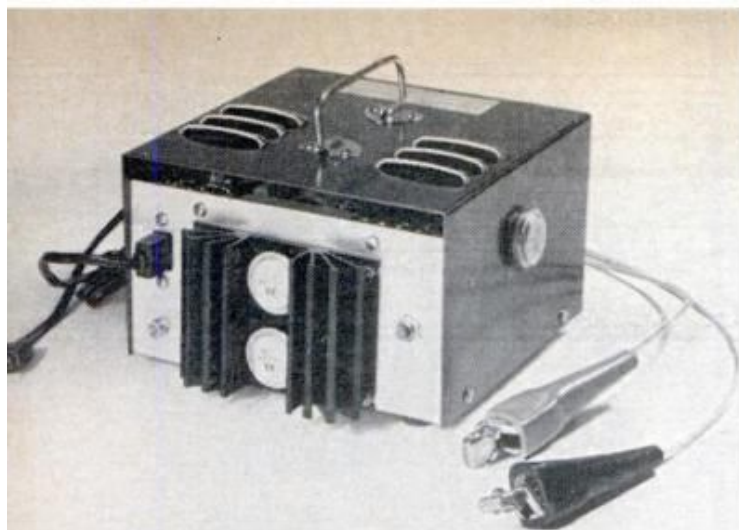
By BILL HARTFORD
Electronics Editor

AN EXCITING "two for the price of one" sign—usually confined to the canned-beans shelf at the supermarket—should have appeared next to one of the newest pieces of gear in the Allied Radio catalog. Wrapped up in one compact, transistorized package are two electronic functions that, up until now, have been housed separately.

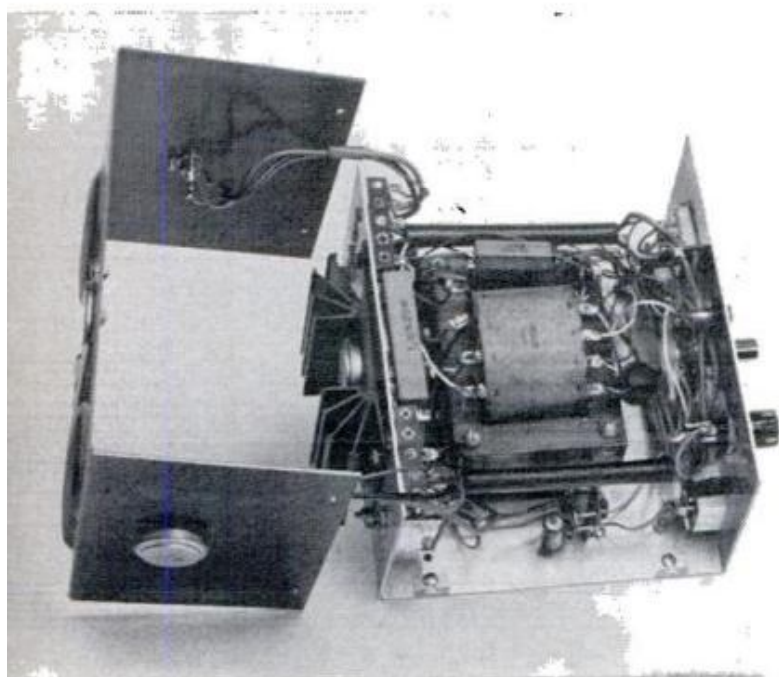
The KG-666 converts power from 12

volts d.c. to 120 volts a.c. and charges 12-volt storage batteries from a.c. house current. One way to look at this double package is that, for a price of \$45 for the kit, the 200-watt inverter is competitive with most on the market, but it has a 12-volt battery charger in addition.

The six to eight-hour job of wiring the kit is a breeze, especially since the wires furnished are cut to length, stripped and tinned. The converter charger kit, incidentally, is also available in a 125-watt version, the KG-662, for \$35. Both kits use the same instruction manual since the schematic diagram for each is essentially the same—the main difference being two additional power transistors and a heavier transformer in the KG-666. Devices rated over 200 watts can be powered by



REAR PANEL OF INVERTER, above, shows a.c. input cord on left, ground lug below it, heat sink and power transistors, center, and circuit breaker reset button on right. View below shows wiring layout around large power transformer



connecting two or more of either of the kits in parallel.

As soon as the kit is complete, the enthusiast may be tempted to pack it and an electric blanket in his duckboat and get right out and ride the waves in toasty warmth. An electric blanket is only one of the things the inverter will power. Others include everything from small power tools, soldering guns, hair dryers, and hi-fi equipment to simple incandescent and fluorescent lights. Of course, you have to pay for the power in the way of battery drain so it's a good idea to be familiar with the amp.-hour capacity of your battery and the current draw of the equipment you'll be using.

The inverter alone, supplying no power to a load, will draw 3 amps. from a 12-

volt battery. In use, a 100-watt load draws about 10 amps. Lack of an ammeter built-in as part of the kit is a disadvantage for anyone used to keeping tabs on current flow without the need for mental arithmetic, but in many applications, the inverter is used in an existing car or boat circuit having an ammeter.

In the inverter mode of operation, output voltage can be varied with a high-low switch. In the high position, approximately 120 volts is available, and in the low position, approximately 105 volts. This voltage, incidentally, is available at both the a.c. socket and at a d.c. output socket on the front panel. The d.c. output can be used to run small universal motors (such as found in most portable hand tools) with increased speed and torque over that available from a.c. operation.

Among the thorough notes to kit builders on the operation and use of the inverter charger, Allied includes detailed instructions on battery hookups—both for local and remote locations. Hookup wire, lugs, and alligator clips required for battery connections are not supplied, but can be made up easily.

The cables shown in the photo at the upper left were prepared in 4-foot lengths of No. 12 wire. Longer lengths require No. 10 wire. Wiring details for remote operation are given in a schematic diagram in the operator's manual.

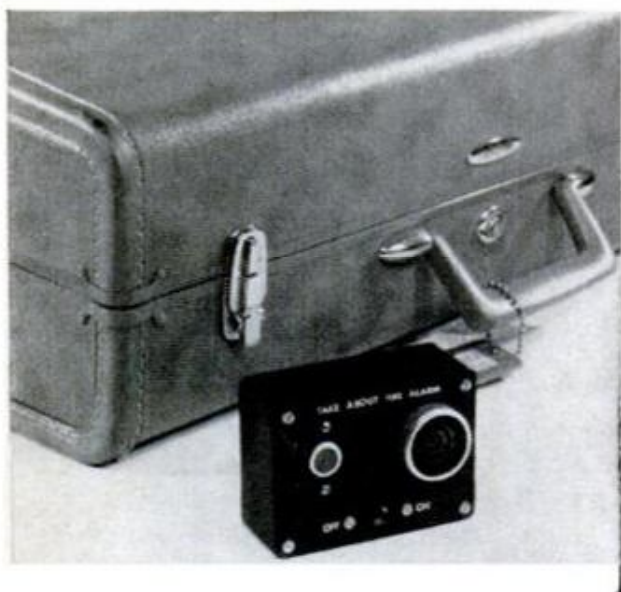
As a battery charger, the KG-666 can be run at both high and low charging rates. A two-amp. circuit breaker in the a.c. input circuit kicks out when the charging rate is too high—as would be the case when charging a nearly dead battery with the charging rate switch in the high position. When this happens, the circuit breaker can be reset and the switch set to the low position to bring up the charge gradually before switching back to the higher rate for a faster charge.

Charging rate is specified at 6 amps. tapering. In use on a half-charged battery, our ammeter indicated that the charger sustained a 10-amp. rate on high and 5 on low. It doesn't have an automatic shutoff feature, but the charging rate dropped to a low trickle as the battery reached full charge. ★★★

Battery-Powered Fire Alarm Goes Anywhere You Go

Anyone can build this completely self-contained alarm with a handful of parts in just an evening

By JAMES A. FRED



A FIRE ALARM in the right place at the right time could prevent the devastation caused by a galley fire on board a boat or an overturned lantern at a summer cabin.

This portable alarm is activated by moving the slide switch to the "on" position. The thermostatic switch then connects the battery to the silicon-controlled rectifier when room temperature reaches 135° F.

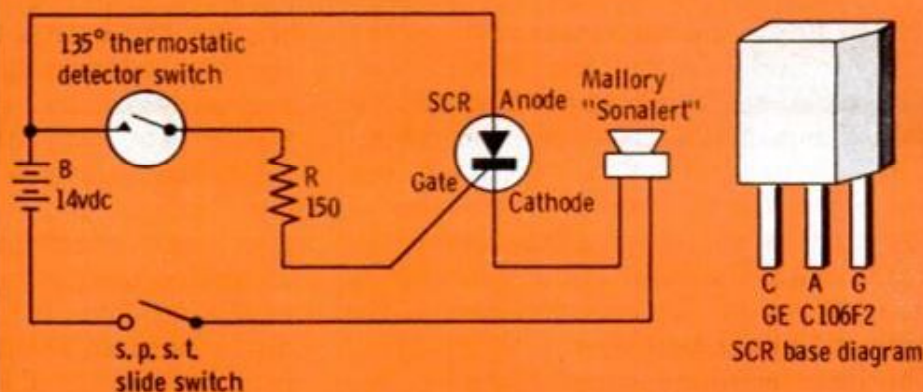
This causes the SCR to conduct, keeping the battery connected to a solid-state signaling device called a "Sonalert" even if the switch should open. This is a safety feature that doesn't let a momentary heat rise go undetected.

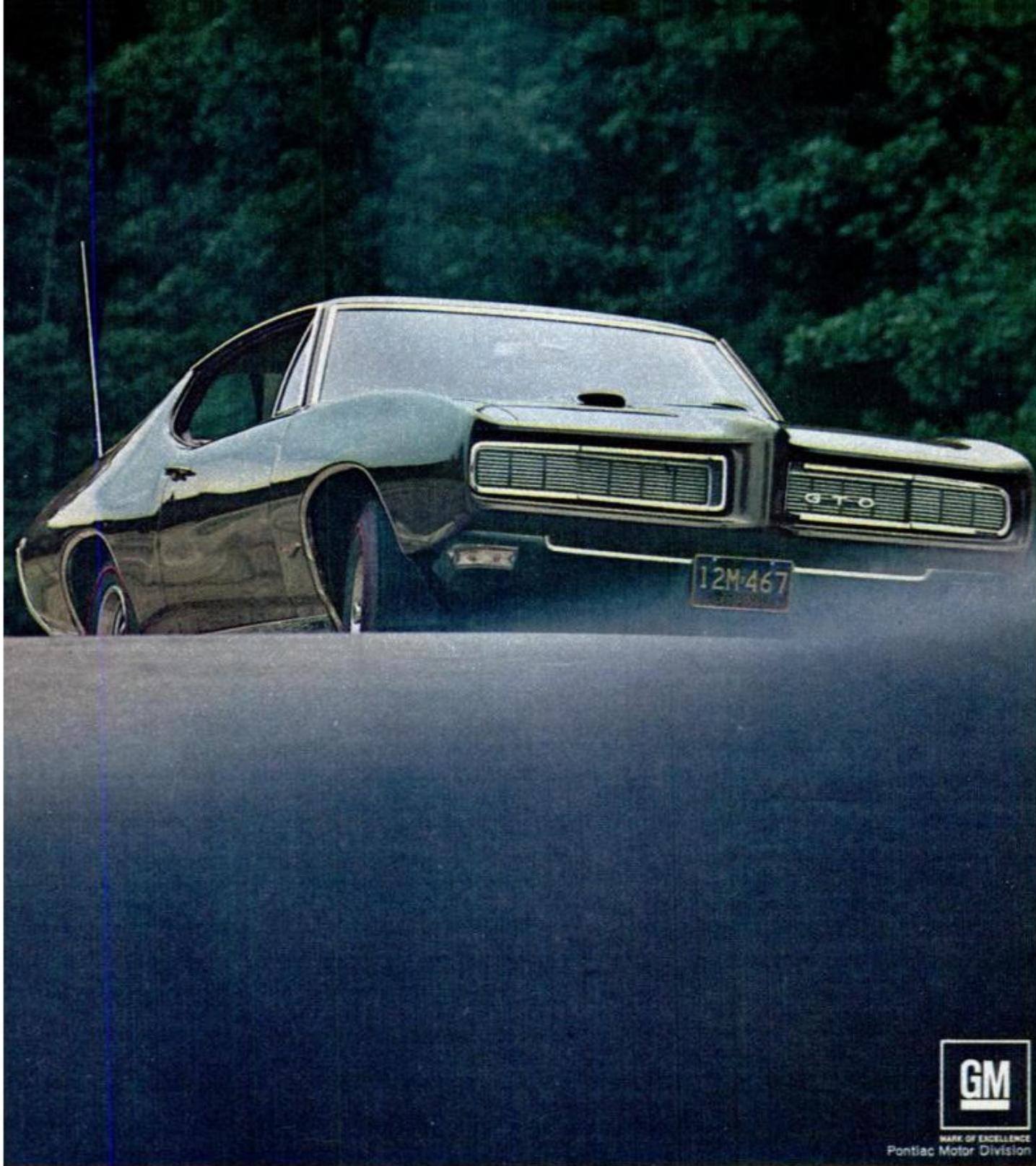
The Mallory Sonalert emits a piercing tone when connected to a 6 to 28-v.d.c. source. It is rated for operation up to 130°, but this conservative figure was exceeded with no difficulty in oven tests. The Sonalert could be insulated in the case for extra insurance, however. ★★★

PARTS LIST

- B**—14-v. mercury battery (Mallory RM-411 or equiv.)
- R**—150-ohm, 1/2-watt resistor
- 1**—S.p.s.t. slide switch (Allied Radio 56E3853 or equiv.)
- SCR**—Silicon-controlled rectifier (GE C106F2 or equiv.)
- 1**—Mallory "Sonalert" Type SC628 (Allied 60E8983 or equiv.)
- 1**—135° detector switch (Lafayette Radio 14H8202 or equiv.)
- Misc.**—Plastic meter case (approx. 2x3x4 in.) and cover, battery holder, solder

SCHEMATIC DRAWING 'TAKE ABOUT' FIRE ALARM





MARK OF EXCELLENCE
Pontiac Motor Division

The GTO's new bumper is so fantastic you can't even see it.

It seems that everything our engineers touch turns to great. Last year, they made wipers disappear. This year, the most unique bumper since the invention of the bumper.

In constructing this super-snout, they begin with a sheet of heavy stamped metal. Then, a new micro-cellular urethane foam—a substance that's more than rubber, but not quite plastic—is bonded

to the metal. And finally, the bumper is coated with a special resilient paint.

The result? A bumper that not only is color-keyed to the car, but also resists minor chipping, peeling and corrosion. There are, however, some people who have to kick the bumper before they'll believe it. If you're one of these, go ahead. Kick the bumper. When you find it.

Specs, decals and 5 color pictures are yours for 30c (50c outside U.S.A.). Send to: '68 Wide-Tracks, P.O. Box 888H, 196 Wide-Track Blvd., Pontiac, Michigan 48056

HOW TO SELL YOUR INVENTION

(Continued from page 122)

numbered your host with a long, undocumented dissertation on how rusting could be reversed by plugging the car into a 110-volt outlet. Address queries to:

New Devices Section, General Motors Corp., General Motors Technical Center, Warren, Mich. 48090.

Engineering Improvements Committee, Chrysler Corp., Box 1118, Detroit, Mich. 48231.

Chief Engineer, American Motors Corp., 14250 Plymouth Rd., Detroit, Mich. 48232.

Office of the General Counsel, Ford Motor Co., The American Rd., Dearborn, Mich. 48121.

We knew one inventor who was a draftsman by trade, but spent each vacation in Detroit trying to interest automakers in a suspension system that he claimed would cause a car to lean into rather than away from a turn. He finally progressed from drawings to actually installing the system in a car. It worked after a fashion; the car would go around curves like blazes but became uncontrollable at over 30 mph on the straight. The mechanism was complex enough to cost many hundreds of dollars, even in mass production, and its bulk caused the test vehicle to tower over its contemporaries. The principle worked, he kept repeating to everyone who would listen: "Detroit can iron out the bugs." As far as we know he still spends his vacations there, probably as happily as if he were in Miami.

Another impossible obstacle to a sale is anything that requires a drastic shift in driving habits. A fellow from Chicago devised an arrangement whereby if you pressed forward on a centrally hinged pedal, the car would go, and if you pressed backwards with your heel, it would stop. He was capitalized well enough to equip a fleet of demonstrators and brought them to Detroit where they were accepted for testing. One by one, though, the test drivers encountered an emergency and reacted by jamming their foot down on a non-existent, conventional brake pedal. One by one, the demonstrators were returned with the comment that the public could not be expected to cope with such a radical change in controls.

Many years ago, practically all automotive innovations stemmed from the lone inventor. This is not to say, though, that resistance was not encountered then as now. A man in Buffalo invented the vacuum-operated windshield wiper and pounded in vain for months on the doors of the carmakers. Finally, in despair, he

sold the patent for \$1500 to a syndicate of three theater owners in his hometown. Thus came the name Trico and the foundation of the industry. And there were success stories, too. Former racing great Peter DePaolo credits his 1925 Indianapolis win to a man named Al Redmond, who came to the garage door the night before the race and talked Pete into using a then-revolutionary mechanical fuel pump. Up until Redmond showed up, passenger cars were equipped with pesky vacuum tanks and race cars relied on pressure pumped up by the riding mechanic. This pump, thanks to the publicity resulting from the race, soon became and still is standard on all cars and made Redmond a millionaire many times over.

Detroit can be sold. Chrysler's safety rim wheel, a vacuum-assisted transmission used by Chevrolet a few years back, the basic current design for the impact-absorbing steering column, and ceramic-coated exhaust systems are all ideas first proposed by either lone inventors or very small companies that were ultimately put into mass production.

Other approaches to a sale

Many times it is advisable for the inventor first to approach a supplier. For example, you would probably get a quicker reading on an idea to simplify, say, the speedometer from a maker of these devices than from a carmaker. This way, if you could figure out how to save 50 cents an instrument, both of you would be heroes. That's exactly what Al Redmond did with his fuel pump. He went to AC, not a carmaker. AC did the selling.

Still another method of gaining acceptance indirectly has been practiced for years with modest success by inventor Frank Brisko. Frank, another ex-Indy driver, has developed a string of items such as fuel-pressure regulators, automatic-choke heaters and smog-valve filters. He launches them on the aftermarket via mail-order. Soon they are picked up by national parts jobbers and even the auto companies' own supply systems. So far none has become original equipment on a car, and reasons for this should be of interest to every inventor. All of Brisko's items have been either add-ons or more expensive replacements for an original part. They do a *better* job, but Frank has found from bitter experience that Detroit is interested in an *adequate* job. Beyond this level of performance, every dime added to the car, particularly when it can't be seen, is scrutinized and, more often than not, rejected by top management.

Brisko has found this attitude not to be

(Please turn to page 192)



**Your wife drives it 50 miles to the hairdresser's and back.
Is she a truck driver?**

When it comes to work, the truck-framed, truck-powered, truck-tough INTERNATIONAL® pickup is second to none. And never has been.

But the new INTERNATIONAL pickup is even more now. Works as a "car" too, because we made it easy and fun to drive.

We took the crank out of the

steering wheel. It's so easy, you may discover you don't even need our power steering. And we took the stomp out of the clutch. But you may want our smooth automatic transmission anyway.

We also offer you handsome interiors with bucket seats, stereo, carpeting and air conditioning. A sporty touch of extra

chrome here and there. You can hardly blame your wife for loving it.

If you can live with all that comfort, you've got yourself more than just a tough pickup. You've got a new kind of "car."

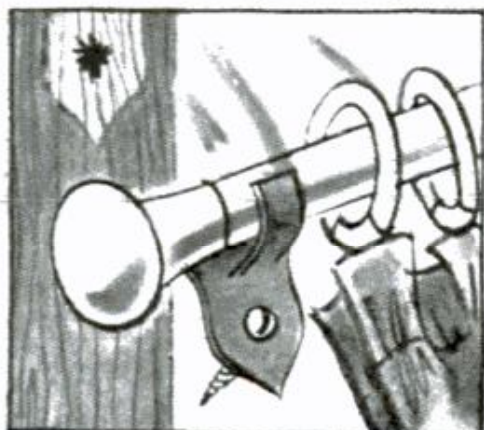
IH INTERNATIONAL HARVESTER COMPANY
Chicago, Illinois 60611

**The New International Pickup.
Don't call it a truck.**

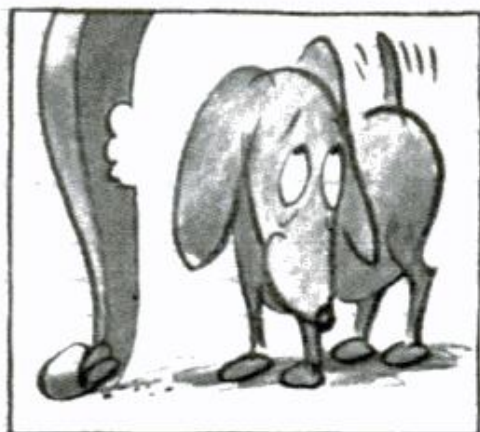
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Your five-year-old banged a hole in the floor?



The curtain rod came crashing down?



Pup chewed on the table?

Fix it with the
genuine **PLASTIC WOOD**.®
Looks and lasts like real wood.



Handles like putty—comes in 5 colors.

POWER BRAKES

(Continued from page 135)

for disassembling a typical assist unit in the accompanying photos.

Here are a few tips that will keep your power-assist unit, and brakes in general, in good operational shape for thousands of miles after you've rebuilt or replaced the booster.

- Refill your entire braking system with high-quality hydraulic brake fluid every year or two. This will get rid of any dirt that has worked its way into the system.

- Bleed the brake system periodically to get rid of built-up air which can cause a spongy brake pedal. Bleed the power-assist unit first. If the unit doesn't have a bleeder valve, loosen the hydraulic line fitting at the master cylinder, pump the brake pedal a few times and reattach the line.

- Adjust your brakes often to cut down on the amount of movement inside the power-assist unit, thereby reducing the amount of wear.

- Keep a check on the vacuum line from manifold to booster. Make sure it's tight and in good shape.

- Keep your engine tuned up to assure sufficient vacuum for the assist unit.

- Make sure the power-assist unit is firmly attached to its base in the firewall and the brake-pedal push rod is properly adjusted. Pedal free play should be adjusted for $\frac{3}{4}$ to 1 inch.

- Never "ride" your brake pedal, whether or not it is power-assisted. ★★★

HOW TO SELL YOUR INVENTION

(Continued from page 190)

exclusive to carmakers. It would seem logical to sell the smog-valve filter, which extends valve life (in some cases indefinitely), through gas stations, but when he tried it everyone from the station manager on up would have no part of the scheme. "We don't want to jeopardize our valve-service business," they said.

The invention with the most chance of success is one that will cost less or at least the same as the part it replaces. It will not threaten any sacred cows, such as obsoleting heavy existing investments in plants and tooling. If it performs a new function, this function must be important and useful enough to sell more cars and thus pay for itself. And lastly, it should be in tempo with the times which at the moment means safety and not speed equipment. Good luck! There're millions in it if you can figure a way to buck the 32,000-to-3 odds. ★★★



Stands up as a tough truck. Stands out as a second car.

Camper Special models.



Roomiest, quietest cab in any pickup.



Twin-I-Beam; stronger, smoother riding.

New V-8's under the hood—up to 390 cu. in.

Convenient one-hand tailgate.

Secret is Ford's unique suspensions: Twin-I-Beam in front, with two forged I-Beam axles that work independently to smooth the ride. In rear: New Flex-O-Matic that automatically adjusts spring stiffness to load. Both features are standard on F-250 and F-100 with heavy-duty springs. Together they make Ford pick-

ups ride like cars with no compromise of big-truck durability. Other better ideas for the asking: front power disc brakes, SelectAire Conditioner, bucket seats, V-8's up to 390 cu. in. Drive one soon!



...has a better idea!

all-new Seasport II is quality in depth ...16 feet in length!*



We could have offered instrumentation as an accessory, instead of making it standard: tach, speedometer, ammeter, fuel gauge, heat and oil warning lights—plus control switches, a cigaret lighter and electric horn. Plus a new indicator that shows drive direction before you start. But we didn't.

We could have given you no power choice instead of two Johnson-dependables: 155 hp V-6 or 120 hp 4-cycle 4-in-line—each with electric power tilt, 90° steering arc and one-hand Electramatic throttle and shift control. But we didn't.

We could have foregone wall-to-wall cockpit carpeting that's fungus and water resistant. But we didn't.

We could have screwed our 3-position bucket seats to the floor instead of using bolts plus special gripper nuts. But we didn't.

We could have saved by eliminating all that storage space in bow, side and rear seat compartments, or by not padding side and glove compartments for your valuables. But we didn't.

We could have devised a conventional floor plan for a conventional hull, instead of our square, open bow that helps provide 57 sq. ft. of room for 6 people in our open-deck Seasport II. But we didn't.



*Actually, 16'-2" center line

We could have supplied plated, screwed-on deck hardware as optional equipment, instead of including all deck hardware of non-corrosive alloy, through-bolted, as standard equipment. But we didn't.

We could have skimped on flotation, instead of pressure-packing every cranny below deck with more than enough to keep a boat full of water and people afloat. But we didn't.



We could have settled for a plastic windshield instead of specifying tempered, tinted safety glass in heavy die-cast aluminum brackets bolted to the deck with hinged center section for access to bow. But we didn't.



We could have offered our convertible top and front tonneau cover as optional instead of standard equipment, neatly stowed to protect against dirt and damage. But we didn't.



We could have designed a conventional pointed-nosed hull instead of our Sea-Foil hull with its twin-arch contours that put water to work for our soft, smooth, level, dry ride. But we didn't.

We could have put a lot less built-in value into our Johnson Boats—especially since many of those built-in values don't even show. **But we didn't!**

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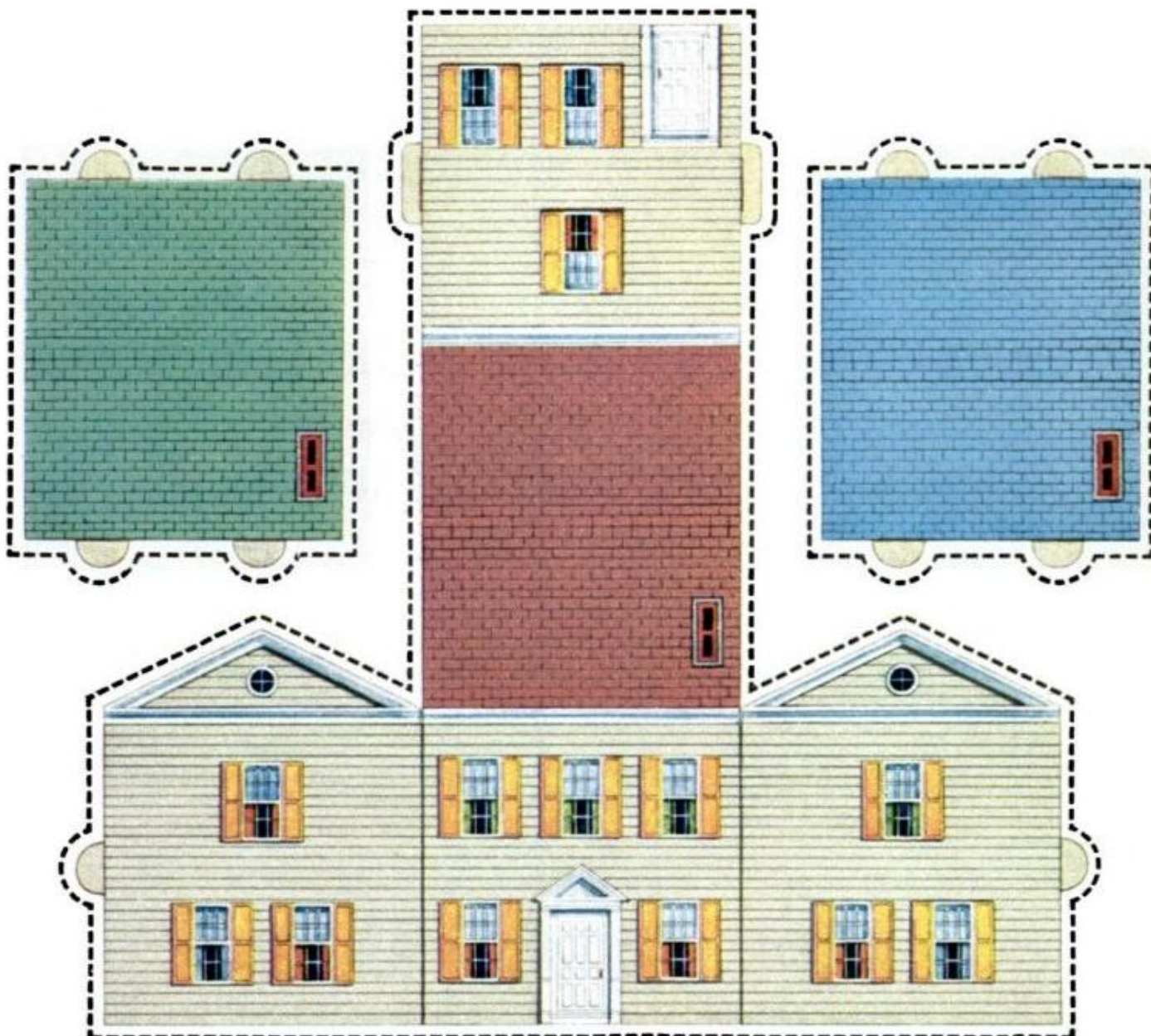
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CHEVROLET ***Job Tamer*** pickups

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GURNEY TESTS THE NEW AMX

(Continued from page 43)

some hard laps on the flat road course and tried several successive stops on the extra-long strip. Each time I shut down straight and the car stopped amazingly well. Those hard road course laps also revealed commendable all-around manners and handling qualities. The AMX handles "flat," as race drivers say. It's a nice, light-feeling car that seems to do things rather effortlessly.

Much of the battle in the car-selling game is styling, however, and it should be interesting to see the general reaction to the looks of the AMX. As I already mentioned, it made a good impression on me, but it's a little different—and *very* different from anything we've seen before from American Motors (as is their Javelin).

When the AMX was little more than a rumor outside American, speculation had it that a Corvette competitor was on the way. The AMX isn't the same approach at all, and the two-passenger theme shouldn't be misunderstood. For one thing, the AMX carries a lower price, which should be one of its most popular features. And although some people probably will wind up referring to it as a sports car, American's own description—"two-passenger sports coupe"—hits the nail on the head. Some of the styling features that I particularly liked were the overall exterior configuration, the seats, and the dashboard.

Seats are often the most disappointing part of a car to me. I seldom find them in the position of slight incline that I prefer. Particularly in the lighter cars, seats seem to consist of three or four large springs lightly covered in vinyl. The AMX seats were genuinely comfortable, however, both in standard position and quality of construction. I liked the dash because it is simple and straightforward and doesn't interfere with either day or night visibility.

I'm not crazy about the hood-styling gimmick, incorporating twin V-shaped hood blisters. And when we hit some rough roads the car seemed to develop more rattles and noise than you might care for. But that's about the extent of the undesirable aspects I observed—a much shorter list than usually is the case.

One thing that I feel sure contributed

(Please turn to page 199)



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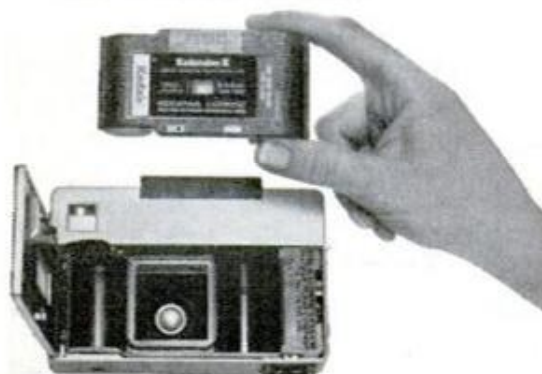
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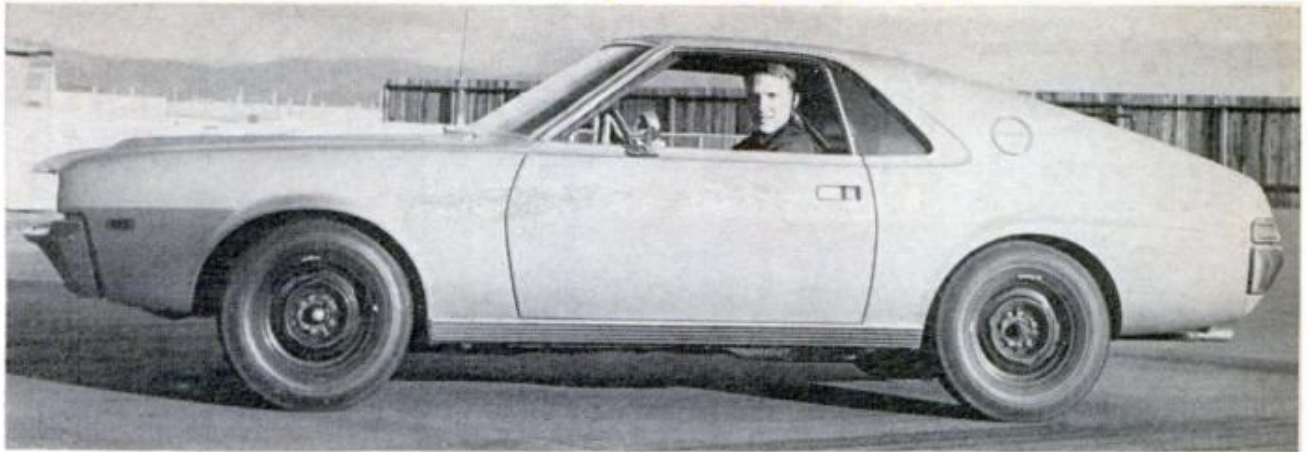
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AMX APPEARS SMALL, is actually quite roomy. I had no trouble with cramped quarters or getting in and out

a bit to the AMX's good handling qualities was the type tire used—a new fiber-glass-belted tire. I understand that a number of the tire companies are beginning to make this type tire now and I feel it adds much to safety and performance.

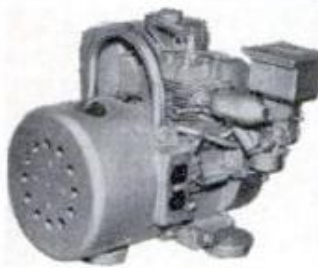
American rates the optional top-power 390 engine at 315 hp at 4600 rpm. Torque rating is 425 at 3200. A 343-cu.-in. engine, with less bore and stroke, produces 280 hp at 4800, and 365 torque at 3000. The standard engine is a 225-hp, 290-cu.-in.

V8. Compression ratios are at least 10 to 1 and premium fuel is recommended.

Although to me the AMX appears even smaller than the 97-in. wheelbase, 177-in. length and 71.6-in. width might suggest, I was not cramped and had no trouble getting in and out. (Editor's note: Dan is 6-2, 196 pounds.)

The AMX, being introduced this month, sells for \$3245. I figure it to be a mover—both for the dealers and the guy who winds up behind the wheel. ★★★

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CHEVELLE OWNERS REPORT

(Continued from page 100)

side windows too wide." He "can't see when backing or driving out into traffic." The same roof panel brings a comment of "poor rear passenger side vision" from an Ohio housewife. And an Illinois cab driver finds "the rear deck too low." When backing up, he "can't see the rear of the car, making it difficult to park."

Except for the visibility complaints, owners find parking a snap due to Chevelle size and handling characteristics. A rural mail carrier from Illinois, who got a Chevelle only because he was "talked into it by (his) family," seems to find his car is a lot more than he expected. His praise of handling is unqualified: He likes "ease of handling in traffic, roadability on dirt and gravel roads and ease of parking in cities."

A California farmer sounds as if he's chased a few rabbits through the lettuce patch from his enthusiastic comment on his Chevelle's "snappy response and nimble handling." Another farmer, from Ohio in this case, after praising the "ride" of his car, does, however, lament the fact that he didn't order power steering: "We've got power steering on our pickup truck and on all our tractors and it really makes a difference."

A dialogue between owners who are pro and con about the workmanship and economy of their Chevelle would be a heated one. Although low gas mileage was a top complaint, the mileage averages are reasonable to expect from engines of 307, 327 and 396-cu.-in. displacement. Owners with the 327 engine, as the figures in the summary chart indicate, are going a little farther on a gallon than owners with the 307—a fact that has to be explained by the all-important factor in fuel economy: the driver.

An electronics technician in Iowa has a simple message for petrol-poor owners who will have to resign themselves to the facts of motoring life: "I can't think of any complaints except maybe I would like a little better gas mileage, but you can't have performance and economy, too."

When it comes to workmanship—paint defects and loose or missing screws were mentioned most often—I wouldn't like to be around to see what would be a knock-down, drag-out fight between the disgruntled Kentucky maintenance man who says his Chevelle "needs a new body," and the ecstatic Pennsylvania forklift driver who's owned Chevys since 1931 and exclaims that this year's is the best one yet!

► **May they never cross paths.**

★★★

The start of the finish.



You turn your ignition key in the morning.

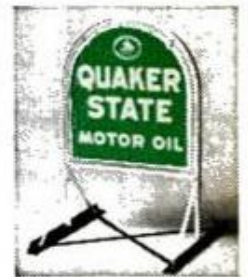
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HANDY LITTLE HONDA

(Continued from page 90)

old, makes only automobiles—the N600 and N360, plus a few \$2000 S800 sports cars. According to our host, plant manager Shigeru Shinomiya, who had decorated his conference room with tiny American, Canadian and French flags in honor of his three foreign visitors, there is a big demand for S800s in Europe, but Honda is “too busy to make them.”

Honda makes its motorcycles in two other factories: little ones at Suzuka, big ones at Hamamatsu, motorcycle capital of the world, home also of Suzuki and Yamaha. Mr. Shinomiya said the Sayama plant is essentially a “laboratory,” and that if the N600 really takes off, production will be shifted to Suzuka. Sayama, though small by Detroit standards, is extremely modern and automated. Honda makes its own machine tools here for all of its factories, a fact of which the company is understandably proud.

Another thing it brags about is the youthfulness of the work force. Average age of Sayama's 4000 workers is 24. They may not all be hot-rodders, but it's obvious they *like* building cars. It's a cinch their morale didn't suffer when John Surtees drove Honda's 12-cylinder Formula I race car to victory in the Italian Grand Prix last fall.

With its tiny two cylinders, the N600 is no race car, but it goes faster than anything you can buy on four wheels for \$1275. If you *want* a car this small, this is a good one—fine for driving to work or to school, to supermarket or station. ★★★

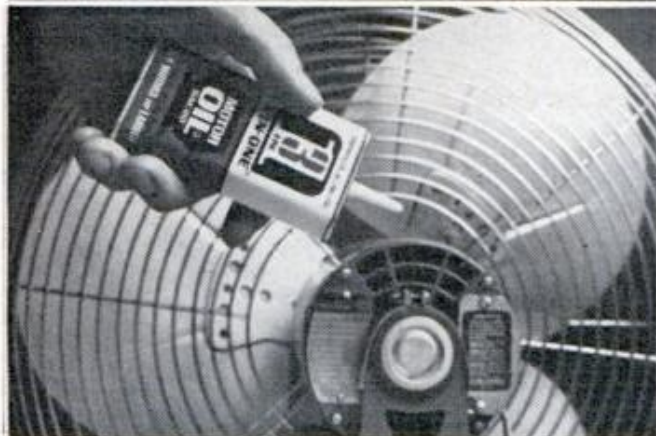
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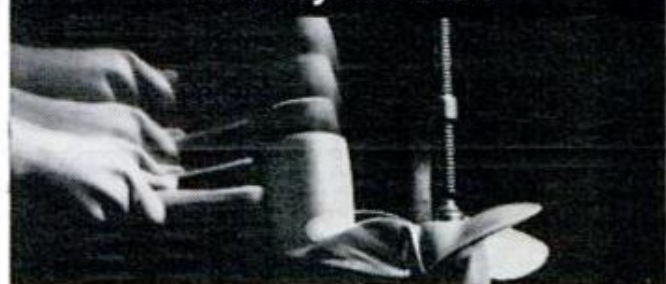
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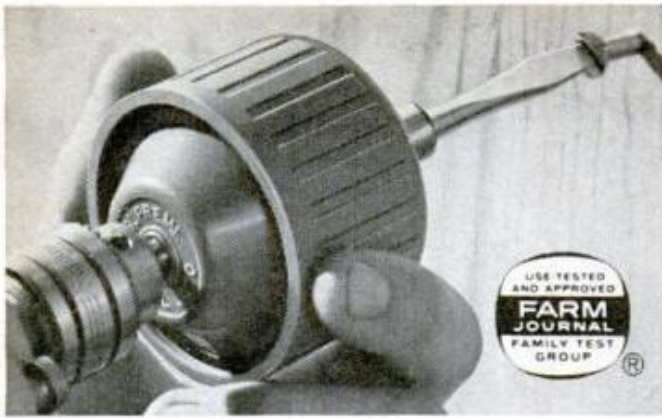
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THREE WEEKEND PROJECTS

(Continued from page 138)

the slotted brackets hacksawed to form open-end slots. The pivot parts are screwed to the ends of the bassinet to engage the slotted parts of the guards which are screwed to the posts. To remove the bassinet, you merely lift it out of the slots.

The ends of the bassinet are cut from 1/2-in. plywood, the bottom from 1/4-in. Note how quarter-round molding is used to provide a rabbet all around for the bottom. While a drill press makes quick work of drilling holes for the dowel spindles, you can do this with a portable electric drill aided by a simple jig. This can be a U-shape block of wood with a hole in it which is made to straddle the rail and held with a C-clamp. With a witness mark on the side of the block to align with hole-spacing marks on the rail, and a depth guide on the drill, you'll have no trouble drilling holes, all at right angles.

The projecting ears at the ends of the bassinet, to which the pivot hardware is attached, are made from three pieces of 1/2-in. plywood. These are doweled and glued together, then crossspinned and glued to each end of the bassinet.

After sandpapering all parts smoothly, give the wood three coats of orange or white shellac thinned 50 percent with denatured alcohol. Rub each coat lightly when dry with 00 steel wool and finish with a coat of paste wax.—*Erich K. Erdt*

LIFTED FROM STAND, cradle serves as handy bassinet when infant must go along with mom in the car



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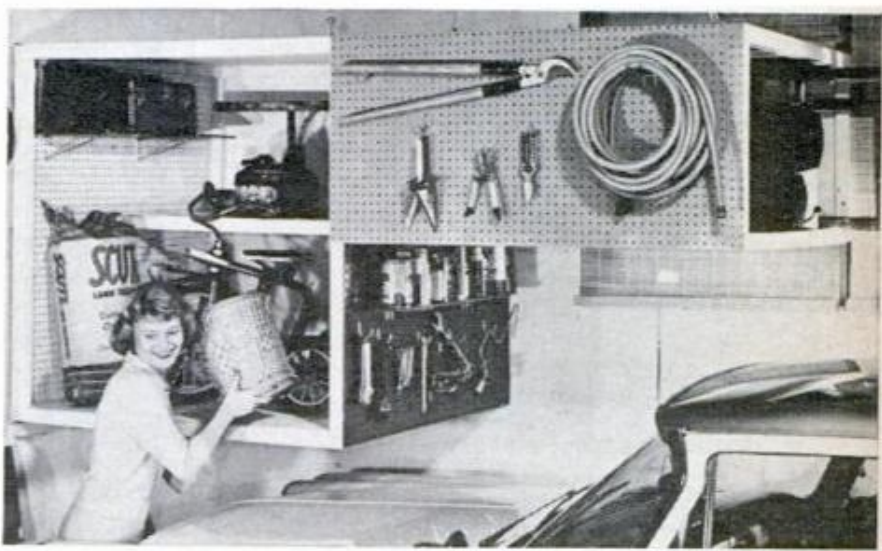
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HOLOGRAPHY: 3D MAGIC

(Continued from page 107)

a dark area. The result is a series of tiny light and dark lines known as an interference pattern—those meaningless streaks and blobs.

Since a particular object will scatter light in a particular way, the interference pattern produced by any given subject represents the code pattern for that subject. When the developed hologram is illuminated by a laser beam, the thousands of microscopic lines on the film bend the light rays into the same pattern as that reflected by the original object, creating an identical image.

All of picture in focus

Besides their spectacular three-dimensional qualities, holograms exhibit some other unusual characteristics. Because they record light waves instead of an image produced by a lens, every part of the picture is sharp and in focus, no matter how far away each area is from the film plane.

In addition, each point of a subject is recorded equally over the entire hologram—that is, any portion of a hologram contains all the code information needed to reproduce a complete image of the subject. You can cut a hologram in half or in quarters and each piece will show the whole scene. As the pieces get smaller and smaller, the image gets less distinct, but you still see the full picture.

The first hologram was made some 20 years ago when Dennis Gabor, a physicist at London's Imperial College of Science and Technology, attempted to photograph the interference pattern produced by reflected light from a mercury-vapor lamp. The system worked but didn't seem to hold much promise because the mercury beam lacked the intensity and coherence—its waves didn't match precisely crest to crest and trough to trough—required to produce successful interference patterns.

Laser launches new studies

The coming of the laser—a brilliant, intense, highly coherent beam—opened the way for full-scale exploration into the fascinating possibilities of holography. Today, laboratories all over the country are working on exotic applications of the magical phenomenon, and new developments are coming thick and fast.

Colored holograms have been made by Bell Telephone physicists using three laser beams in the three primary colors—red, blue and yellow. Each color produces its own characteristic interference pattern depending on the color of the subject.

When the hologram is illuminated by the same three beams, the three interference patterns create three images perfectly superimposed to produce a colored picture matching the original subject.

A way has also been found to view holograms in ordinary white light, eliminating the need for an expensive laser. The trouble with ordinary light is that it contains many different wavelengths all mixed up, while a laser consists of "pure" waves all the same length.

To solve the problem, the interference pattern is recorded on the film in a series of layers throughout the emulsion instead of just on the surface. When you shine a white light through the developed film, the overlapping layers block out all the unwanted wavelengths. Only those matching the original laser's frequency get through. These reproduce the 3D image just as if a laser of the same frequency had been used.

You don't even need an actual object to make a hologram. Since the image is merely a code, it's possible to generate such a code artificially without having any subject to start with. Using a computer, researchers at General Motors have already succeeded in plotting the interference patterns for simple shapes like a square and letters of the alphabet. When the resulting hologram is viewed, the shapes show up as if they were real—even though they never existed. Using this technique, it eventually may be possible to visualize what a complex design will look like long before it's actually constructed.

Sees things X-rays miss

Perhaps the weirdest development so far is the creation of holograms with sound waves instead of light. This has been done by physicists at Bendix using two underwater ultrasonic generators. One generator beams its high-pitched sound waves at an object under the water, while the other generator is aimed directly at the water's surface. The waves that bounce off the object meet the direct waves at the surface and clash, producing an interference pattern in the form of thousands of tiny ripples. When the water is illuminated by a laser beam, the ripples form a 3D image of the object just like a hologram made by light.

The big advantage of sonic holograms is that they make it possible to take pictures of things you can't see and things that don't show up on X-rays. Soon, it is hoped, doctors may be able to study 3D images of your heart or liver without ever touching a scalpel. Thus, in this fantastic world of holography, the surface is just beginning to be scratched. ★★★

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MY FIRST YEAR IN BOATING

(Continued from page 159)

Deep water has its difficulties too, though. One weekend I made tentative plans to meet some friends at Fair Harbor, a summer colony near the western end of Fire Island about 25 miles from where I moor the boat. With a guest aboard, I started out the afternoon before, running down through the channel and into Great South Bay where we anchored off the island shore for the night.

The next morning the weather was breezy, but beautiful. According to the marine forecast on my transistor radio, the wind was 15 knots out of the west, the direction we planned to travel.

We headed for the marked channel out in the middle of Great South Bay, but as the water got deeper, the waves got higher. The boat was pitching a lot and three-foot waves were breaking over the bow. While nothing really terrible was happening, my boat seemed a little too small for those waves so I decided to change course, quarter across the waves, and head for the other side of the bay.

The motor was in good form that day. With the throttle at half speed, it droned steadily along as I twisted the wheel to

keep the bow pointed at the best angle to the buffeting waves. I knew exactly what I was doing and this made me feel pretty good, especially when I remembered my nervousness about little things at the beginning of the season.

We covered the four miles across the bay in about three quarters of an hour, then anchored in the lee of a point until the breeze moderated somewhat. I didn't make it to Fair Harbor, but I didn't mind too much. Somehow, the day had turned out to be quite rewarding.

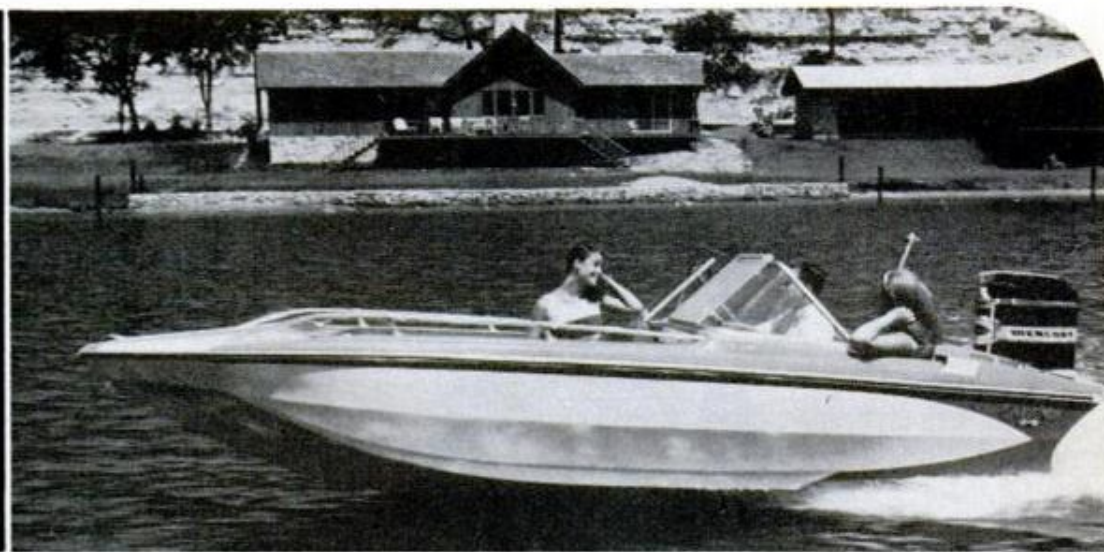
Last summer, I got over wondering if I'd made a mistake in buying the boat. I'm satisfied, for the time being at least.

I'll put a little more work and money into it this year, but I don't think I'll ever develop a deep attachment to this first boat. This one is strictly for experience, something for getting out on the water so I can see what boat I really want. ★★★

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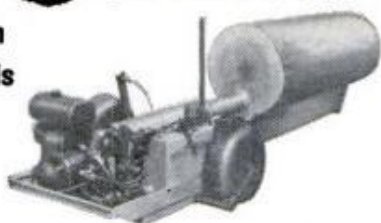


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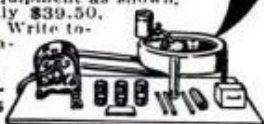
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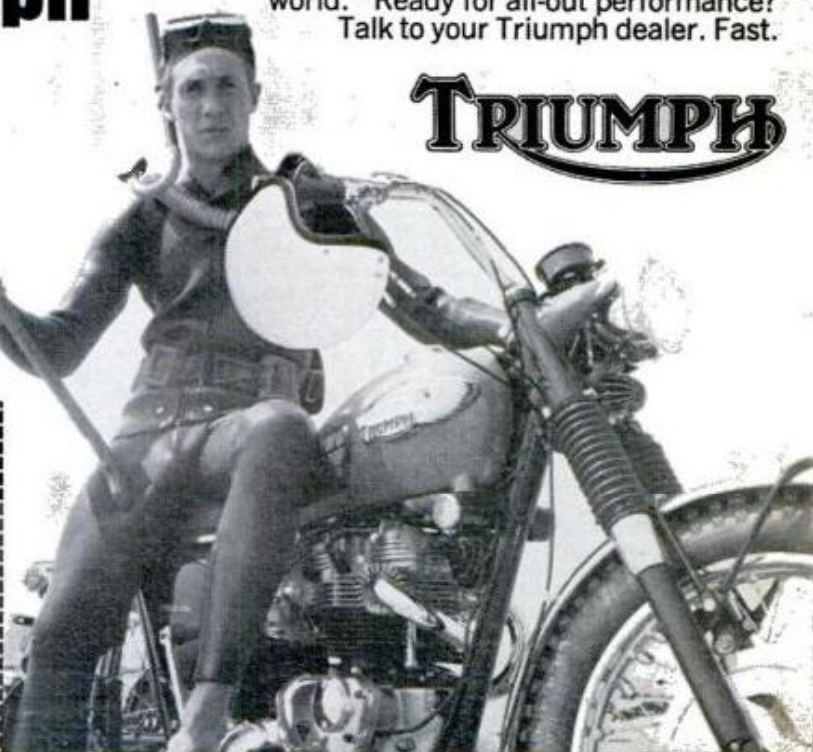
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THE SEABEES SWARM AGAIN!

(Continued from page 58)

welding, plumbing or concrete finishing.

This gives you an idea of the qualifications you would need if you wanted to get into the Seabees. First, you join the Navy and request Seabee duty. If you qualify and if there's a need for Seabees at the time, your chances of being assigned are quite good. As of this writing, the number of Seabees has reached the Navy's currently required level. What that need will be a couple of months from now is something only the Navy can tell you.

Every Seabee outfit has one doctor, one dentist, two dental technicians and eight corpsmen. Their primary job is the medical well-being of the battalion.

But health of Americans doesn't seem to be a problem. So, each MCB in Vietnam has set up a clinic to care for the Vietnamese who come from miles around.

The type of job these men are doing is exemplified by the actions of Dr. (Lt.) Harvey M. Henry, who was assigned to MCB 9 at Da Nang. While in the unit hospital that the men of the battalion built for him last October, he heard bursts of rifle and machine-gun fire and demolition charges. The VC were attacking.

In an hour, the battalion took some 90 casualties. As the hospital was literally coming down around his ears, Henry hopped from one wounded man to another. Two eventually died, but the rest recovered. The credit for that goes to Henry.

How did he feel under attack?

"I knew the Vietcong were making a shooting gallery of the place," Henry recalls. "How could I miss that? Casualties I was getting weren't kicked by goldfish.

"But I swear I didn't know how bad the hospital was beat up until everything was done. I don't know, maybe I'd have ducked under something if I had realized what a pasting it was getting. But I was busy."

Once Vietnam ends, what will become of the Seabees? Probably what happened after World War II and Korea. They will be doing unpublicized jobs around the world.

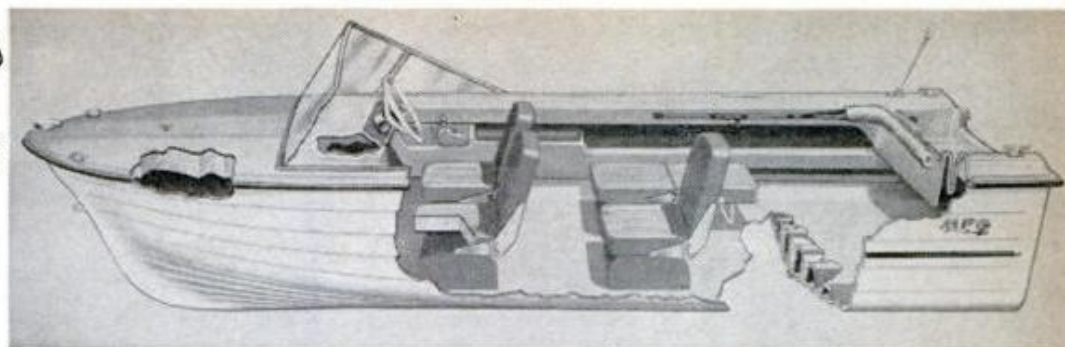
Before Vietnam, Seabees played a unique people-to-people role when requested by the State Department. They took part in earthquake recovery operations in Chile; they built roads through African jungles; they taught construction techniques to natives from Costa Rica to India; they built and still run a nuclear power plant at McMurdo in the Antarctic.

Publicity, though, doesn't concern the Seabees. They don't give a hoot about it. All they're concerned with is living up to the motto made famous in World War II:

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PM-38

HOW TO BUY A HOUSE

(Continued from page 127)

"The living room is as bad as Grand Central Station."

We know another woman whose biggest complaint is her laundry, located in the basement. She must make repeated trips down and back to start the wash, answer the buzzer, transfer clothes to the dryer, and so on. Never again will she have a house with a laundry that far away from the kitchen.

And we know a woman who craves another house because her present one lacks a "mud room." Particularly during bad weather, her children track in dust, dirt and mud over freshly cleaned floors. A mud room would permit the kids to get off their rubbers or boots before walking through the rest of the house.

Actually, it's not necessarily the lack of a mud room, per se, that causes the trouble. It's a bad floor plan that requires children (and everybody else) to pass through various rooms before they can shed dirty things and clean up.

Clearly, the way to avoid a garbled plan is to know what constitutes good interior design. Start with the basic floor plan and see how well (or not so well) its circulation will work for your family. The main traffic routes—the paths your family will use every day—are the key to judging any house plan.

Six tests for good circulation

1. *The main entrance*, the front door, should funnel people directly to the living room. An entrance foyer is highly recommended for receiving guests. A coat closet is virtually essential nearby. The main entrance should be quickly and easily accessible from the driveway and street. It also should be accessible from the rooms where you are likely to be when the doorbell rings, especially the kitchen. A foyer is also important as a buffer or transfer chamber to keep winds, snow and rain from blowing into the heart of a house every time someone opens the door.

2. *A separate family entrance*, ordinarily a back or side door, should lead directly into the kitchen area. This is important to permit unloading of groceries. It also should be located so that children can travel in and out easily and quickly. The route from the car to this entrance should be sheltered from rain and from snow and ice.

3. *The living room* should have a dead-end location. It should not be a main route for travel around the house. Sometimes one wall of the living room serves as a

traffic lane; in effect, it's a hallway. That's all right if it happens to work in a particular house. Sometimes, though, a screen or half-wall may be necessary between it and the heart of the living room.

4. *The room arrangement* should be designed so that you can go from any room to any other without going through a third room, except possibly the dining room. Direct access to a bathroom from any room is particularly important.

5. *The kitchen* should have a central location. It should not be located way out in a left-field corner of the house. In the kitchen, a woman not only should be close to the front door, but she also should be able to oversee children playing in the family room or outside, and she should be able to serve the dining room and living room or guests on the terrace without long trips.

6. *The main travel routes* between the house and the outdoor living areas—patio, terrace or porch—should be short and direct. Can guests, as well as family members, go in and out easily?

Interior zoning

Every house should have three clear-cut zones to accommodate the three main kinds of activities: living, sleeping and working. Each should be separate from the other. The two-story house provides natural zoning between the bedrooms and the rooms downstairs. On the other hand, a garbled split-level house can turn your life into a nightmare if, for example, the living or working zone is split among different levels with no regard for the way people live.

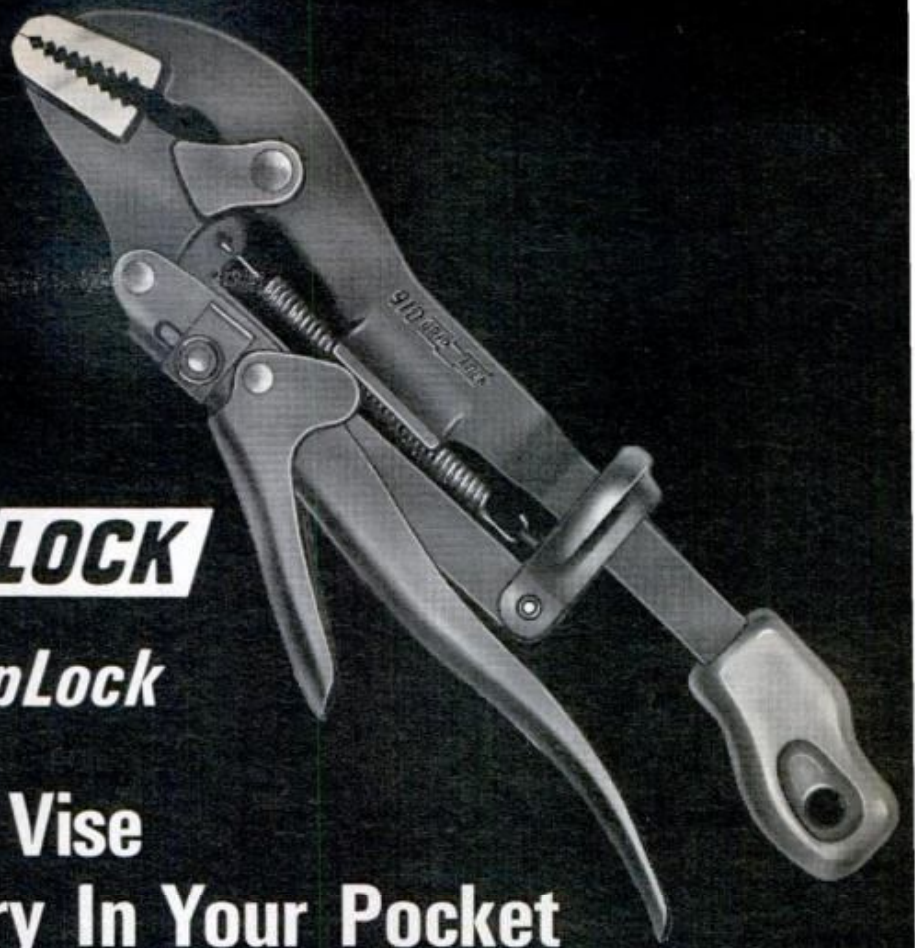
Regardless of the kind of house, a buffer wall, or other such separation, is essential between the bedrooms and the other two zones, if for no other reason than to permit you to entertain guests without disturbing children at study or in bed. The kitchen and work zone should be separate from the living area. Can dishes be left stacked and unwashed there without being seen by guests? Can laundry be left unfinished but out of view when visitors call? The answers should be yes.

Check the kitchen plan

The kitchen deserves top-priority attention. A woman usually spends more work time there than in any other room. The kitchen, more than any other room, also tends to influence resale value of your house.

The heart of a kitchen is its "work triangle"—the arrangement of the refrigerator, sink, and range in relation to each

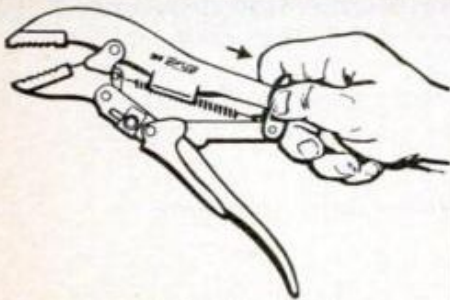
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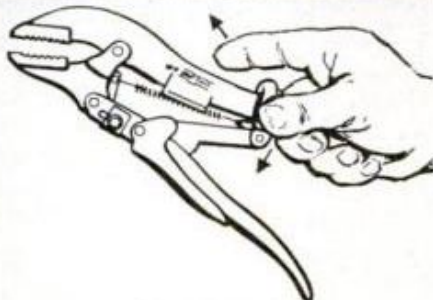
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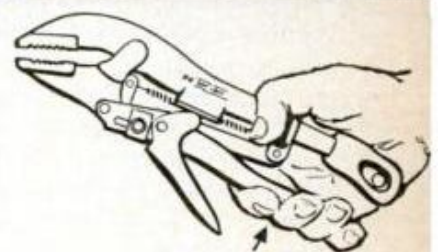
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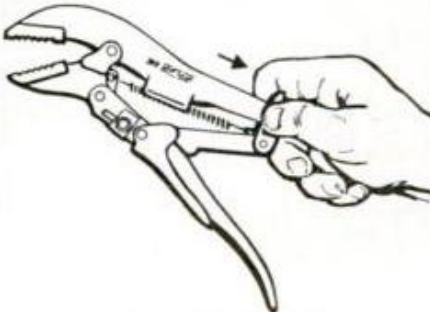
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HOW TO BUY A HOUSE

(Continued from page 214)

other. The entire process of efficiently preparing and cooking food hinges on a good work triangle. The refrigerator to sink to range should form a triangle with a total perimeter of at least 12 to 15 feet and no more than 22 feet, according to research at Cornell University's renowned kitchen laboratory. They should be in that order to conform with the natural sequence of cooking.

Plenty of countertop space around the triangle is a must. The University of Illinois' Small Homes Council recommends these minimum standards: At least 4½ feet of countertop length on the open door side of the refrigerator between the refrigerator and the sink; 3½ to four feet between the sink and range, and at least two feet on the other side of the range. That adds up to a minimum of 10 feet of countertop length.

An additional two feet of countertop is desirable at or near the range as a last-step serving center where food is put on plates. If the refrigerator, sink, or range is separate from the other triangle centers — on a separate wall, for example — extra countertop space should be placed at its side, in addition to minimum standards just given.

Make sure the refrigerator door opens the right way — toward the counter between the refrigerator and sink so food can be conveniently unloaded where you will want it. The wrong-door refrigerator is a common flaw.

Cabinet size and location

According to studies at the University of Illinois, a minimum of 8½ running feet of wall cabinets and or storage shelves is recommended. Another rule calls for at least 20 square feet of interior storage space under the countertop, plus at least 10 square feet in wall cabinets. The proper cabinets and shelves obviously should be located where they can house the items needed in each part of the kitchen.

Appliances are largely a matter of personal preference. Sometimes some or all come with a house, and sometimes not. You should know, however, which ones do or do not come to avoid a misunderstanding.

Stand back and view the overall kitchen. It should be large enough to hold the table size required by your family, or an adequate dining area should be nearby. Some women also like space for a work-desk and perhaps a sewing table. The

(Please turn to page 218)

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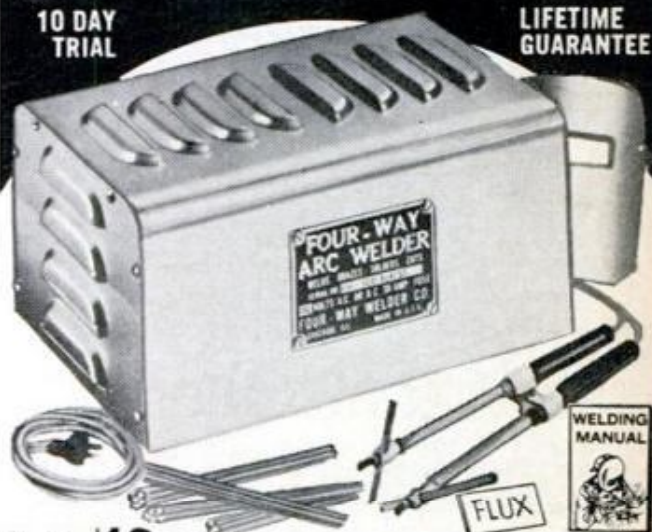
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HOW TO BUY A HOUSE

(Continued from page 216)

laundry also should be nearby, or you may desire space in one part of the kitchen for a washer, dryer and ironing board.

Are electric outlets spaced behind the countertop for convenient use of small appliances? Or else how will you operate a mixer, blender, electric frying pan, toaster and coffeemaker? You'll want good lighting from above, and lights should shed illumination over the full length of the countertop. Finally, there's the need for good ventilation to keep the kitchen (as well as the rest of the house) free of cooking fumes and odors. This means at least a built-in exhaust fan. It should be located in the wall directly behind and above the range or in the ceiling directly over the range. If located elsewhere, its exhaust efficiency will be low. A large range hood with built-in fan is even better.

How about the bathrooms?

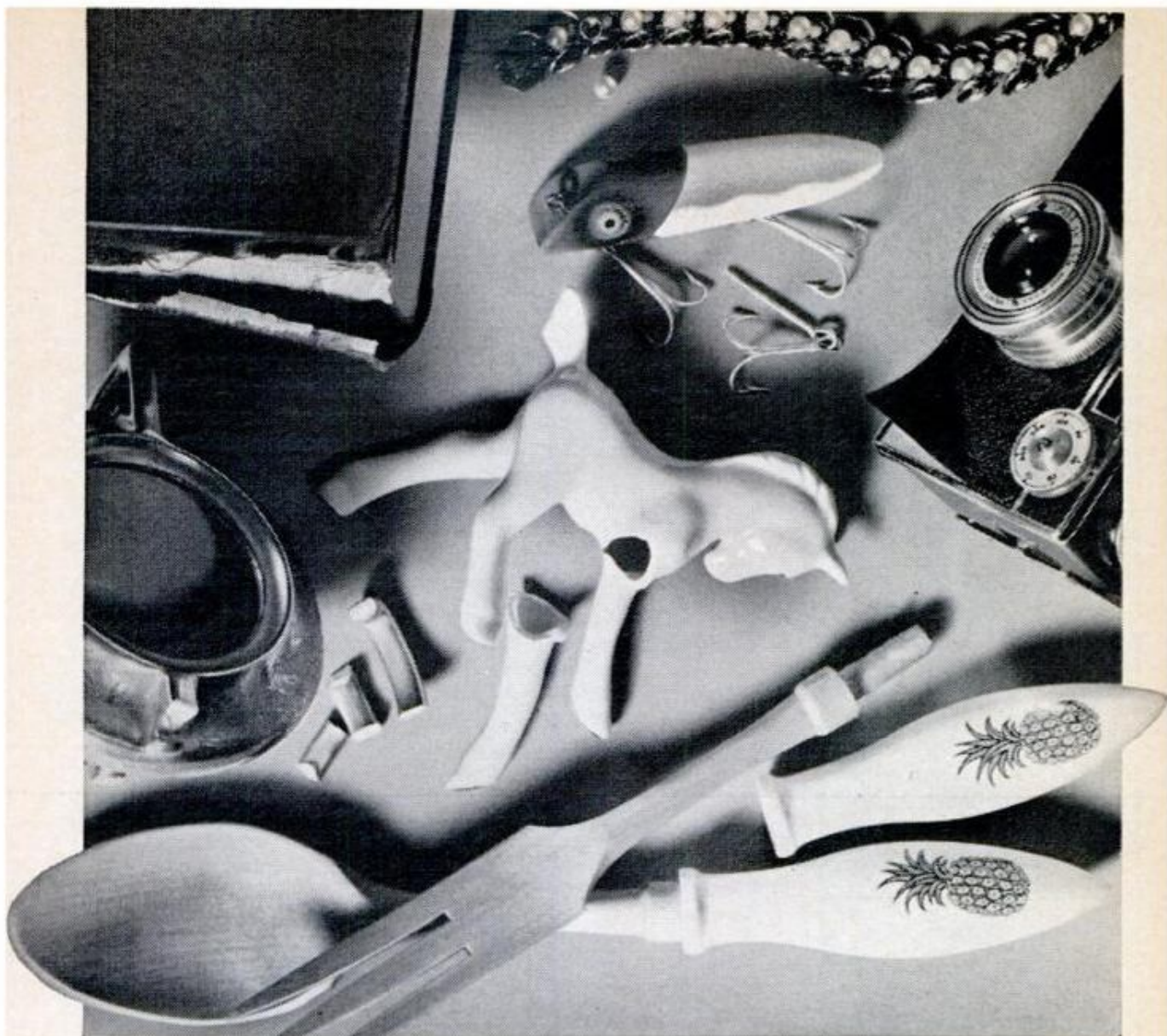
The location of the bathroom(s) is of first importance. There should be one near the bedrooms. If it's the only one in the house, it also should be convenient to other rooms. Two or three bathrooms are usually essential for a large family, especially in a large or multilevel house.

A big-selling feature in new houses is the private bathroom for the master bedroom, but this is not always good design. In a two-bathroom house, it can be better to locate the grown-ups' bathroom outside the master bedroom where it is accessible to guests. Otherwise guests are restricted to using the children's bathroom, which can be an embarrassing mess.

Other rooms

A room should look and "feel" bright, cheerful and pleasant. Properly designed windows can make a huge difference. There should be enough unbroken wall area for furniture placement. Rooms should be large enough to accept your furniture. Good heating and adequate wiring and lighting are also points to check. As for size and location, here are some minimum standards from the Small Homes Council:

- A living room at least 12 by 20 feet, with at least 10 to 12 feet of unbroken wall for a couch.
- A family room of at least 12 by 16, though 12 by 20 is more like it. It should be on the same level as the kitchen, as well as near the kitchen.
- Bedrooms at least 9 by 11½ feet with at least four square feet of closet space per person. ★★



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BREAK THE SOUND BARRIER

(Continued from page 115)

CA regulations dictate that cabin pressure shall be maintainable even with one of the four air systems out *and* with one cabin window smashed. To allow for the remote chance of solar flares producing an unacceptable amount of radiation, a special device gives enough warning for the pilot to glide down to a safe 50,000 feet.

All sorts of new problems arose in design. A cruising speed of Mach 2.2 (about 1450 mph) would raise temperatures to 266° F. at the leading edge of the wings, a sizzling 307° F. at the nose. It meant the use of a special heat-resistant aluminum alloy called Hiduminium RR 58 in Britain (AU 2 GN in France). They forsook heavier stainless steel and titanium planned for the American SST.

At subsonic speed, these surfaces could ice up, so they have to carry heaters, too. In the same way, the airconditioning system has to *heat* the interior at subsonic speeds and then cool it after Mach 1 is passed.

For engines, designers took the Olympus 320 meant for the now-defunct TSR 2, and worked from there. The basic principles, and the metallurgy, were proved to be fine. But this meant increasing the thrust from 30,000 lbs. (with afterburner) to 35,000 (without). For testing, they bolted it underneath a Vulcan bomber, flew it aloft, and then ran it under the surveillance of hundreds of gauges and four closed-circuit TV cameras. On the ground, they catapulted four-pound chickens, fustillades of hailstones, and gallons of oil into the air intake. Olympus 593 digested them all without so much as a cough. To guard against "buzz"—a violent shock-wave vibration caused by air entering the engine intake too fast—the 593 intake carries a complex system of ramps and spill doors to control the flow—all, of course, computer-controlled and linked to the autothrottle.

Hinged nose swings down

In the first sketches, it became clear that the Concorde must have an unusually long nose—so long (20 feet in front of the pilot's controls) that visibility would be very poor for landing and takeoff. To let the pilot see where he was heading, designers hinged the whole of the nose (which also doubles as a radome) to drop 17.5° out of the way. In flight, the nose is lifted level with the rest of the fuselage, and for supersonic flight, a long visor rises from the nose to meet the top of the windshield, making the whole plane impeccably sleek and aerodynamically trim. As a con-

trast to the futuristic origins of the rest of the Concorde, the nose cones are made of about 30 layers of huge, conical, fiberglass stocking knitted by the elderly craftswomen of an old-established Scottish hosiery firm!

André Turcat, the prospective test pilot for prototype 001, has spent many hours at Toulouse, learning his new job in the \$4 million flight simulator. Engineers out of sight test him to his extreme limits: They fix the dial readings to show that he is surrounded by fog, short of fuel, and bereft of electricity; sometimes, in playful mood, they pretend to set his undercarriage on fire. Turcat can handle it all. This month, he will be handling it in earnest, in the air.

5000 hours just for tests

Prototype 002 is scheduled to take off in late summer. Already work has started on 01 and 02, the preproduction models. They are already different from the prototypes: 12 feet longer, with engines 7½ percent more powerful. These first four planes will never fly in service, but their job is vitally important. Before Concorde No. 1 is judged satisfactory for public service, 001, 002, 01 and 02, and 1 and 2 of the production aircraft, must put in nearly 5000 flying hours. Loaded with 12 tons of recording equipment, they will carry out rigorous testing and retesting for power and fuel consumption, range and speed, maneuvering and stability, efficient pressurization and resistance to metal fatigue, comfortable and quiet takeoff and smooth landing. They will be tried at high altitudes and low, in the freezing Arctic and at the scorching Equator, in gales and snow—every extreme condition that can be found.

In the meantime, confident representatives from 16 airlines have examined the full-scale wooden mock-up (which itself cost \$350,000) and have deposited about \$300,000 per plane for options on 74 Concorde. In the United States, PanAm wants eight; American, Eastern, TWA and United, six each; Braniff and Continental, three each. To meet these and other anticipated demands, the two manufacturing companies plan to turn out Concorde at the fantastic rate of one a week once they get going.

The Supersonic Age is just round the corner. It will mean that the New Yorker can contemplate a day trip to London or Caracas; from Anyplace, U.S.A., to Anywhere, the World, will take at most 12 hours' flying. Concorde's world has, by comparison with 19th-century travel, shrunk to the size of a county; the Atlantic to no more than a pond. ★★

HI-FI GOES COMPACT

(Continued from page 95)

size. As proof, look at the typical luggage portable, which is so small that all three units form a single case about the size of a man's two-suit. With the typical weight around 30 pounds, it makes a portable stereo system for footloose audio fans who are not professional weight-lifters.

The current compacts have more similarities than differences. All use high-quality record changers—precision units built to closer tolerances than those found in ordinary phonographs. This assures constant turntable speed—eliminating such bugaboos as wow and flutter. It also gets rid of the rumbling noise made by most inferior changers. The stereo cartridge is the high-compliance magnetic kind that provides undistorted, silk-smooth treble. And lightweight, low-friction tone arms enable these sensitive cartridges to track the stereo grooves accurately and without excessive wear on records.

Compact power


Of the two basic types of compacts—the luggage-style portables and walnut-finished, stay-at-home models—the latter usually have larger speakers and, therefore, more power-handling capacity. This helps them sound more like full-size systems than the portables. Power ratings in various models range from 15 watts per channel for the smaller units to 50 watts for the more beefed-up versions, which easily fill even a big room without strain. In normal-size rooms, even the smaller models sound very impressive.

Wattage, by the way, is conservatively measured according to standards set by the Institute of High Fidelity. Compact manufacturers avoid the watered-down testing standards that result in the inflated wattage claims usually seen in ads for lo-fi equipment. You can't rely on wattage figures alone, though, to tell you how much sound a system will put out. It also depends on speaker efficiency—how many watts the speaker gobbles up to reach a certain loudness level. A rough-and-ready way to check this when comparing different systems is to play the same record on them, set the volume controls at midpoint, and see which system gives the most sound.

With some compacts you have the option of getting a built-in FM stereo tuner. Some models also feature optional AM, even though AM falls short of hi-fi standards. And a few of the nonportable, stay-at-home compacts have special features,

(Please turn to page 222)

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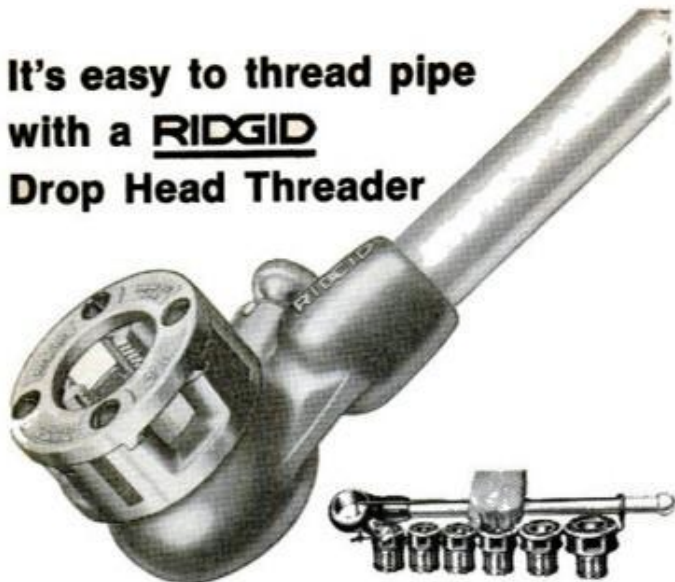
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HI-FI GOES COMPACT

(Continued from page 221)

such as a built-in cassette tape recorder, as in the Harman-Kardon SC-2520 (see *Big Boom in Tiny Tape*, page 140, Jan. PM), or provision for playing the eight-track tape cartridges commonly used in cars as with the Bogen MSC-1.

If you plan to tape programs off the air or dub records to tape, make sure the compact you consider has a special tape output jack for connecting your recorder. And if you plan to listen via earphones occasionally—to keep from bothering the rest of the family—pick a system with built-in earphone jacks.

Compacts versus components

How do compacts stack up against full-size component systems? To claim that they're just as good would be stretching a point. But the heftier bantams (those with power ratings around 30 watts per channel) come so close that even keen-eared experts can't always tell the difference blindfolded. The difference shows up mostly in great orchestral climaxes. Big systems sail through them without distortion. Compacts may blur the music at such moments.

Whether or not a compact is your best bet therefore depends mainly on your musical taste. If you like to shake the walls with heavyweight orchestrations—crashing kettledrums, roaring trombones, deep-rolling pipe organ, and massed choirs—only a full-size component system can put them across convincingly.

Fortunately, not every kind of music requires such range and power. If your taste runs to show tunes, mood music, jazz, folk songs, or classics without massive scoring, most compacts will do an outstanding job for you. Their highs and lows are in natural balance, and the tone-color of the individual instruments comes through true and lifelike. In short, you won't be bothered with what one manufacturer calls "ear-pollution." If you haven't yet lived with a music system of such quality, it's hard to imagine what this means in terms of sheer listening pleasure.

As a new breed of sound equipment, the compacts now fill the wide gap between ordinary, garden-variety radios and phonographs and full-fledged component systems. As one audio expert puts it: "Size, price and performance are all related. Unless you want to go all-out into big components, you've got to settle for an optimum compromise between these factors." And, for a growing number of listeners, the new stereo compact is the perfect middle ground. ★ ★ ★

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MICROSURGERY

(Continued from page 119)

runs along one side of the nerve sheath, an oval shape to the sheath, or differences in the size of fiber bundles—all these can be a tipoff to the correct hookup.

Microsurgery holds such exciting promise that one of its pioneers, Dr. Julius Jacobson, director of the Vascular Surgical Service at Mount Sinai Hospital in New York City, describes it thus: "The first experience with a microscope may be likened to the first time that the moon is viewed through a powerful telescope."

Dr. J. Lawrence Pool, professor of neurological surgery at Columbia University and director of neurological surgery at the Neurological Institute in New York City, summarizes the importance of this new technique in operations on the brain and nerves: "Microsurgery is a major advance. I've used it for tumors of the eighth nerve, the nerve for hearing. But when such a tumor is big, it is often too late to save the seventh nerve and you may then get facial paralysis afterward. I've done eight of these now with the microscope. My score is seven okay. One patient has some facial weakness, but that too may yet clear up."

Dr. James W. Smith, assistant professor of clinical surgery at Cornell University, is one of the outstanding pioneers in this field, along with Doctors Pool and Jacobson. "In the past," he says, "it has taken as much as five years for a patient to get a return of function that, at best, is usually only half of normal. To get back only about 50 percent of the usefulness of an arm or leg, and to wait five years for it, is certainly not good. The microscope has helped us find what prevented a return to normal."

The superprecise demands of microsurgery have brought with them other advancements in addition to the diploscope. The microscopic tissues handled at extreme magnifications are like thin, wet tissue paper and would be torn by the ordinary metal tips on tweezers and forceps. Now, by using instruments coated at the tips with diamond dust, surgeons can firmly grasp fine tissues without injuring them.

Applying sutures by microscope is about as tricky as you can get. Imagine this typical job: In an artery with a diameter of about $\frac{1}{100}$ th of an inch, a $\frac{3}{4}$ -inch cut is closed with 58 stitches. To aid surgeons working in tight places where a fraction of an inch is a long distance, there are now pneumatic needle holders for suturing that work by compressed air at the touch of a foot switch. ★★★

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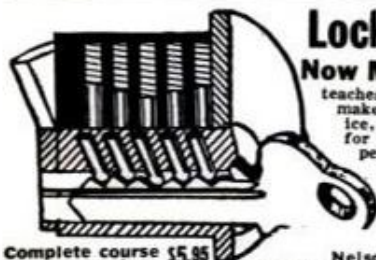
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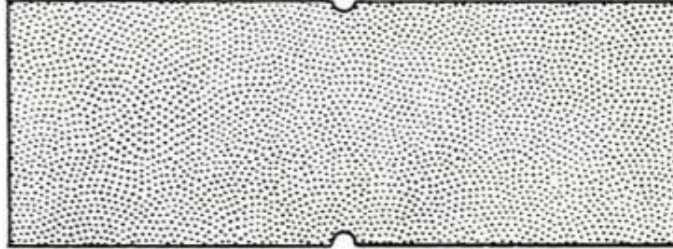
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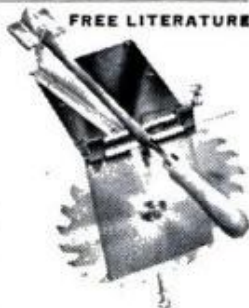
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