

DETROIT'S '66 SURPRISES—A SPY'S EYE VIEW

POPULAR MECHANICS

JULY 1965
35 CENTS

**DOWN DOWN DOWN—HALF MILE DEEP WITH SCUBA
NEW TASTE SENSATION FOR CAMPERS—WEEDS**



DESERT WINDJAMMERS

PAGE 86

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Get the smoothness of *two* front axles and a Six that feels like an Eight

You'll have to ride in this new Ford to believe that *any* pickup can ride so well.

For only Ford has two front axles. They work independently so that jolts at one wheel are never

transmitted to the other. The front end doesn't "mush out" on curves. Virtually no dive when braking.

On the road—or in the rough—you'll find Ford's Twin-I-Beam ride far smoother. And Ford's en-

gines are smoother, too. Big, new seven-main-bearing Sixes feel as smooth as an Eight. A new 352-cu. in. V-8 is most powerful in Ford pickup history... economical, too. See your Ford dealer!

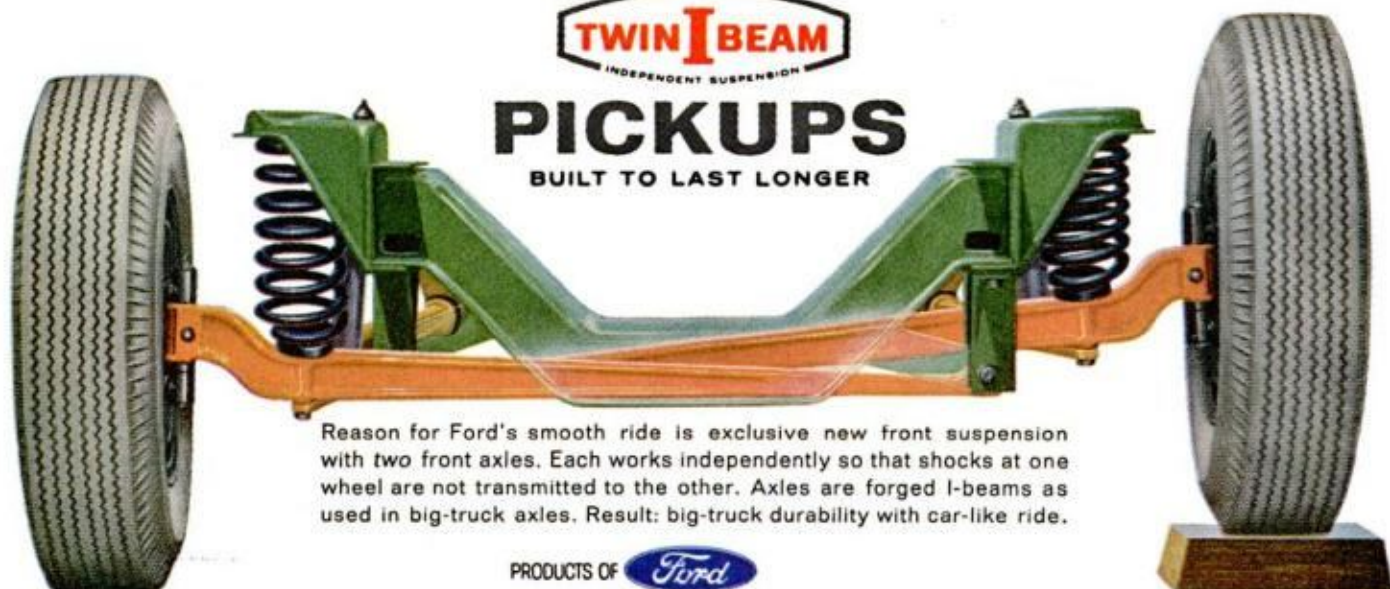
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'65 FORD



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Reason for Ford's smooth ride is exclusive new front suspension with two front axles. Each works independently so that shocks at one wheel are not transmitted to the other. Axles are forged I-beams as used in big-truck axles. Result: big-truck durability with car-like ride.

PRODUCTS OF 



Is July the right month to buy an outboard?

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The Merc 650: 65 HP. Great ski motor! This 4-cylinder, small-bore, short-stroke outboard outpulls, outruns, outlasts competitive "big-barrel" V-4s—on less gas! And it's *quiet!*

The Merc 500: 50 HP. Economical—versatile. Exclusive 1965 Mercury features—from its sound-isolated cowl to Jet-Prop exhaust—

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The Merc 350: 35 HP. Looks husky, is husky—yet it's the *lightest* 35 HP outboard ever built! Flo-Torque rubber safety clutch makes Mercury the only outboard which has no shear pin (or drive pin) to fail. It's quiet, too.

You get more RUN for your money with Mercury 1965... 100, 90, 65, 50, 35, 20, 9.8, 6 and 3.9 hp.



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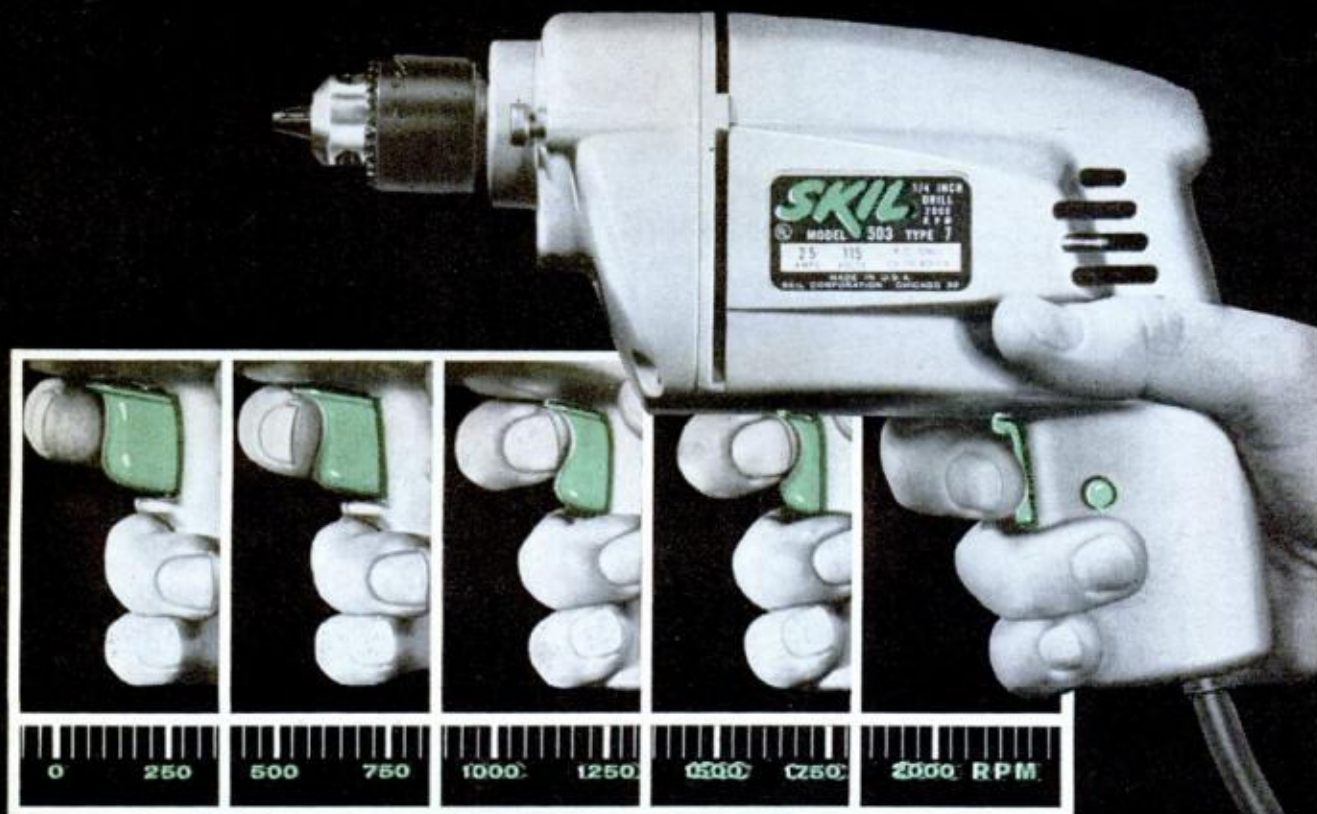
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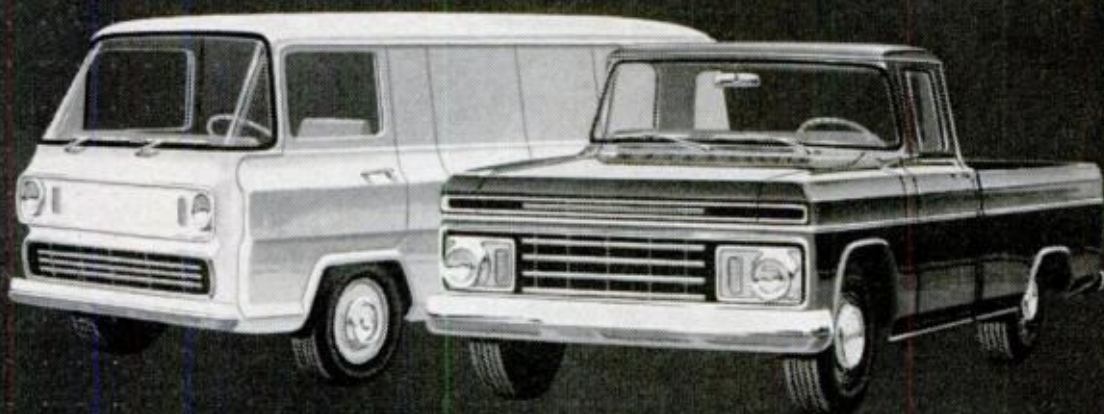
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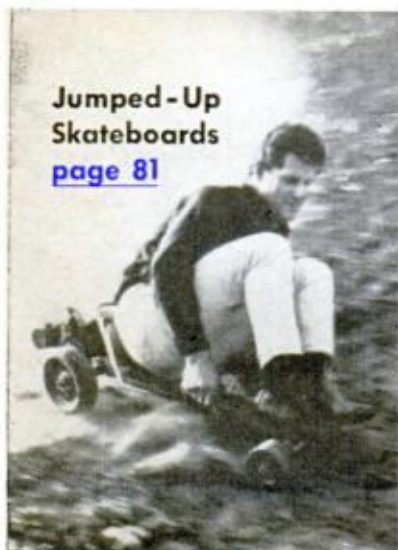
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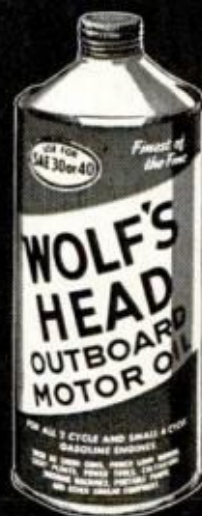
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Over the Editor's Desk

Two-Car Family

We built two small cars from your *Side-walk Classic* plans (page 146, November

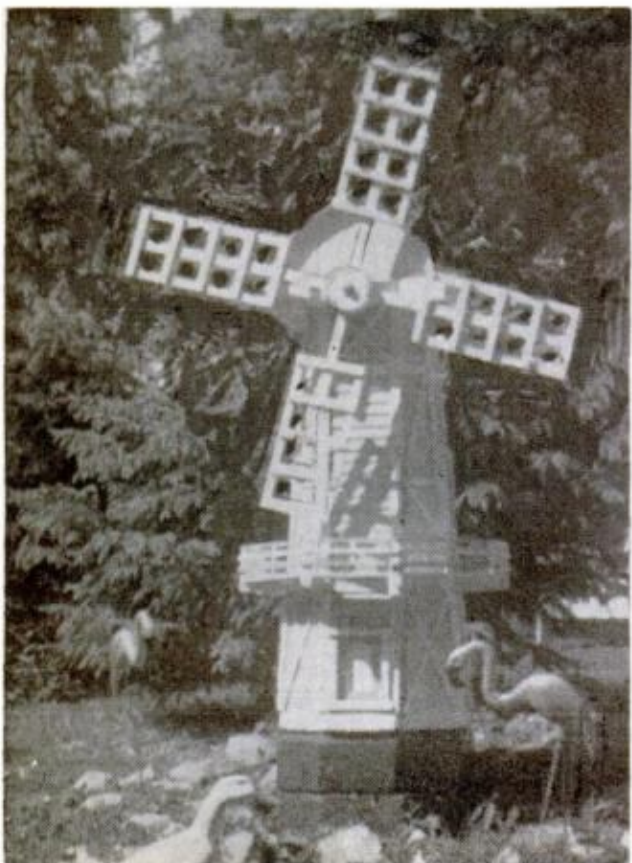


1963 *PM*), and we gave them to our boys for Christmas. Thought you'd like a picture of the cars.

Birmingham, Ala. FRED AND CHARLES QUINN

Good as New

I made a windmill (*Dutch Windmill Stores Garden Tools*, page 105, September 1941 *PM*) when it appeared in *PM* and have since kept it in repair and painted.



I thought you'd be interested in a photo of the mill, which is still as good as new after all these years. Thank you.

Emerson, Nebr.

R. D. HINGST

And thank you, we are interested. Wonder how many other readers still have one of those windmills in the yard.

Found It—at Last

The article, *Whispering Engine* (page 118, January *PM*) is very good and of special interest to me. I have been looking for this type of engine for several years. Southington, Conn.

EMILIO FIORELLO

Blue Hawaii

I built *Sea Knight* (page 164, May 1957 *PM*) and launched her in the spring of 1962 under the name, *Blue Hawaii*.

She is powered by a 60-hp engine and will plane at 12 mph and reach a top speed of 28 mph with four adults aboard. I am



more than satisfied with her performance and maneuverability.

As I fiberglassed the hull, decks and cabin top, I have had no maintenance.

Palgrave, Ont.

A. N. TATTON

Roughrider

I was looking for a boat kit when my brother-in-law gave me a copy of the March 1963 *PM* with your *Hydro Dynamic* plans (page 144). It was love at first sight.

I decided I was going to build it the way I wanted to, so the cost exceeded the \$75 mentioned in the story. I fiberglassed the complete exterior of the boat.

The performance of the hull is quite good. When in the boat alone, using a 30-hp motor, I get 28 mph. It is a little slow on takeoff with a skier or with four aboard; I'm going to remedy that with a 60-hp engine. I eliminated slipping on turns with a skeg.

As for structural integrity, I've hit wakes

(Please turn to page 8)

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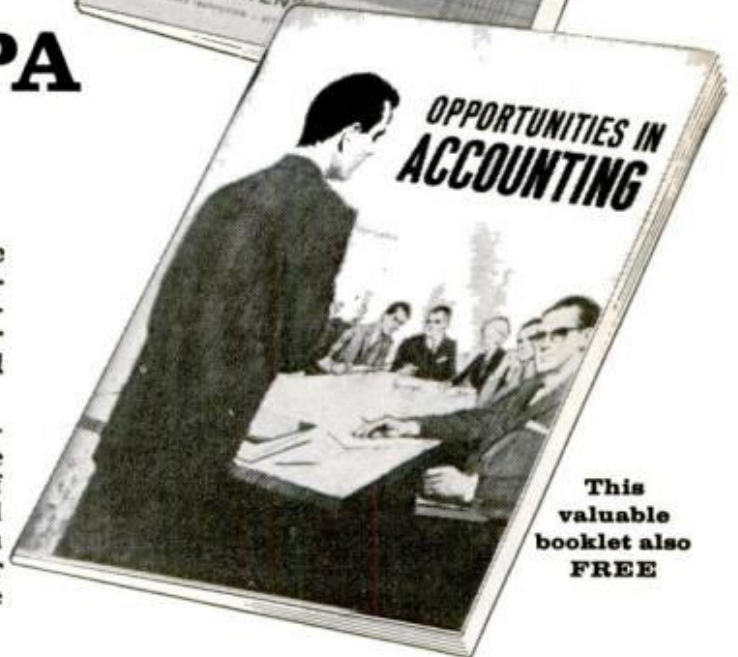
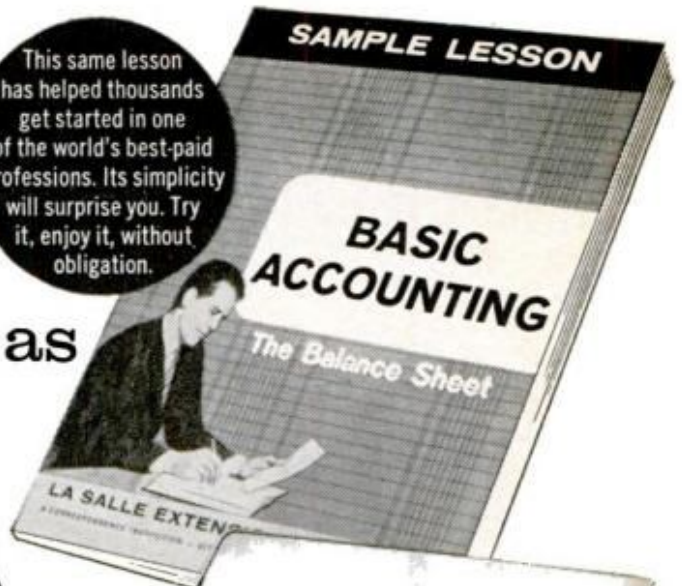
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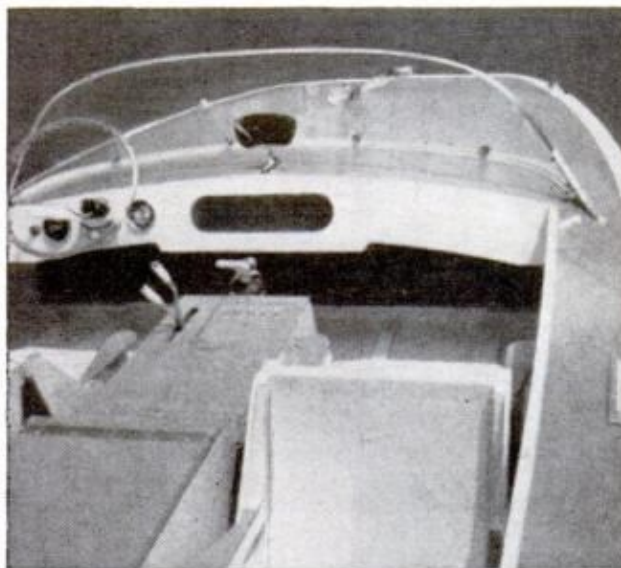
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Over the Editor's Desk

(Continued from page 6)



at 28 mph and had the boat thrown almost out of the water. No trouble. The final test was the Colorado River. At one point, the boat was thrown sideways and the engine hit bottom so hard it was knocked half off the boat. No damage to the boat.
Duarte, Calif. **DEAN WHISLER**

You ought to test Army tanks just for relaxation, Dean. Yes, the plan is good, and you've obviously done a good job of putting it together.

Experienced Mixer

In regard to the item on the secret of good mixing (*Science Worldwide*, page 10, May PM) which you attribute to a chemical engineering professor, I have been tipping the bowl while mixing cake batter for so long I cannot remember when I started. I never knew the exact reason—just that it seemed easier and quicker and made a much better cake.
Redgranite, Wis. **MRS. MILES HAWK**

Tell you what, Mrs. Hawk. Send us one tipped and one untipped and we'll compare 'em in our hungry-editor testing lab.

The Editors
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The Thorp T-18 all-metal airplane (page 80, Dec. '64 PM) now has three models flying and several more near completion.

John Thorp, who designed it, has sold more than 250 sets of plans to amateur builders and, based on their reactions, especially those who have flown it, he is revising the plans in several areas.

The T-18 was meant to be an "irreducibly simple" do-it-yourself airplane, the first all-metal airplane that even a beginner could build. It called for an open cockpit, no flaps or trim, and speeds from 130 to 200 mph depending on engine size.

After a few flights of the first T-18, built by Bill Warwick of Torrance, Calif., it became obvious that a canopy would be needed. The plane is too fast, making it uncomfortable to fly without one. So Thorp designed a canopy to fit all present and future T-18s.

Also, he is nearing completion on plans for flaps and is working on an elevator trim. Those are the major changes.

Another change, and a happy one, is the estimated cost. Thorp is a conservative man and originally estimated it would cost the average T-18 builder about \$3000. This now seems too high.

Warwick brought his in for \$2000, and several other builders, either completed



DICK HANSON'S T-18, a plush jobbie, gets 185 mph

or nearing completion, expect to finish up near that figure, some a few hundred dollars less and some a few more.

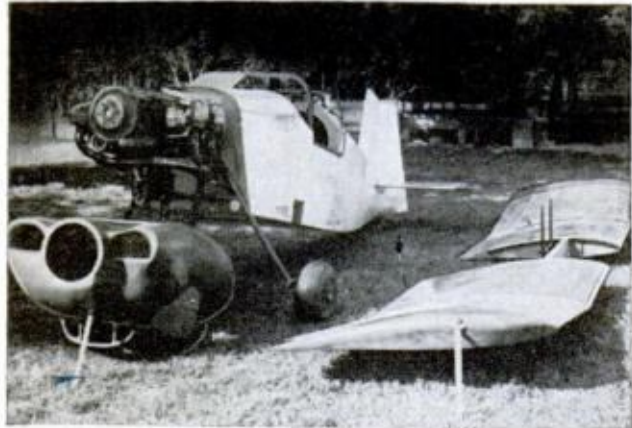
It would probably be safe to say now that the *maximum* average cost would be around \$2500, with \$2000 a good mean average. Not bad for an all-metal plane.

One of the two new T-18s now flying is owned by Dick Hanson of Pacoima, Calif., and will probably be the least typical of all T-18s. It's a real cream puff on which

Hanson has spent close to \$10,000, mostly for radio equipment. Hanson, like Warwick, has a 180-hp engine and has been averaging 185 mph true air speed on about 9 gallons of fuel per hour. A real plush model, it has a tinted canopy, metal prop and spinner, wheel pants and gear fairing, and upholstery.

Hanson, who has other planes he can fly, says, "I've never had a plane I enjoy so much. It really moves."

The second new T-18, built for \$2200 by Ralph Thenhaus of Van Nuys, Calif., is the



OTTO ZAUNER'S T-18, with 150-hp engine, gets ready

most typical of T-18s. He followed Thorp's original plans to the letter, even to using the 125-hp ground-power unit Thorp recommended and leaving an open cockpit.

However, Thenhaus, who is averaging about 120 mph indicated, is putting a Thorp-designed canopy on his plane. "There's just too much breeze." He expects to pick up another 20 mph with it.

Neither Hanson or Thenhaus have had any problem getting in and out of short fields, one of the difficulties envisioned by prospective T-18 builders. They're landing and taking off within 1500 feet easily. Warwick, in fact, made a tour of just about every small airport in California in his T-18, sod fields included.

Taking off is no problem and, while the T-18 lands hot without flaps, it's a tail-wheel plane and slows down quickly. So a 2000-foot field seems adequate.

On the East Coast, the T-18 nearest completion is being built by Otto Zauner of Vineland, N.J. He expects to bring it in for about \$2000 with a 150-hp engine.

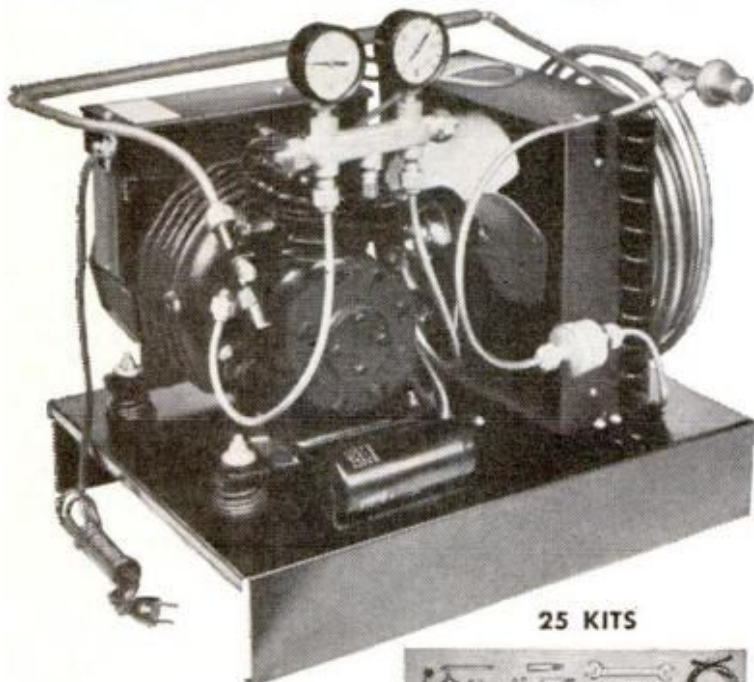
Another bonus from the boom in T-18s is the availability of parts. Several new sources have sprung up about the country, especially for the hard-to-get extrusions for the fuselage and wing.

All in all, we haven't changed our mind about the T-18. It's a good little plane.

Kevin V. Brown
Aviation Editor

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Not for criminal use. A drug company is marketing a "barrier cream" that seals the fingertips and prevents the transfer of oils, salts and acids to objects touched. Result: no fingerprints. The cream is used in the electronic, aerospace and optical fields to prevent fingerprint corrosion in handling and assembly procedures.

Batten down the hatches if the moon is new or full. Those are the danger times for late summer Atlantic hurricanes, according to Donald A. Bradley of New York University. He investigated 269 hurricanes and found 90 of them hit within two days of a full moon or a new moon, when sun, moon and earth are in line and ocean tides are greatest.

A hot suit underneath a wet suit may be the way to keep arctic divers warm. A conventional wet suit has a good deal of insulation value, but enough cold arctic water seeps through it in about half an hour to drive the diver out of the water.

Canadian divers are testing a vest made of absorbent material that is soaked in warm water and worn under the wet suit. This layer of warmth is said to delay the invasion of arctic chill. But the best feature is that a hose can be lowered to the diver and connected to his inner vest—the "hot suit"—to flush out the chill with a new supply of warm water.

Fish never seen before by man are being studied and classified by University of Southern California biologists. Taken from a four-mile-deep trench off the west coast of South America, the specimens were identified as new species of lantern fish, eelpout, smoothtongue smelt and slickhead.

Plastic seaweed is being used to fight erosion at Bournemouth, an English seaside resort. The area lacks natural seaweed, a protection against the eroding effect of tides, and so British engineers came up with eight-foot-long clumps of a man-made fiber that resembles horse-

hair. The clumps are anchored in 12 feet of water about 400 feet off shore. It's thought that the "instant" seaweed, by dampening the action of the water, may even encourage the growth of the real thing.

Witch doctors are still needed. So says the English-trained psychiatrist who heads the mental health service in Nigeria, Africa. Native medicine men can even help sophisticated Nigerians, who may have spent years away from their villages. These patients tend to regress to their tribal backgrounds when they suffer a psychotic breakdown, says the psychiatrist. Help must be offered at the most basic level—and that's where the witch doctors come in.

Dirty air, soil and water aren't our only pollution problems. Many areas are being contaminated with electromagnetic noise.

Scientists at M.I.T. are concerned about the problem and are attempting to see to it that the campus is "clean." They point out that stray energy throws off sensitive measuring instruments in laboratories, industrial plants and hospitals.

They recommend the filtering of all fluorescent lights, elevator machinery and motors with brushes; use of coke-loaded cinder block for all nonload-bearing walls, and the grounding of all conduit to the frame at least once in every bay of every steel-frame building.

British surgeons and nurses were checked for germs before and after showering. Surprisingly, all of them spread more germs after washing than before. Scientists who conducted the tests think that "washing removes the outermost layer of dead cells from the skin and releases many skin-inhabiting bacteria that would otherwise remain trapped below the surface."

A new family of plastics with unusual properties is now being used for specialized packaging and insulation applications. Heated to a vapor, the plastics cool on objects they contact and form into a film of transparent, tough plastic. Continuous films thinner than 1/100,000-inch can be produced. (Common plastic films sold as household wraps are more than 150 times that thick.) The new product is called parylene and is made by Union Carbide.

People who live and work in areas where there is a considerable amount of lead in the air will have a greater than

(Please turn to page 14)

There's more to the new Buick Skylark Gran Sport than meets the right foot.

Some people might think a whacking-big 400-cu. in., 325-hp Wildcat V-8 alone is worth the price of admission to a Skylark Gran Sport. Not us Buick people. We had to go and lock that engine to a heavy-duty suspension, a floor-shift 3-speed that's synchronized in all forward gears, and the kind of steering and handling that'll make you want to leave home at the first hint of an open road. Tell you what. Go visit your Buick dealer and ask for a test drive. And then see if the whole car doesn't match that accelerator pedal.

One of the new Gran Sports from Buick.



BUICK MOTOR DIVISION

JULY 1965

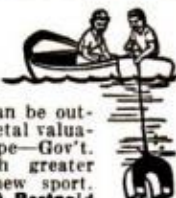
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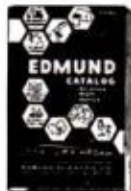
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Science Worldwide

(Continued from page 12)

normal concentration of lead in their blood and urine. That was revealed by the Public Health Service after a year's study to determine whether increased amounts of lead in gasolines would make for a health hazard.

Public Health scientists concluded that the amount of lead most persons have in their systems is well within the presently accepted range of lead levels for humans.

Customs inspectors no longer will have to worry about the possibility of having missed a batch of smuggled gold. The Atomic Energy Commission has come to the rescue with a whistling "coffee urn."

An object that is suspected of containing hidden gold is placed inside the urn. There it is bombarded by radiation from Xenon-133, a radioisotope. This causes the gold to give off X-rays; they, in turn, are filtered so that only X-rays peculiar to gold reach the radiation counter in the top of the machine. Impulses from the counter set off the whistling mechanism.

The urn, say officials, can be used on works of art, handbags, suitcases and all kinds of metal objects.

Fragrant therapy. Russian scientists report that a bactericidal preparation made from garlic proved effective against 14 microorganisms, in some cases succeeding where some antibiotics failed.

Radiation doses heavy enough to kill a squad of soldiers actually lengthen the lives of male houseflies, according to University of Miami researchers. A total of 12,000 flies in the pupa stage were exposed to doses ranging from 10,000 to 30,000 rads (a rad is a basic unit of absorbed dose of ionizing radiation). By contrast, 450 rads delivered to the human body is considered lethal within a period of 30 days.

The flies exposed to from 10,000 to 15,000 rads lived about 25 percent longer than a nonirradiated group. Although lives were shorter in the 30,000-rad group, the normal male loss of wings, a natural feature of aging in flies, was entirely eliminated.

The fact that the insects were treated in the pupa stage has led the Miami scientists to conclude that cells were altered that normally aren't susceptible to change by irradiation in the adult fly.

John F. Pearson
 Science Editor



Dan Gurney, Grand Prix driver and three-time winner of the Riverside 500, tells you

**“How to improve
your car’s
performance
without raising
the hood...”**

Blow out your engine on a fast stretch of highway . . . it helps get rid of carbon in the combustion chamber and cleans plugs of deposits that result from slow driving and idling. But take care. Lead deposits that form on plug insulators become conductive if heated rapidly, shorting plugs and causing misfiring. What's more, the deposits may become so badly

fused that you can't remove them even by cleaning. Then it's "good-bye," plugs! So don't just stand on it all of a sudden. Accelerate slowly. And stay within safe, legal limits. With today's "long" axle ratios that let big V8 engines loaf along, you might have to run in an intermediate gear to get the cleaning job done.

Power Tip plugs, pioneered by Autolite, all but eliminate the spark plug problem. Autolite Power Tip plugs have long insulator tips and electrodes that extend further into combustion chambers. The result is that swirling gases and higher tip temperatures keep Autolites free of deposits—keep power and economy at a peak longer.



RIDE WALT DISNEY'S MAGIC SKYWAY AT THE FORD MOTOR COMPANY PAVILION, NEW YORK WORLD'S FAIR

Take Charge of Your

CAREER

By Richard Dunlop

AN FCC LICENSE can be a ticket to a better job. The Federal Communications Commission reports that there are almost two million radio transmitters in the United States without counting those operated by the armed forces. This agency licenses operators to prevent chaos on the airwaves. From the youngest radio ham to the chief engineer of the nation's largest television station, radio technicians must have a technical understanding of the fundamentals of electronics. No TV or radio station would hire an unlicensed engineer.

Today many employers consider such a license as proof of a man's ability to work in other areas of electronics. It can help him get a job maintaining mobile radio systems and microwave relay links or repairing radar devices. Pan American Airways, for example, has hired a number of radio mechanic helpers to work at its New York base. Those chosen had a second-class FCC license, some practical experience and a sound foundation in theory.

To assist men who are trying to win commercial FCC licenses, Cleveland Institute of Electronics issues a booklet describing the requirements and tests. Readers may obtain the booklet, *How to Get a Commercial FCC License*, by writing the institute at 1776 East 17th St., Cleveland, Ohio 44140. Those seeking information on amateur FCC licenses can write American Radio Relay League, Newington, Conn.

For those whose interest in TV is on the studio side, new courses now cover all facets of TV studio operation and production. Students handle cameras, sound booms, dollies, lights, scenery, audio-console, turntables and audio-tape machines. They learn how to integrate live and film portions of a program, direct one-man shows and dramatic programs, and master the fine arts of takes, fades and dissolves. Details can be obtained from RCA Institutes Inc. Studio School, 1600 Broadway, New York, N.Y. 10019.

Bumper Crops: More Jobs Now

We have it from the Illinois State Employment Service that asparagus is one farm crop "still resisting automated harvesting techniques." Illinois harvests 10,000 acres of asparagus a year, and there is

nothing for farm workers to do but stoop, cut and lift the tender shoots. The farmers around Danville, Hoopston and Peoria count on their family, neighbors, townspeople, migrant workers and youth from the larger cities to help them out.

Across the country, state employment service farm placement representatives check where and when crops need harvesting and help to form crews. This year there is a marked increase in demand for seasonal farm workers to harvest what promises to be bumper crops. Cutting off of sugar imports from Cuba has increased U.S. cane and sugar beet acreage.

All told, 260,000 more farm workers are expected to be needed this year than those hired in 1963. High school and college boys are being counted on more than before. Jobs will be available into fall.

Appalachia Looks to Chicago

Temporary farm jobs may be up this summer but long-term farm employment trends are still down. Mechanical bean pickers have all but eliminated harvest hands in the bean fields of the East. Harry H. Woodward Jr. of the Council of the Kentucky Mountains, point out that "few farm jobs, fewer lumbering jobs, as well as fewer jobs in the coal mines have brought about unemployment and underemployment in Southern Appalachia."

The council has been working with mountaineers in their home states for more than 50 years, but now that so many of them have emigrated to Chicago, it has moved right along with them.

"We run a real casual sort of operation," Woodward, who directs the Chicago office, says, "helping the families get squared away here. Men are getting jobs as punchpress operators and service station attendants. Bell & Howell has hired many ex-mountaineers for its production lines.

West Coast Layoffs Continue

The national employment picture still looks bright, but we must report that aerospace and defense industry layoffs continue to raise unemployment in Southern California. When Genisco Technology Corp. placed an ad in Los Angeles for three senior structural design engineers, it received 700 applications. A few years ago, these would have been hard to fill.

PM's West Coast Bureau reports that engineering and science PhD's are still in short supply. Advanced degrees were required for 75 percent of the jobs filled by 400 companies which visited the University of California at Los Angeles campus last year. Recruiters were from aerospace companies, nonprofit groups, government and basic research laboratories. ★★

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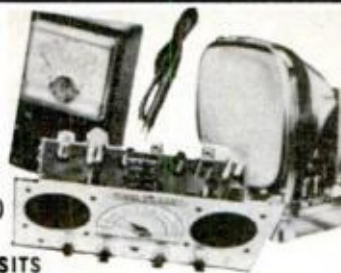
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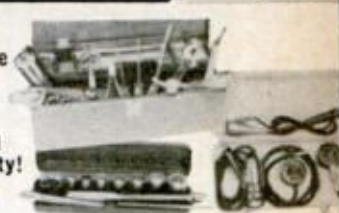
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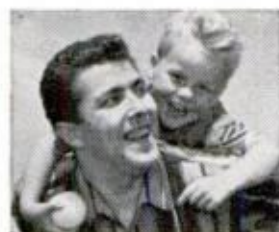
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detroit listening post

- Squeeze Goes on Shoddy Tire Builders
- Used Cars Get Guarantee
- No V4 for MG

PM's STORY ON THE NEW industry-wide standards for auto tires mentioned there was little the **Rubber Manufacturers Assn.** could do to enforce them. Let's give Akron its due and bring you up to date: The RMA, through an independent lab, was to start tests in June and promised to name any tires that flunk. It puts the squeeze on anyone making flimsy shoes for your car.

Now, if requirements can be stiffened, one of the foggiest areas for a car owner will get some sunlight.

Months ago I paid **Chrysler** a well-deserved compliment for the two-stage flow control valve going into power steering systems. Its purpose: Limit power steering fluid flow at high speeds but let it increase at low engine speeds (for parking maneuvers, ending the hard catch-up felt when you spin the wheel fast.

I still say the change is needed. Test cars we drew apparently missed the new valve, but **Chrysler** had said it was being installed. After a reader complained, I checked Detroit again and found installation began only in late March; by late April it had reached barely half the Six and 318-in. V8 engines. Old systems are being installed until they are used up.

There are plenty of reasons to discount rumors you may have read about a V4 engine for the **MG-B**. **British Motor Corp.** admits factory people have toyed with V4s for some time. But the project is shelved except for possible industrial use. A Four is difficult to balance, at best, and in the V configuration it's especially rugged. More displacement with a shorter block could eventually come via a V6 such as **Buick Special's**, and it could shoehorn under the **MG-B** hood.

The **Italian Supreme Court** of Appeals has decided it's legal for local authorities to restrict parking hours, and they can use meters to do it if they like. But meters charging parking fees are out.

Got your passport?

Chrysler has combined lubrication and hydraulic systems in its turbine car to serve the transmission and power steering gear as well as the turbine itself.

Rambler denies rumors that **Kaiser** and **American Motors** will merge. But financial circles quote **Kaiser** officials who say, flatly: Yes—we'd like to be back in the passenger car business. We aren't talking about any specific ways to do it, however.

The new 327-cu.in., 250-hp "**Vigilante**" V8 for the **Jeep Wagoneer** was originally **Rambler's**—built for **AMC** by **Kaiser**.

Buying a used car has always been risky even with the most candid dealer in town since even he can't know all the problems coming up. So a salute is due to **Chevy** dealers who are instituting a limited used-car warranty. It isn't complete, of course. For 30 days you get 50 percent off on certain repairs by the selling dealer. And for two more years you get a 15-percent cut. Not much, maybe, but it's a start.

Biggest safety problem at **GM's** Milford, Mich., proving ground is old man **Morpheus**. To fight driver drowsiness—most common just before dawn—night-shift men must sign in every hour. Any driver who feels sleepy is urged to turn into the garage. (He might be driving a pre-production prototype that's almost priceless.) Of various keep-awake gimmicks, none tested has helped much. **GM's** solution: Clear the land about 150 feet on each side of the road.

It's hard to see who'd want to copy the blue used on competition stockers from the Lee and Richard Petty stable, but if there is such a person he has a big job ahead. The secret paint formula is locked in a vault at **Chrysler** headquarters. Even **Chrysler** can't use it except on **Petty** cars.

Pontiac's overhead-cam **Six**, due into showrooms for the 1966 introduction, uses a quiet belt drive instead of the chain we all have thought for so long was the most rugged. This belt, however, is something special. Instead of rubber, it uses a synthetic that's supposed to outlast the car. We haven't found out yet just *what* synthetic, but you can bet it'll be called "an engineering breakthrough."



Automotive Editor

POPULAR MECHANICS

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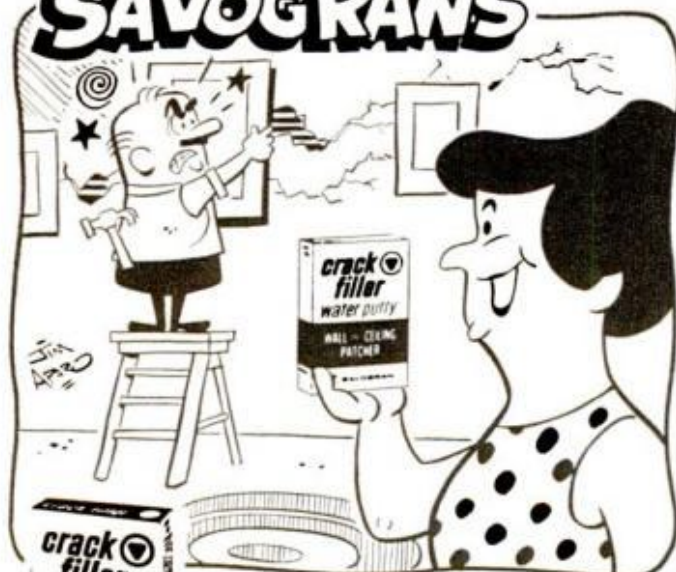


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Items from All Outdoors

Should the federal government charge campers and picnickers for using the national parks and national forests?

This is a bone of contention among many groups of outdoorsmen, and the grumbling about the \$7 annual fee now being levied for use of these federal facilities is particularly loud in the West.

In the language of the Bureau of the Budget a camper is: ". . . An identifiable recipient, receiving a service or privilege . . . which provides special benefits above and beyond those which accrue to the public at large." And in Circular A-25 dated Sept. 23, 1959, the Budget Bureau made the suggestion that: ". . . A charge should be imposed to recover the full cost to the federal government of rendering that service."

This has meant, in the past, a charge of from \$1 to \$3.50 per car for a two-week to 30-day visit at each national park. In most areas of the national forests there was no charge for camping and picnicking.

But now, as part of the new Land and Water Conservation Fund, there is a standard \$7 charge for an auto sticker that entitles a carload of visitors to unlimited admission to both national parks and forests for one year. On top of this are user fees: camp and trailer sites range from \$1 to \$3 for overnight use; picnic sites from 50 to 75 cents a day; boat-launching sites, 50 cents to \$1.50 a day.

The Department of the Interior feels that the people who use the facilities should also pay for them. In 1963 there were more than 95 million visitors to the national parks and they paid \$6,451,000 into the government coffers. But it cost \$132,610,000 more than that to operate the parks. The new admission and user fees are expected to total \$125 million this year.

Critics of the new system feel that the national forests, particularly, are essentially public land belonging to all the people and should be open to the people without charge. And they have a valid point.

But on the other hand, if the new fees, and they are not really exorbitant, insure the continuation of a program of outdoor recreation and the further enhancement of the wilderness program, then they cannot be considered a bureaucratic evil.

STUART JAMES

Outdoors Editor

POPULAR MECHANICS

L.T.P.*

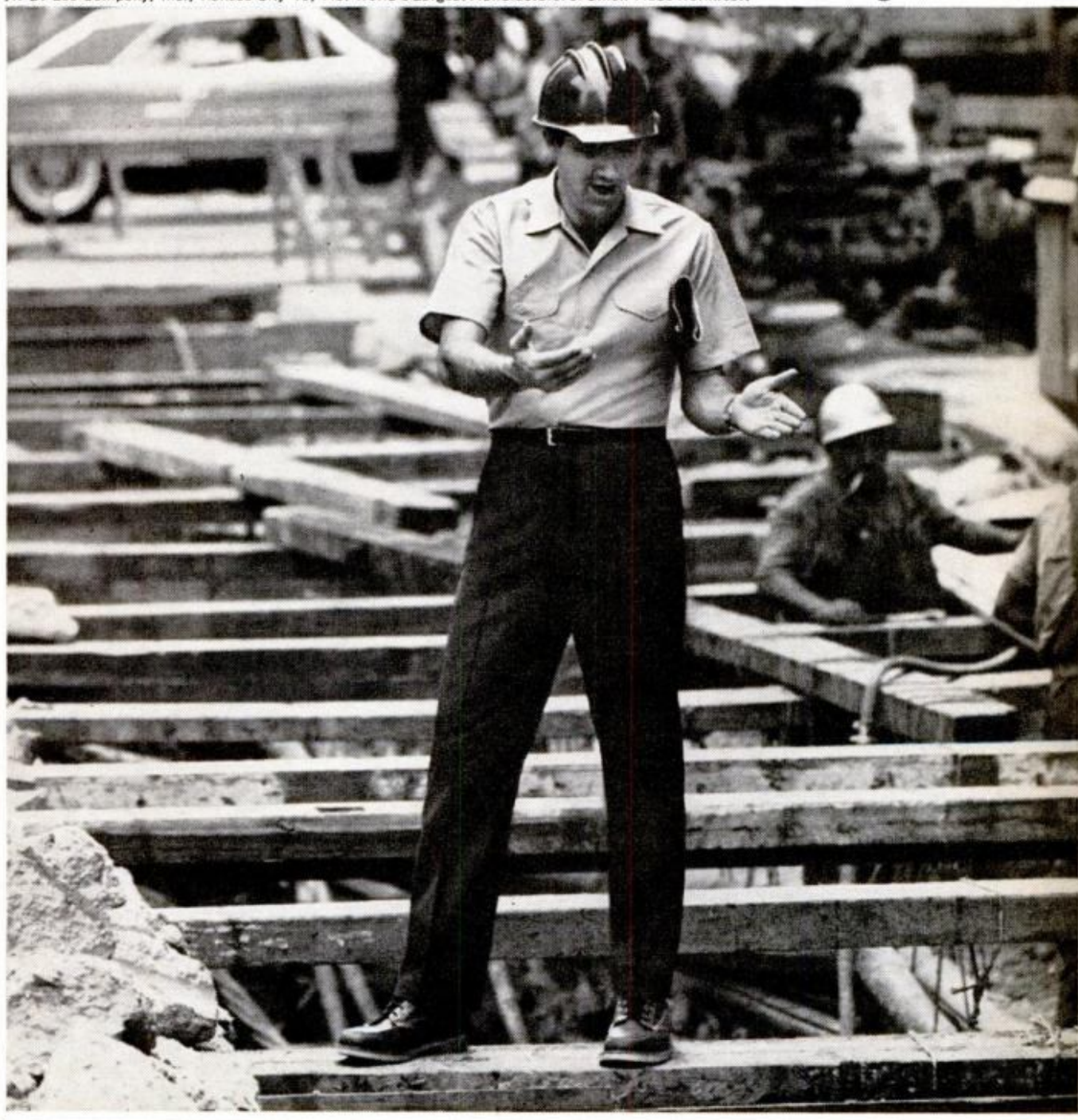


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Noteworthy New

By M. J. Pedersen

Endless airport runway is literally without beginning or end in that it circles the periphery of an airport. Operational facilities are centered inside the banked circular track and are reached by means of tunnels under the track.

The inventor, Woldemar R. Bary of East Stroudsburg, Pa. (one of the original founders of Sikorsky Aircraft), points out that such a runway allows a pilot to make as many loops as needed to gain speed for a takeoff. The hazard involved in overshooting the runway is also thus eliminated. Patent 3,173,634 was awarded on this design.

A stranded plane crash survivor can now "fly" to safety by donning a plastic suit that inflates and floats him away in a cluster of giant balloons. Stored on board an aircraft or ship, the balloon-suit can be put on quickly in an emergency. It earned patent 3,176,935 for two U.S. Government engineers, John S. White, Falls Church, Va., and David S. Cooper, Fairfax, Va.

The suit consists essentially of a crash helmet and an inflatable capsule girdled around a person and tied to six 12-foot-wide balloons. Each balloon has two cells, an inner cell filled with helium (to provide lift), and a thin outer cell filled with air. Thus, the survivor can control his altitude by varying the volume of helium in the balloon.

Forest fires may be detected automatically by reservoir pipes which then douse it with water. Using solar batteries to control a series of valves that regulate the flow of water, the fire-fighting system is equipped with thermostatic devices that open up the valves when the temperature gets too high. Patent 3,176,733 went to Richard T. Headrick, Duarte, Calif., and Edward E. Headrick, La Canada, Calif.

Sound-wave curtain that could be draped in the ocean to provide a warning system against enemy submarines earned patent 3,177,466 for Robert A. Arnoldi, Elmwood, Conn. A long pipe with tiny air holes is stretched along the ocean bottom. As the air bubbles coming out of the holes rise toward the surface, they cause the colder

water at the bottom to rise, producing the vertical curtain. Sound waves sent through this artificial sound channel by an underwater transmitter are trapped in the curtain, thus increasing the range of sonar.

Goldfish may now be decorated using a scale transplanting technique already employed to identify fish used in research on new drug compounds. The method, which is quite painless to the fish, consists of replacing scales of one color with those of a contrasting color. The fish is first anesthetized by placing it in a solution of water and tricaine methanesulfonate. Using a magnifying glass, the operator then transplants, one at a time, as many scales as are necessary to achieve the desired pattern. For this process Dr. Louis Levy and Miss Carol A. De Fusco received patent 3,174,458, assigning patent rights to Rexall Drug and Chemical Co., Los Angeles.

Nuclear reactor for making a miniature sun on earth, with the help of two magnetic mirrors, received patent 3,170,841. Its aim being the production of power through the control of thermonuclear reactions such as stoke the sun and other stars, the Pyrotron reactor must ionize and heat the fuel to a temperature of 100 million degrees or more. And the resulting hot gas, or plasma, must be confined at this temperature long enough to allow a substantial number of the atomic cores to fuse, thus releasing a massive energy which can then be harnessed and converted to usable power.

The inventor, Dr. Richard F. Post of the University of California Lawrence Radiation Laboratory, Livermore, Calif., commented that the patent establishes the basic idea of using magnetic mirrors to help confine the plasma.

Futuristic fire truck claims among its numerous unique features two tank-like bulldozers which sit on a raised platform in front of the truck, as well as giant tanker-tires that store fire-extinguishing chemicals. Upon reaching a fire, these remote-controlled bulldozers, or "fire cats," dart toward the blaze squirting their chemicals, and creep in much closer to the flames than human firefighters could safely do.

Primarily designed for use at airports, though adaptable for regular community use, these trailer-hauling fire trucks are supposed to be much more efficient than conventional fire-fighting means in extricating passengers and crew from burning planes which have crashed on a runway. Patent 3,169,581 went to Phil F. Cummins, Fort Worth, Texas.

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cars 17,000,000 miles a year. Ford Motor Company does both—and it makes thousands of other tests!



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JULY 1965

23

Spotlight on the TRIUMPH TR-4A

This spunky British sports car adds comfort and control with its new independent rear suspension



CORNERING FORCE AS THE NEW TR-4A negotiates this bend is almost enough to lift the inside wheels. The car held on tight, drifted manageably at 60 mph

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DRIFTING THROUGH TURN 5 at Bridgehampton, N. Y., is a solid, thoroughly controlled experience in Triumph's new TR-4A. And it's fun. There's no question of where you're going and what you can do.

With TR-4A's independent rear suspension (irs), 60 mph through that corner is no trick. For comparison, we'd also borrowed a live-axle TR-4—and found it had snow tires on the rear. The easy way out was to throw on the spare from each car. But they weren't matched. Even so, I'm not willing to blame tires for the live-axle Triumph's eagerness for the outside edge of the turn—and eager it was. I still got around holding 60, but every run left me wondering. In contrast, with the irs I never came close to using the full track width.

When the photographer was working from the outside edge, therefore, the irs helped to preserve the driver's peace of mind. (Photographers themselves are a courageous—or foolhardy—breed. Ours always seem unworried.)

The TR has always been something of a brute; hardly the car Mom would pick for a cross-country trip. Now all that is changed. Even Mom, unless she's too arthritic, may find happiness behind the TR's wheel. She'll get comfortable excitement without being able to count hairline paving cracks as they pass under the wheels.

While wheel rates are unchanged in front (it still take 106½ pounds at the wheel to deflect the suspension an inch), the rear has been softened about 12 percent from 120 pounds per inch to only 106. And the rear is where you feel the difference. (In comparison, the MG-B rate is 93.)

Some may find the TR-4A seats narrow. I found the all-synchro transmission, though beautifully precise, still stiff after nearly 1000 miles. These criticisms are niggling; they don't detract from the fun.

[\(Please turn to page 26\)](#)

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Spotlight on the Triumph TR-4A

(Continued from page 24)

Standard-Triumph has a theory that there remain in North America a few hard-bottomed machochists who prefer the old live axle. So there will still be a live-axle version of the TR-4A, and it will show up on the ticket as a \$150 option. Handily, it lets S-T advertise the basic convertible at under three grand (\$2899 East Coast port of entry).

The convertible top for any British sports car is small; they've had to be so you could get them up and down without assistance. They deserved their reputation as the devil's own device to rattle, flap and crush fingers. They will also delay you in the rain, wrestling with bows and snaps. The TR-4A eliminates the problem; you can work its top with one hand.

For kicks we timed the job. Hotfooting it frantically back and forth around the car, I could get the old TR-4 version up in 2 minutes, 24.1 seconds. The new one took 1:16 flat and left me far less frazzled.

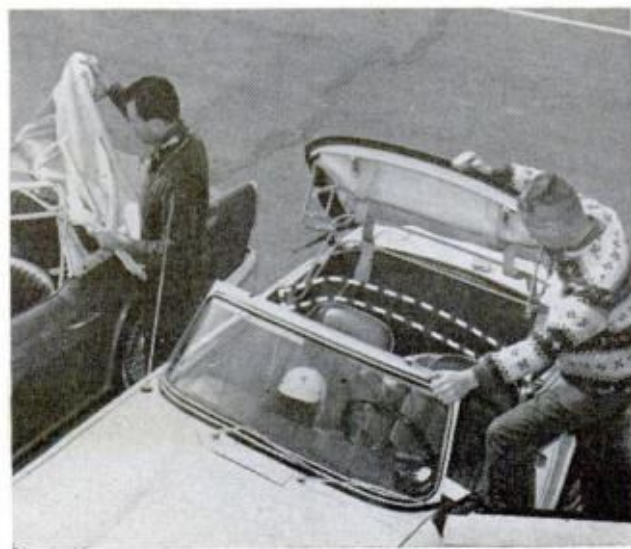
The 4A also gets a simpler diaphragm clutch for less pedal effort, so Volvo is about the last major import to use the lever-type—and they may switch for '66.

With few engine or drive line changes, the 4A straight-line performance about equals the TR-4's; 0-60 came up in an easy 10.4 seconds despite snug gears.

You can identify the new model by the changed top, rear deck lettering, lack of vertical bars in the grille, or some aesthetically unappealing amber parking lights. Twin tail pipes help, too.

TRs commanded respect since the first one began to win. The IRS-equipped TR-4A will not foul the image and, on rough courses, may well improve it.

THE CONVERTIBLE TOP goes up or down easily and quickly compared to the old system (rear). Lines show how retracted top cuts off space at the rear



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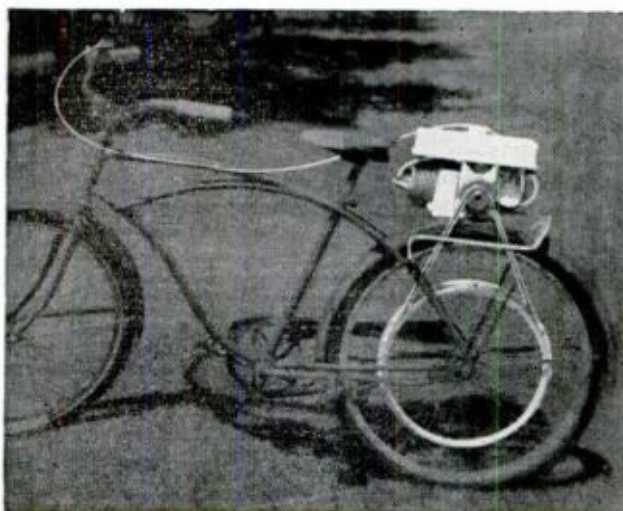
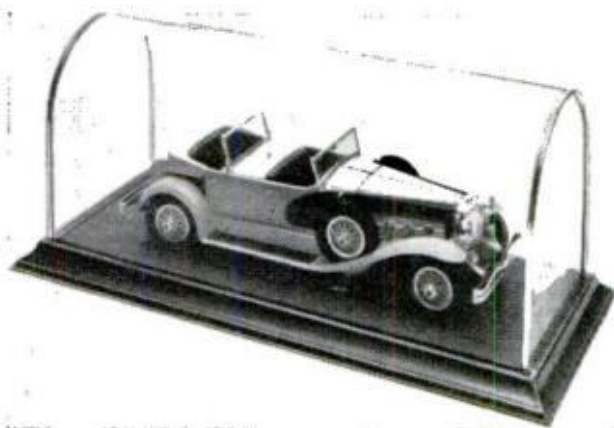
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Painting by roller is made easier for the beginner with packaged kits which contain everything you need: a seamless roller with 14-in. extension handle, a trim roller and a paint pan. Available in 7- or 9-in. size, at \$3.69 and \$4.49, respectively. Manufactured by Thomas Industries, Inc., 207 East Broadway, Louisville 2, Ky.

Just the thing for showing off those meticulously-built models: Attractive display cases are supplied in kit form. Base is made of wood-grained plastic. Top is clear plastic. Lengths run from 6 to 36 in. heights to 24 in., widths from 3 to 12 in. Case shown at right measures 6x16x6 and sells for \$4.50. Available from Maryland Model Co., Box 100, Wittman, Md.

Motorize your bicycle with the Go-Byk motor kit. Outfit consists of a two-cycle engine, engine mounting bracket, V-belt clutch, pulley, notched V-belt and throttle. Said to deliver up to 100 miles per gallon of gas and speeds up to 30 mph. No welding required for installation on ordinary bikes. Price is \$69.95. Go-Byk Industries, Rothsay, Minn.

Powerful putty (not shown) is a two-part epoxy which comes in stick form. You cut equal lengths from each stick and knead them together like dough. According to the manufacturer, the resulting mixture adheres to almost any surface, achieves a steel-like hardness in 1½ hours and can be drilled, filed, tapped and sawed. Epoxy-bond costs 98 cents for 3-oz. size. Atlas Mineral Products, Mertztown, Pa.



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Sidelights from the **SERVICES**

By William R. Kreh

An electronic nerve has been developed by the Navy. A radically different electronic device, called a neuristor, may cause a revolutionary change in the design of digital computers and some electronic systems by eliminating the need for transistors, resistors and capacitors. It behaves like a human nerve fiber. It is a special type of "wire" which operates like the burning fuse of a firecracker—an electrical impulse moves along this "wire" like the burning region moves along a fuse. However, unlike the fuse, the neuristor can be re-used indefinitely.

▼ ▼ ▼
Whalebones—nearly 60 tons of them—have gone down in the books as one of the most unusual cargoes ever carried by the Navy. Transported by the USS *Pictor*, the bones comprised the skeleton of a rare Pacific Right Whale. It was shipped to the Smithsonian Institution in Washington, D.C., as a gift from the Tokyo Whale Research Institute. It was captured in 1961 near Kodiak, Alaska, and is now being re-assembled at the Smithsonian.

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[\(Please turn to page 32\)](#)

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Sidelights from the Services

(Continued from page 30)

recovered by heavy tractors because of ice conditions. The human haul was done by attaching three skis to the three landing points of the helicopter and mounting a rope bridle with two 100-foot lines to the axle of the forward landing gear. The Navy men's grunts and groans saved the Navy an estimated \$40,000.

Color blind. A quirk in the human eye of not seeing colors as they really are is being used by Air Force to make instrument panels easier to read. It has developed an "electroluminescent" instrument panel which is one color but can appear to be others under various lights. Idea is to trick the eye into seeing the non-existent colors and make instrument reading easier.

Putty plugs may sound silly, but Silly Putty works better than ear plugs, according to one Army medical man. He uses the soft clay-like plastic—known as a child's plaything—to plug his ears when riding in noisy planes or on the firing range. He explains that the substance is "one of the silicones completely non-irritating to tissues."

Erosion by meteorite takes about 600 tons of weight off the moon each day. The moon has no atmosphere to burn up incoming pellets from space as the earth does. The meteorites hit and each one blasts into space about four times its own weight in moon stuff.

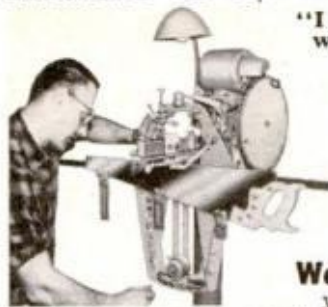
Earth on the other hand, with an atmosphere and stronger gravity, captures the little visitors and gains weight.

But in neither case is the weight change significant, according to Air Force studies, because it would take billions of years for erosion of the moon or accretions to the earth to become noticeable.

A laser device for getting hair-splitting altitude readings has been successfully tested for the Air Force. From 1000 feet, the light-beam altimeter can sense the elevation between a street and sidewalk.

A fancy tank that does "deep knee bends" is being tested by the Army. The tank uses a three-point hydropneumatic suspension system that's designed to eliminate the tendency of low profile tanks to "bellyout" or catch on rocky terrain. With its ability to change ground clearance, the system will also improve concealment and protection from enemy fire. The driver can vary ground clearance while moving.

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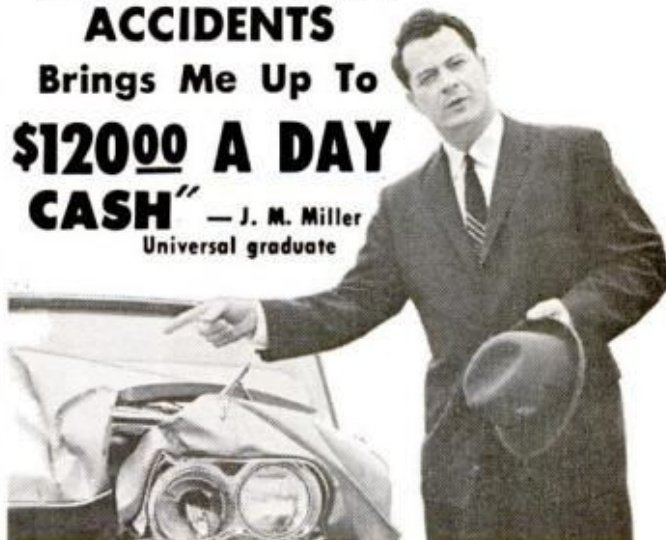
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CLINIC FOR HOMEOWNERS

Q Single-lever mixing faucets were recently installed in our kitchen and bathroom. But now a rather high pitched hammering sound is produced each time the bath faucet is opened for cold water. I've been told variously that there's some obstruction in the faucet, that an air chamber should be added, and that something is loose. Who's right?—M.V., Pa.

A It's difficult to say at long range who is right. Although installation of an air chamber on the cold-water line is the usual remedy for noises such as you describe, there can be other causes. A small, hard object loose in the line, possibly loosened at the time of installation, cannot be ruled out as a cause, although it is relatively remote. Some part of the faucet that is faulty, loose, or damaged in installation is a more likely cause. We suggest that you have your plumber examine the faucet.

Q One room in our home is plaster-board faced with simulated knotty pine. We'd like to paint the room, but what can we use to fill the V-grooves?—P.T., Va.

A We're rather doubtful that you will find this procedure satisfactory, particularly if the material is plasterboard and not some other type of board finished to simulate knotty pine paneling. You can use a spackling compound to level the surface, but we hesitate to suggest this because in some instances it is difficult to conceal the patching. In time, it may show through the paint even though an undercoater has been used. Though painting is possible, we think it would be best to simply clean the surface, particularly if the board has not been gouged or otherwise damaged. Either a mild soap solution or a wallpaper cleaner may be used.

Q I want to attach furring strips to a concrete-block wall. I'd prefer not to use masonry nails because of the danger of cracking the blocks. What other fasteners are available?—B.H., N.Y.

A There is little danger of damaging blocks when using masonry nails, but if you feel uncertain of the results, we recommend that you use anchor nails. These are perforated metal plates 2 in. square, with a nail projecting from the center. The plates are fastened to the wall with adhesive, leaving the nails projecting like file spindles to receive the furring strips. An alternative method involves the use of lead screw anchors. Holes for the anchors are made with a masonry drill, to a depth slightly greater than the length of the anchor. The anchor is then tapped in place—it should be a snug fit, the furring strip is positioned and attached with screws of the proper size for the anchor used. It is important to drill screw clearance holes in the furring.

Q I want to build a garage on my present concrete patio. The concrete slab is somewhat larger than required for a two car garage, I live in the country and there's no building code. How can I anchor the sills to the concrete?—B.H., Minn.

A The sills can be fastened to the slab with anchor bolts. It is necessary of course to make certain that the slab is thick enough to support the weight of the structure and the two cars. A potential problem is water seepage under the sills. We suggest that you use only that portion of the slab required for the floor of the garage, breaking up and removing the excess concrete, then trenching and pouring foundations for the walls below the frost line. If care is used in breaking away the excess, the patio foundation can be poured against the edges of the remaining slab with an expansion strip between. In this way you can salvage and utilize the greater portion of the slab.

Q My home has two roof valleys with cornering gutters and downspouts. The gutters have splash guards and in winter, snow collects in the valleys, works down to the gutter, seeps under the shingles and drips into the attic. What can be done to prevent this damage?—A.F., Iowa

A The only remedy is to remove the snow from the valley immediately after the storm. This may be done with an improvised rake made by nailing and bracing a board to a length of 1 x 2. Or, you can install low-heat electrical cables. When these are turned on they will melt openings in the ice formations and permit trapped water to drain away.



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PURRING DOWN the straight at the grueling Bridgehampton, N.Y. race track, our striped beast is clocked by Paul Widener, the track superintendent

Renault's Racy R-8 Gordini

We roll a car with an Achilles' wheel—and Renault quickly tells us that it ain't necessarily so

By Alex Markovich

I WAS PUSHING the Renault R-8 Gordini—a 95-hp competition model—progressively harder through the corners to see how it acted during breakaway. This is part of our test routine, simulating some of the hairiest situations the average driver might get into. If you've ever been surprised by an unexpected curve at night, or been cut off on a turnpike, you know how important handling is. The Gordini tracked flat, without sliding. Few cars in

SLIGHTLY WRINKLED, the Renault R-8 Gordini came through rollover with passenger compartment basically intact. Windshield popped out, doors stayed shut



its class had felt better.

Sweeping left-hander coming up. Clear, flat runoff on the outside, no danger in a spinout. I entered the corner at about 45, gently feeding gas. What happened next has never happened to me before in my seven years of testing hundreds of cars on highways, byways and racetracks. The tail should have slid out. Instead, without warning, it lifted; the car rolled bumpety-bump on its roof and flipped. But the windshield popped out neatly, as it should. The roof, though wrinkled, had not caved in and, thanks to the seat belt, I suffered only scraped knuckles.

Disconcerting as such behavior may be, the car does have its fine points. It corners remarkably fast before trouble sets in. The smooth 67.6-inch Four sizzles; shifting at 7000 rpm, I hit 60 in 11.6 seconds. The four-speed box is crisp and fast, the four-wheel discs don't fade, and steering is precise.

The interior is tastefully finished, with sensuously comfortable seats, readable gauges and lots of people room.

As for the cornering, there are possible remedies. Adding negative camber to the rear wheels—giving them a knock-kneed look—would counteract the positive camber—the bowlegged look—that sets in during cornering when the rear swing axle hinges upward. The positive camber can force the outside rear tire to ride on its sidewall, tripping the car over its own wheel. Negative camber, though increasing tire wear, helps keep tread on the road during cornering.

Another possibility is switching from radial-ply to conventional tires. Many racing drivers dislike radial plies because of the suddenness of their breakaway. Others suggest roughly doubling recommended tire pressures—which wasn't done on our test car. *C'est la vie.*

But here's what Renault answers:

Renault Speaks

(The statement below was provided by Renault, Inc., and is published in full without alteration.)

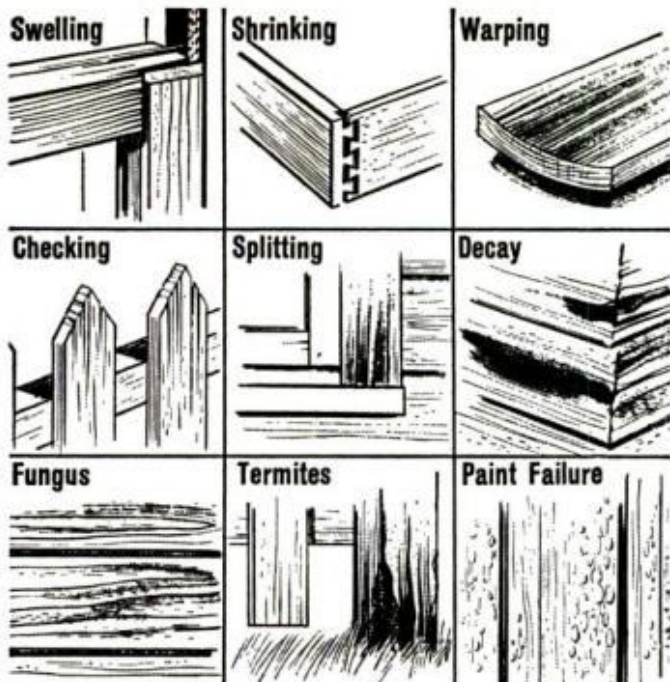
The nation's top 20 auto authorities who have tested R-8s praise them. All leading car magazines laud R-8 cornering. How do expert views compare with yours?

Jim Whipple, for five years *Popular Mechanics'* respected auto editor, wrote: "Either (R-8 or VW) can be made to spin out on dry pavement but R-8's Michelin tires hold it longer."

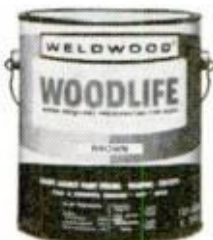
Denise McCluggage, *Town & Country's* racer-writer, called it "easy to handle in corners."

N.Y. *Journal-American* writer John

[\(Please turn to page 38\)](#)



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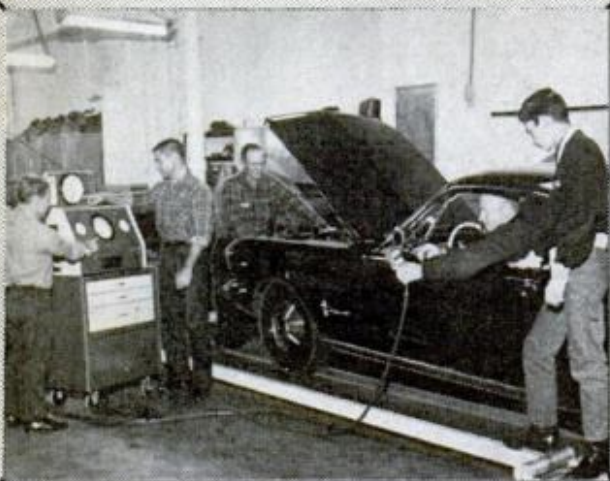
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Renault's Racy R-8 Gordini

(Continued from page 36)

Hearst, who also has a competition license, called R-8 handling "excellent; in all but tightest corners, car sticks like glue."

Road & Track said "handling qualities are fantastic." Science & Mechanics adds: "You feel a skid coming long before it happens." Even Mechanix Illustrated's Tom McCahill, who crashed trying a dangerous turn to get skid photos, praised the R-8, said it saved his life and admitted: "I should have known better (than) to go into a bend as hard as I did."

Of the new R-8 "Gordini," a model for race experts, Foreign Car Guide's Angus Laidlaw said: "Great car! (New) suspension improves handling of an already fine-handling machine . . . One of the surest-footed cars on the road." Sports Car Graphic: "You can take sharp turns terrifically fast." Motor Trend: "Great fun on winding roads. It gained our complete confidence quickly."

Steve Smith, FIA license holder and an editor of Car & Driver (which ran a rave on the regular R-8 last year) tested the R-8 Gordini at Bridgehampton before PM. His entertaining July C&D test report says: "It can be drifted through a 75-mph bend holding an angle of 30° to the car's line of travel.

Writer Stephen Wilder summed up respected opinion. The MIT graduate, Society of Automotive Engineers member and ex-race driver said: "If you try, you can roll almost any car, but even a skillful driver has to try much harder with a race-ready car like the R-8 Gordini."

Ask Renault, 750 3rd Ave., N.Y.C. 10017, for these R-8 test reprints, contest rules and dealer list. Test the \$1748 car yourself (or \$2395 R-8 Gordini if you have an FIA license), write your own report, win a read-map-mile-measurer—and a chance at a bigger prize.

DENISE McCLUGGAGE in full slide in R-8 Gordini on 90° asphalt turn. It's not proper cornering, but shows car will skid, lean before spinout or roll

Photo by John Hearst

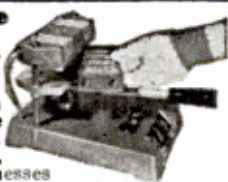


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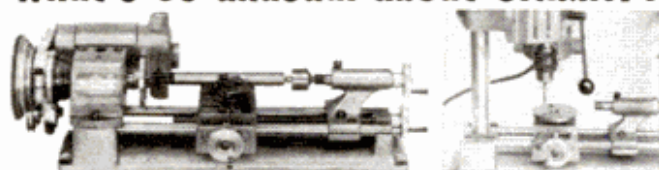
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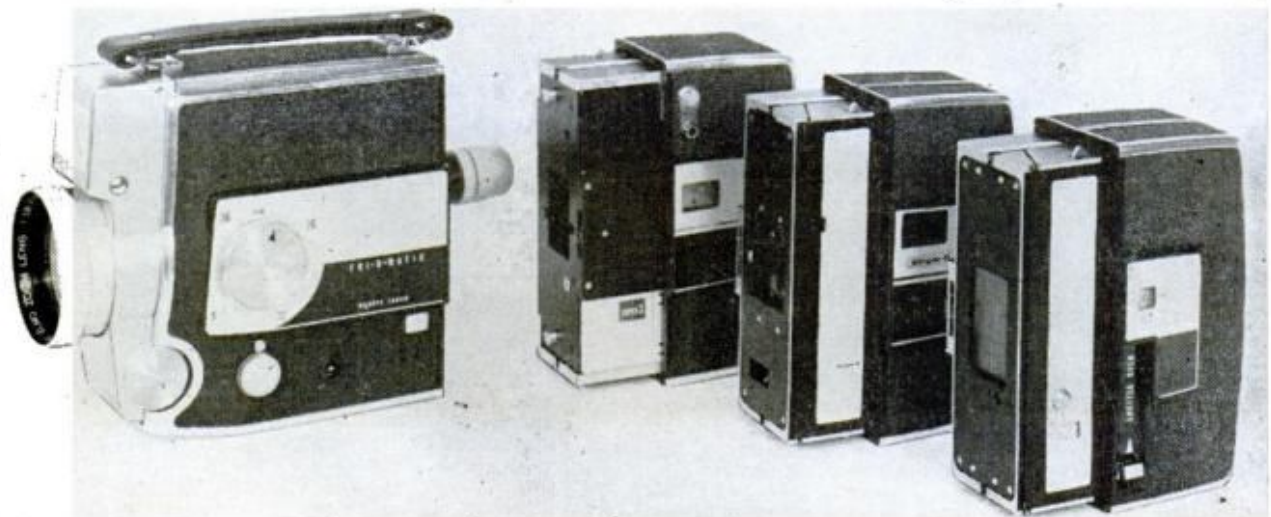
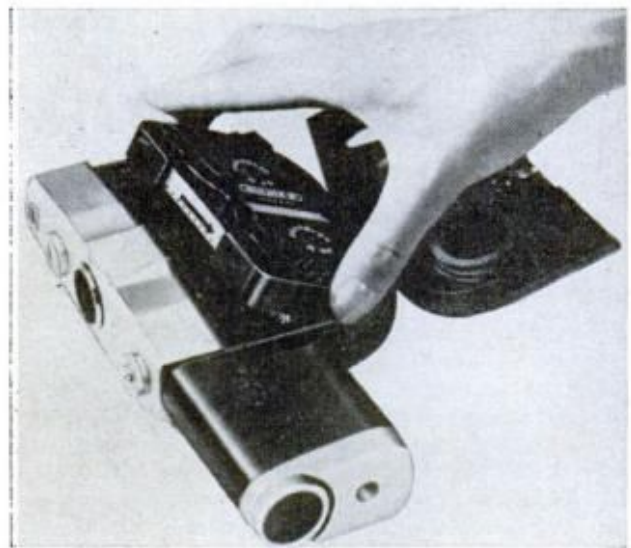
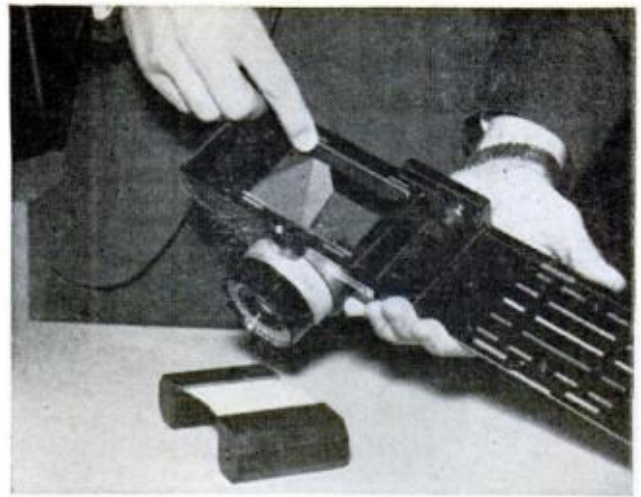
Bright Future Ahead for Snapshooters, Movie Buffs

NEW YORK'S RECENT International Photographic Exposition featured so many enticing new gadgets it was hard to keep track of them all.

For example, Fotochrome's Color Camera (photos, top right) is said to give color snapshots for less than 20 cents each. It uses easy loading cartridges of direct positive paper "film." Each 10-shot cartridge will sell for under \$2, processing included. Duplicate prints will run about the same. With the camera in shooting position, the film lies parallel to the ground. A mirror (top photo) bounces the light onto the film, reversing the image in the process, to avoid the mirror-image effect of direct-positive photos such as tintypes. The electric eye camera will cost under \$40 and will be available in the near future.

For home movie buffs, Japan's Fuji Film Co. unveiled a movie system, also for the near future. It's called Single 8, and uses the same format as Kodak's revolutionary Super 8, on a thin, strong polyester film. The film will come in preloaded, 50-foot cartridges which run continuously without having to be flipped over when you're halfway through. Fuji pushed two Single 8 cameras at the show: the slender, compact P-1 (right) with fixed focus F:1.8 lens, and the zoom lens Z-1. There are also one silent and one sound projector.

If the profusion of 8-mm formats has you confused (Single 8, Super 8, conventional 8), at least one company—Honeywell—has come to your aid. The prototype of its automatic, zoom-lens Tri-O-Matic camera (below) uses interchangeable backs to take any of the three.—A. J. Maher.



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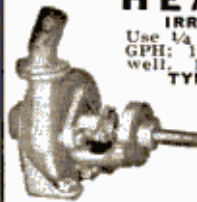
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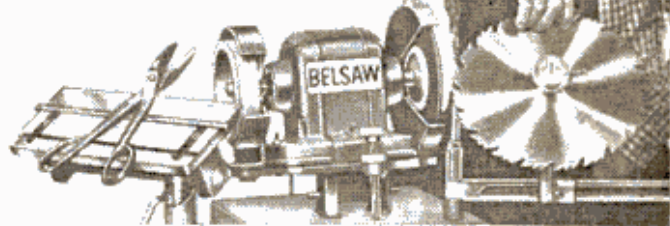
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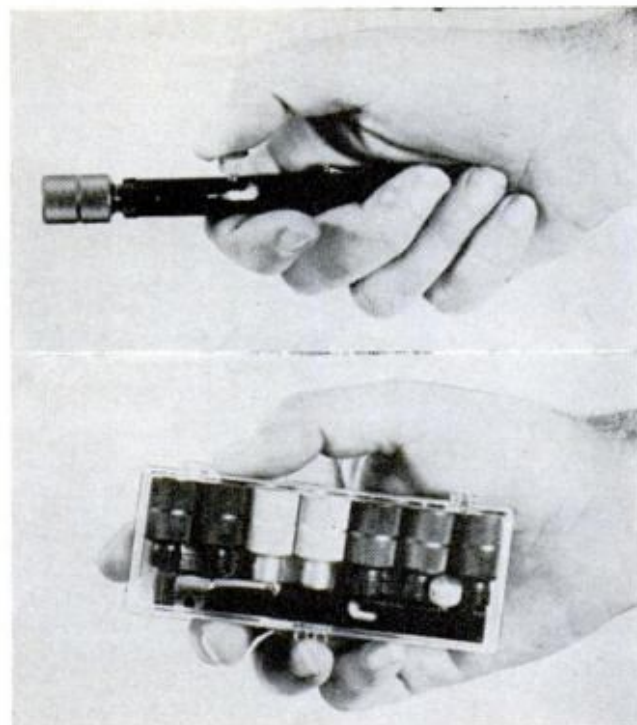
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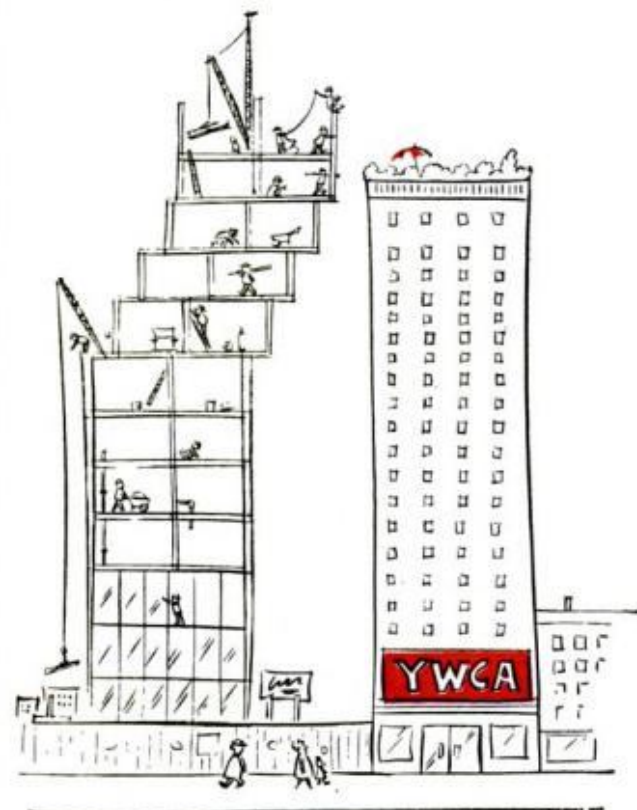
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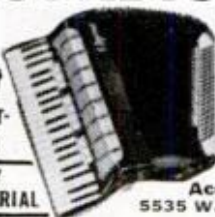
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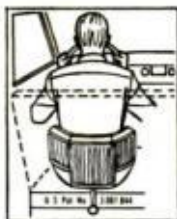
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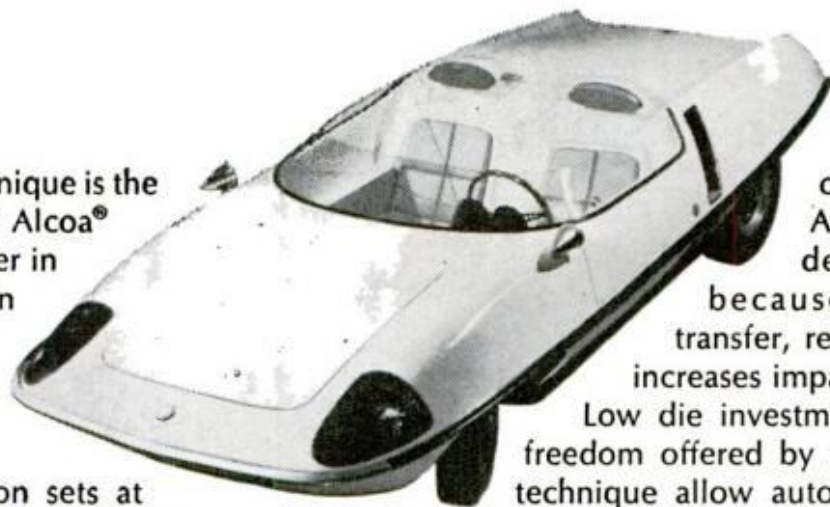
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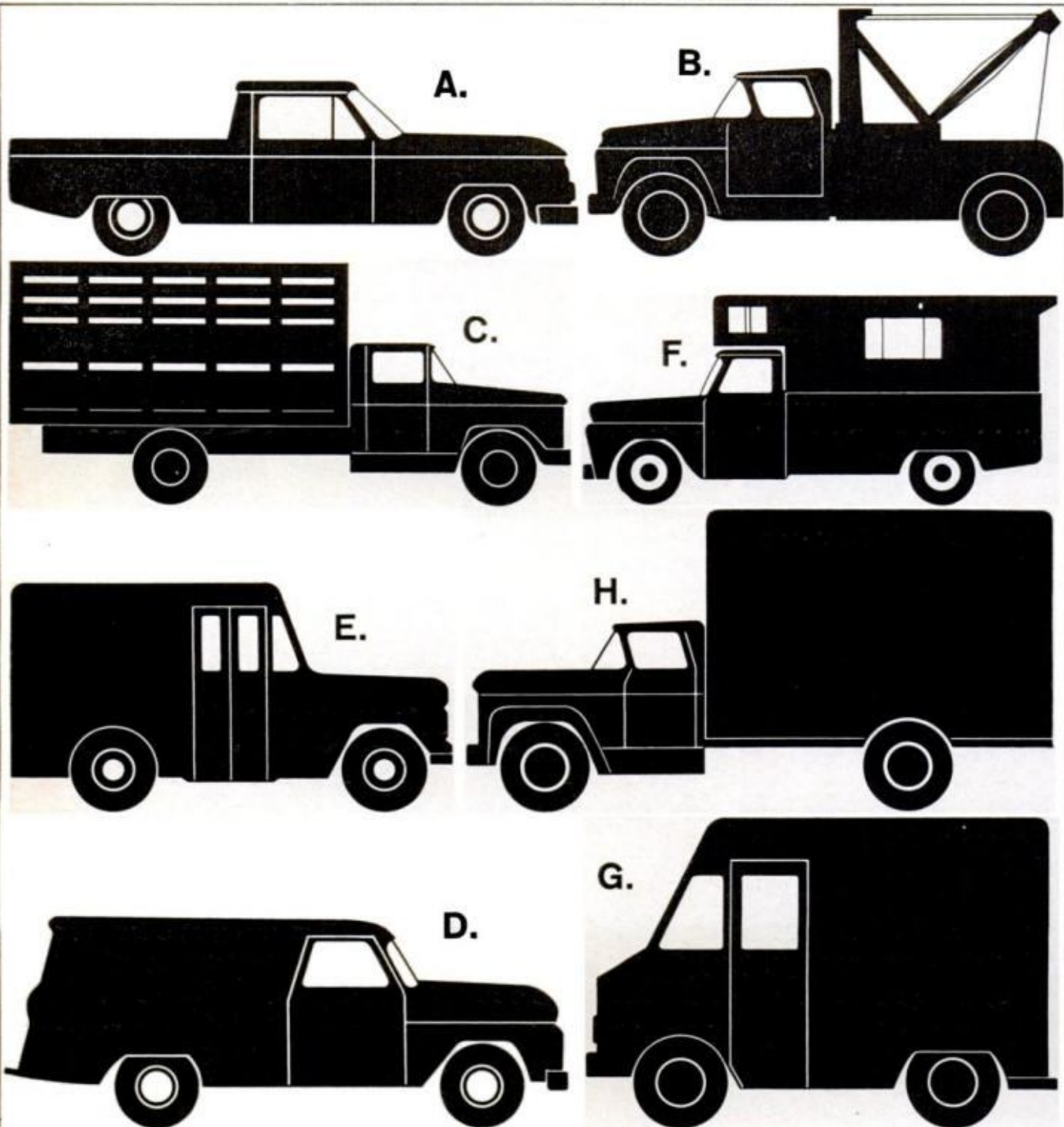
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Merchants Tire Co., 1885 Revere Beach Pkwy.
Fall River
Henry's Tire Service, 714 Globe St.
Fitchburg
Fitchburg Tire & Service, 94 Broad St.
Holyoke
Yoerg's Garage, 158 Chestnut St.
Hyannis
Super Tire Service, Inc., 37 High School Rd. Ext.

Lawrence
Merchants Tire Co., 315 S. Broadway
Lowell
BFGS, 145 Moody St.
Lynn
BFGS, Essex & Johnson Sts.
Malden
BFGS, 104 Exchange St.
Mansfield
Mansfield Tire Co., 8 Cottage St.
Natick
Merchants Tire Co., Rt. 9 at Sherwood Plaza
North Adams
BFGS, 26 Main St.
No. Cambridge
BFGS, 2353 Massachusetts Ave.
Pittsfield
Lipon's Tire, 458 South St.
Quincy
Merchants Tire Co., 234 Quincy Ave.
Springfield
BFGS, 161 Chestnut St.
Vineyard Haven
R. M. Packer, Beach Rd.
W. Springfield
Sol's Tire Service, 953 Union St.
Worcester
Ken Jones, Inc., 73 Chandler St.

NEW HAMPSHIRE

Concord
The Waite Corp., 12 N. Main St.
Keene
Cheshire Oil Co., Ralston & Davis Sts.
Manchester
Car-Go Home & Auto Center, 560 Elm St.
Nashua
BFGS, 227 Main St.
Portsmouth
Gallagher's, 86 Pleasant St.

NEW JERSEY

Berlin
Blaese's Tire Service, White Horse Pike
Bridgeton
BFGS, 11 Washington St.
Dover
Freeway Petroleum Co., 13 W. Clinton St.
Edison
Bob Lember Inc., 1690 Highway 27
Englewood
Englewood Tire Distributors, 386 Grand Ave.
Farmingdale
Thrift Tire Co., Collingwood Circle
Freehold
BFGS, 28 E. Main St.
Hackensack
Broadway Tire & Rubber Co., 555 Hackensack Ave.
Jersey City
Harry Klinger Inc., 47-49 Leonard St.
Montclair
Henry F. Goepfert Inc., 684 Bloomfield Ave.
Mt. Holly
BFGS, 31 Main St.
Newark
BFGS, 677 Frelinghuysen Ave.
Pennsauken
BFGS, 5811 S. Crescent Blvd.
Roselle Park
Roselle Park Tire Co., Westfield Ave. & Locust
Toms River
Minerva Tire Service, Flint Rd.
Trenton
Heath & Wildblood, 1432 Hamilton Ave.
Whippany
Gogel Chevron Service, 2 Parsippany Rd.

NEW YORK

Albany
BFGS, 1043 Broadway
Bayshore
Bayshore Rubber Tire Works, 161 E. Main St.

Brooklyn
Alamac Tire Distributors, 630 Foster Ave.
Buffalo
BFGS, 1050 Main St.
Canton
Hundley Farm Impl. Inc., 62 E. Main St.
Dunkirk
BFGS, 423-25 Central Ave.
Ellenburg Depot
Wilmer Nephew Impl. Service
Elwood
County Tires Inc., 1976 Jericho Turnpike
Endicott
Kearing Tire Service, 236 Vestal Ave.
Garden City
Golub Tire & Rubber Co., 2260 Jericho Turnpike
Huntington Station
Sheehan Tire Co. Inc., 91 E. Jericho Turnpike
Jamestown
BFGS, 405 W. Third St.
Madrid
Kelly Sales Corp., 10 State St.
Malone
West End Service, 119 W. Main St.
Martville
Kyle Farm Machinery
Mexico
Jerrett's Gulf Service, Main & Scenic Sts.
Middletown
Suresky's Tire Service, 111-112 North St.
Newburgh
BFGS, 303 Broadway
New Rochelle
Mallory Tire & Auto Service Co., 20 E. Main
Niagara Falls
BFGS, 928 Main St.
Ogdensburg
Fred Shurtleff's Inc., Washington & Catherine
Olean
BFGS, 112 N. Barry St.
Oneonta
Hamm's Tire Center, 300 Main St.
Oswego
Fruit Valley Tire Co., Route 104 W
Plattsburgh
A. Brown Auto & Home Store, 319 Cornelia St.
Air Base Texaco, 4 U.S. Ave.
Port Henry
Whellocks Garage Inc., 78 S. Main St.
Poughkeepsie
BFGS, 605 Main St.
Riverhead
Rolle Bros., Route 58
Rochester
BFGS, 385 Ridge Rd., W.
Rome
Pettinelli Motors, Martin St.
Stapleton
L & F Tire Co., Vanderbilt Ave. & Targee St.
Syracuse
Barnett-Hewett Tire Co. Inc., Onondaga & Myron
BFGS, 627 Erie Blvd., E.
Brothers Tire Co., 749 W. Genesee St.

RHODE ISLAND
Pawtucket
BFGS, 580 Pawtucket Ave.
DeBlois Oil Co., Colfax & Concord Sts.
E. Providence
Devaney Tire, Inc., 741 N. Broadway

VERMONT
Barre
A. Brown Auto & Home Store, 395 N. Main St.
Brattleboro
Fleming Oil Co., 3 Walnut St.
Burlington
BFGS, 227 Main St.
Enosburg Falls
A. Brown Auto & Home Store, 158 Main St.
Morrisville
A. Brown Auto & Home Store, Rts. 15 & 100
Rutland
Ray Reilly's Tire Mart, 219 Woodstock Ave.
St. Albans
A. Brown Auto & Home Store, 248 N. Main St.

WASHINGTON, D. C.
Washington, D.C.
BFGS, 1801 New York Ave., N.E.
BFGS, 2316 Rhode Island Ave., N.E.

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Half a Mile Down With Scuba

Closed-system 'brains' help skin divers go deeper, stay down longer, surface faster

By C. P. Gilmore

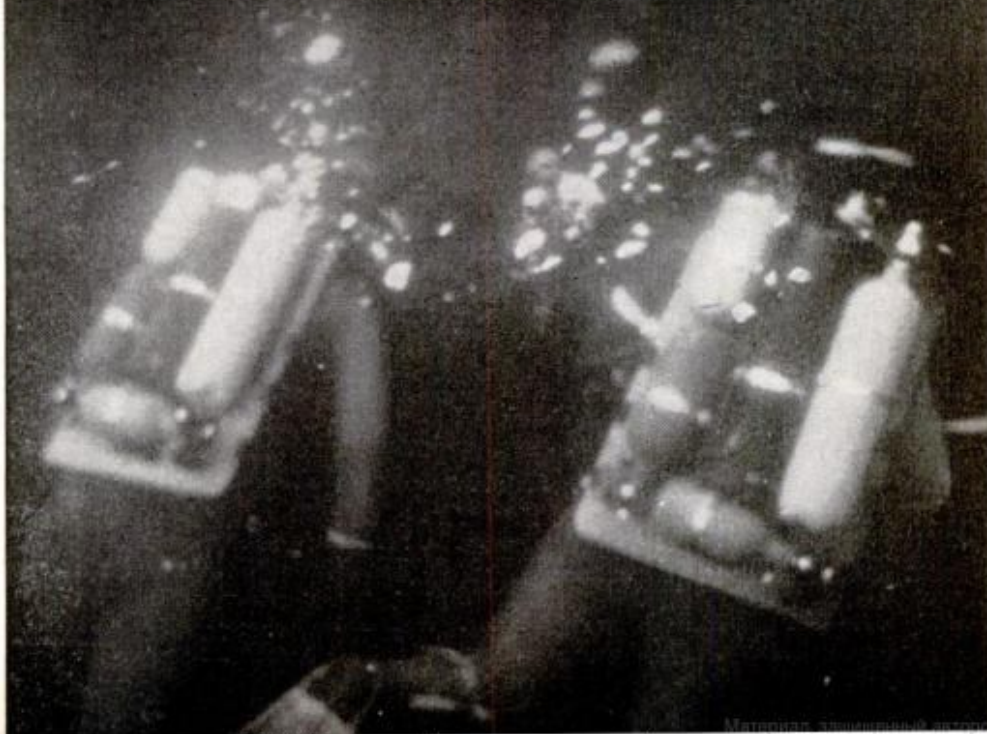
DRAPED OVER A CHAIR in the cluttered workshop, it looked almost like any other professional aqualung. A large tank was in the center of the backpack, and three smaller ones nestled around it. Two of the familiar, ribbed breathing tubes snaked out of the top and joined at a conventional scuba mouthpiece.

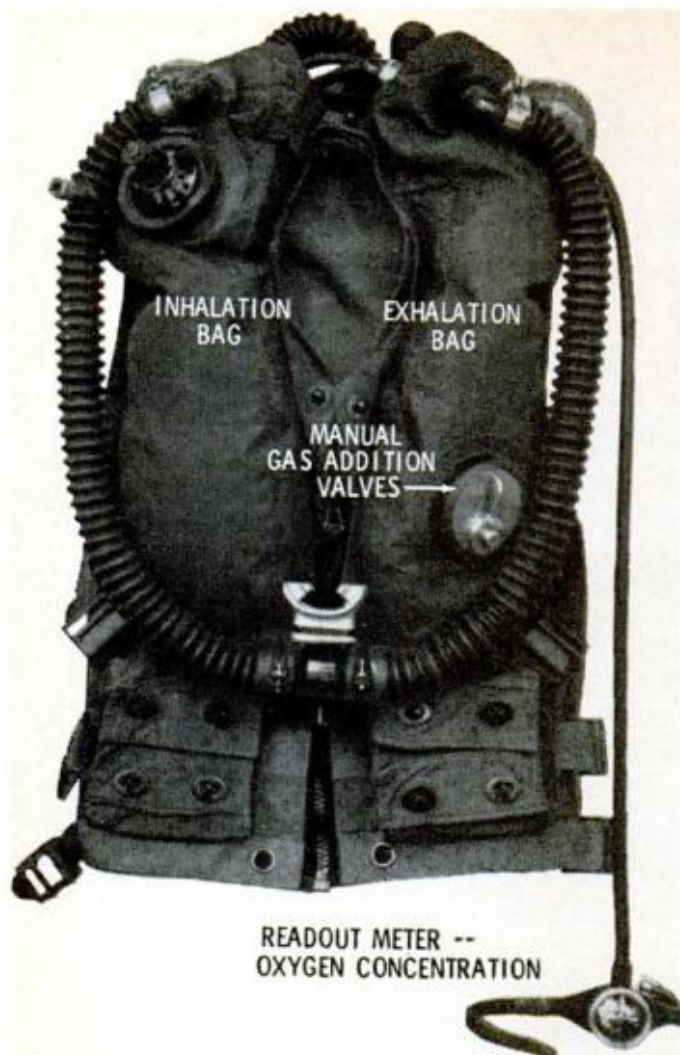
But despite its unremarkable appearance, this machine may be the most important advance in diving since the invention of the air pump. With it, man may soon swim and explore freely 1000, 1500, even 2000 feet below the surface of the sea.

The device that promises such astonishing performance is the Krasberg scubalung, invented four years ago by a 26-year-old student named Alan Krasberg. Since then it has evolved through four successively improved models, and is now under test by the Navy.

Like any aqualung, the Krasberg rig is designed to do one job; to enable man to live and breathe in a

KRASBERG'S REVOLUTIONARY LUNG is tested off the Massachusetts coast. It's thought that equipment of this type brings closer the time when man is capable of farming, mining and freely exploring the sea bottom





THE NEW RIG is a closed system that makes efficient use of its gases. It permits longer dives and shortens the time needed for decompression

hostile world he wasn't designed to inhabit. Down to 100 feet or so—which is roughly the limit for most sports diving—it's not a tough job. About all a diver needs is a tank of compressed air and a pressure regulator to feed it to him on demand.

But for really deep diving, the business of keeping a man alive begins to get complicated. In the realm of the tremendous pressures far beneath the surface, a whole set of exotic and unpleasant things begins to happen to the human body. It's these that the Krasberg machine is designed to counteract.

Oddly enough, it's not the most obvious difficulty—the crushing pressure—that causes the trouble. At least not directly. Human beings are composed of from 60 to 70 percent water, and water is virtually incompressible. So most of man's body is, for all practical purposes, pressureproof. The vulnerable areas are the cavities: the middle ear, sinuses, lungs. And even here, there's a relatively simple solution. So long as the pressure of the air a man

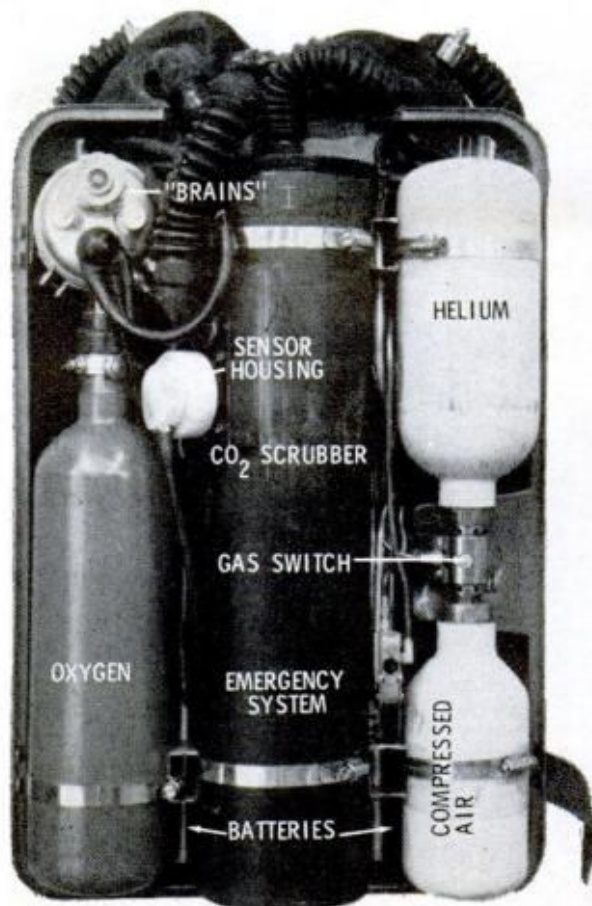
breathes equals the pressure of the sea outside, he's in no trouble. The internal pressure keeps outside pressure from caving him in.

The trouble begins, though at first not seriously, at 33 feet. Pressure at this level has increased two atmospheres (twice normal atmospheric pressure) and the gases in the lungs—mainly oxygen and nitrogen—begin to dissolve in the blood and other body fluids. Nitrogen in the blood acts like liquor. The deeper a man goes, the drunker he gets. Soon, nitrogen narcosis, the dread "rapture of the deep," robs a diver of his judgment. He may stay down too long and run out of oxygen, or decide he can breathe water—and try.

Nitrogen narcosis has killed many a diver, but it's really not hard to prevent. Professional divers who go below 150 feet for any length of time breathe not compressed air but a special mixture of oxygen and an inert gas, usually helium. On the Krasberg rig, a pressure sensor turns on the helium when the diver passes 35 feet on the way down.

But there's a greater problem than nitrogen narcosis. On the surface, oxygen sustains life. Too much of a good thing,

SECRET OF SYSTEM is its ability to change the proportions of oxygen and helium at various levels. The mechanism marked "brains" regulates the mixture



POPULAR MECHANICS

though, can be fatal. As a diver descends, his air pressure is automatically increased by his diving gear to counteract the increasing pressure of the water. For every 33 feet he descends, pressure increases by one atmosphere. At 200 feet, he's breathing air at seven times normal pressure, and thus inhaling seven times as much air as normal with every breath. His lungs hold the same amount, but each cubic inch of air contains seven times as many air molecules. Since the percentage of oxygen in the air remains constant, the actual quantity of oxygen in each breath has increased seven times.

Breathing a mixture of super-rich oxygen for too long causes oxygen poisoning. It begins with dizziness and nausea; progresses rapidly to muscle spasms, convulsions and death. Until the Krasberg device, there was no machine small enough to be strapped on a man's back that could deal with this lethal problem.

Alan Krasberg, a tall, reserved man, became interested in diving as a hobby back in 1950 when he was a high school student in Chicago. Later, during a stint in the Army, he was assigned the grisly business of underwater body recovery. "I had

the choice of that or desk work," he says. "At least, it got me into the water."

In 1960, Krasberg went to Harvard as a graduate student in astrophysics. But diving was still a major interest. He lived in a cooperative house with four other students, and found a way to put his hobby to work. "They furnished the meat and I furnished the fish and lobsters," he recalls.

Where most skin-diving enthusiasts are satisfied to strap on a tank of air and dive to 75 or 100 feet, Krasberg became fascinated by deep diving. The problems of nitrogen narcosis and oxygen poisoning were, of course, well known. At least one large company was working under a Navy contract trying to build an aqualung to solve them. Krasberg went to work on the problem independently.

The principal stumbling block was the lack of a good oxygen sensor that would measure the amount of oxygen in the air regardless of pressure. And where others had failed to design such a device, Krasberg succeeded. By the summer of 1961, he had built a gadget about the size and shape of a small microphone that did the job. The more molecules of oxygen in the air surrounding the instrument, the great-

OVER THE SIDE in a preliminary test. Until the Krasberg lung came along there was no device small enough to strap on a man's back that would protect him from being poisoned by too much oxygen—a danger in deep diving

NBC News photo



er the voltage it put out. And it worked regardless of pressure, regardless of the presence or absence of other gases.

The Krasberg oxygen sensor was ideal for regulating the amount of oxygen available to the diver as he descended. Krasberg rigged it with an electronic control circuit to work like a thermostat. As the oxygen level in the breathing circuit falls, the sensor opens a valve and lets more in. When oxygen reaches a predetermined level, the sensor closes the valve.

Krasberg built a scuba-diving lung to test the sensor. It was crude, but it worked. Next, he joined forces with the Emerson Company of Cambridge, Mass., to get help in building a more refined version. Then he and Emerson set out to interest the Navy. (Emerson's scuba-lung division has since been acquired by the Westinghouse Corp. Underseas Div. and Krasberg now works with that organization.)

Navy Tough to Convince

Cutting through Navy red tape proved sticky. At first officials refused to believe that the improved scuba rig even existed. Their attitude, says Krasberg, added up to this: "It's impossible for you people to

have done this, because you're a little company without government research money. So obviously, you haven't done it!"

But eventually the Navy agreed to test the device and diving experts were impressed. "The oxygen control maintained, and the limited amount of oxygen utilized by the diver shows promise to provide a safe respirable breathing mixture at depths exceeding 1000 feet," the Navy reported in a cautiously and curiously worded evaluation. Krasberg got a contract to build three more units for further testing. The tests are now underway.

Krasberg's machine, along with preventing oxygen poisoning, has several other important advantages. One major difficulty in deep diving, for example, is simply the matter of taking along enough gas to last the whole trip. Most divers use so-called "open circuit" devices. The ordinary compressed-air aqualung used by amateurs is a good example. The diver takes a breath from the tank, exhales into the water. It's a wasteful process, since near the surface his lungs absorb only about 4 percent of the air he breathes in. The other 96 percent he breathes out again.

As depth increases, the problem gets

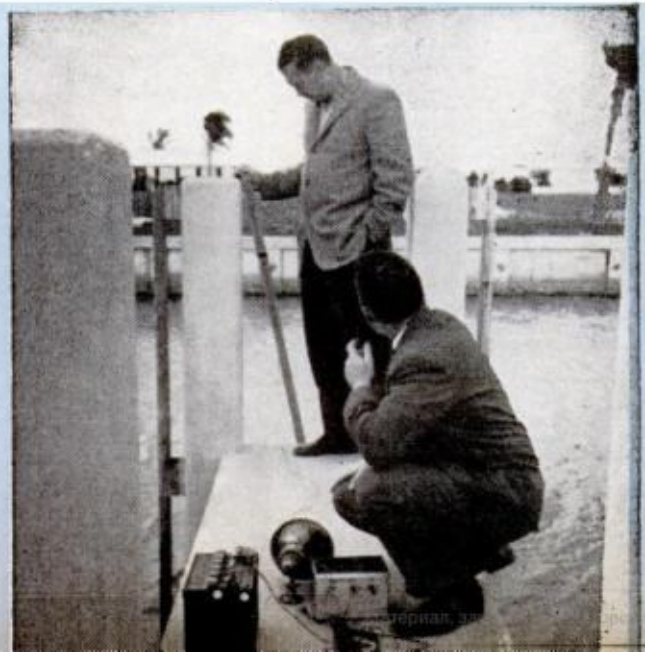
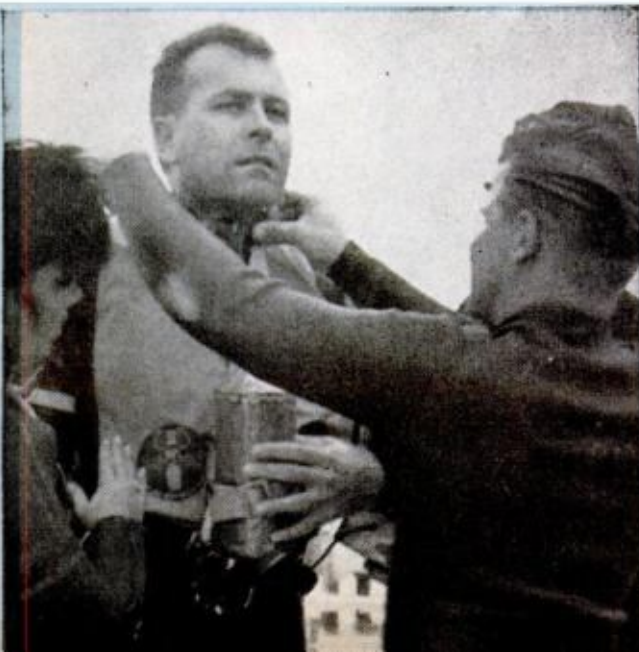
Talking Like a Fish

A POSSIBLE BREAKTHROUGH in underwater communications has brought scientists and Navy experts to Sarasota, Fla., where Wallace L. Minto has his laboratory. The lure: a system that could make other methods obsolete.

The Navy now can contact its subs by

radio, but only if the sub is less than 30 feet deep. The transmission takes loads of power and the sub can't answer unless it sticks an antenna above water.

The Minto system is said to overcome all of these obstacles. Though the signal used is essentially electromagnetic, ex-



worse. Because the air is now highly compressed, the diver takes in far more with each gulp—7 times as many molecules of air at 200 feet, 13 times at 400 feet, 25 times at 800 feet. In a very deep dive, the entire tank would be exhausted after a few breaths. Yet the diver actually uses only the same amount he would have used at the surface, a tiny fraction of the total that passes through his lungs.

Licks Oxygen Problem

The obvious way to solve this problem is to recirculate the air, to use a closed system. Navy frogmen who might be spotted by their bubbles on a wartime mission have used closed systems for years at relatively shallow depths, where oxygen poisoning is not a serious problem.

But a closed system without an accurate, reliable way to control oxygen saturation could be lethal at great depths. With Krasberg's system, the oxygen-level problem has been solved. No matter how great the depth, the oxygen stays within safe limits.

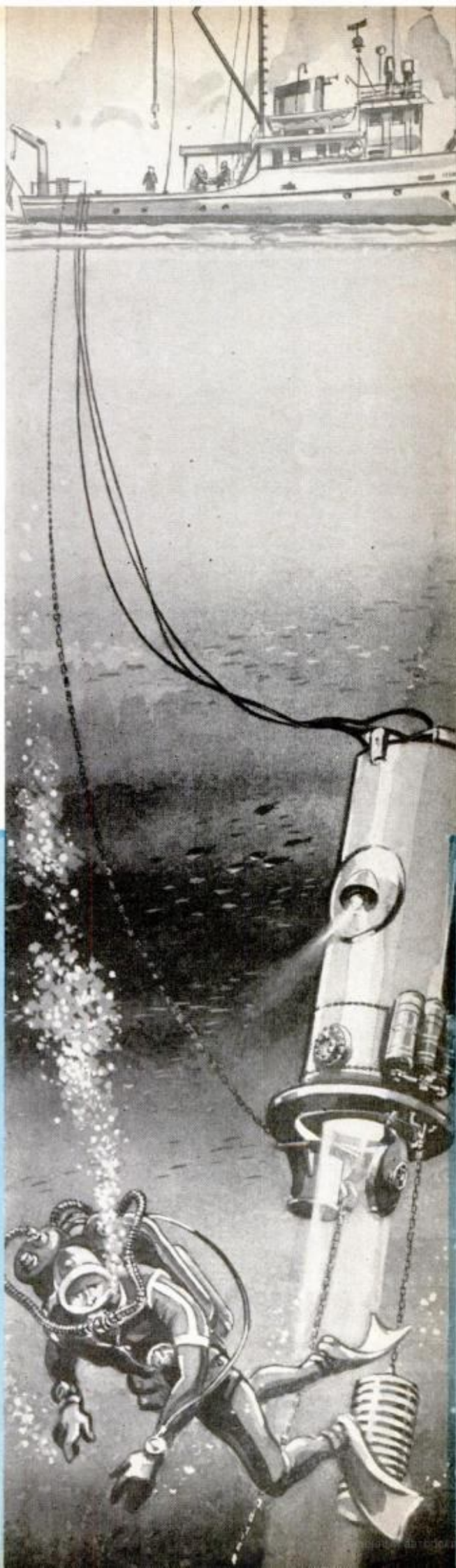
The system is efficient, too. The foot-long tank of high-pressure oxygen, used only as needed and not wasted through an

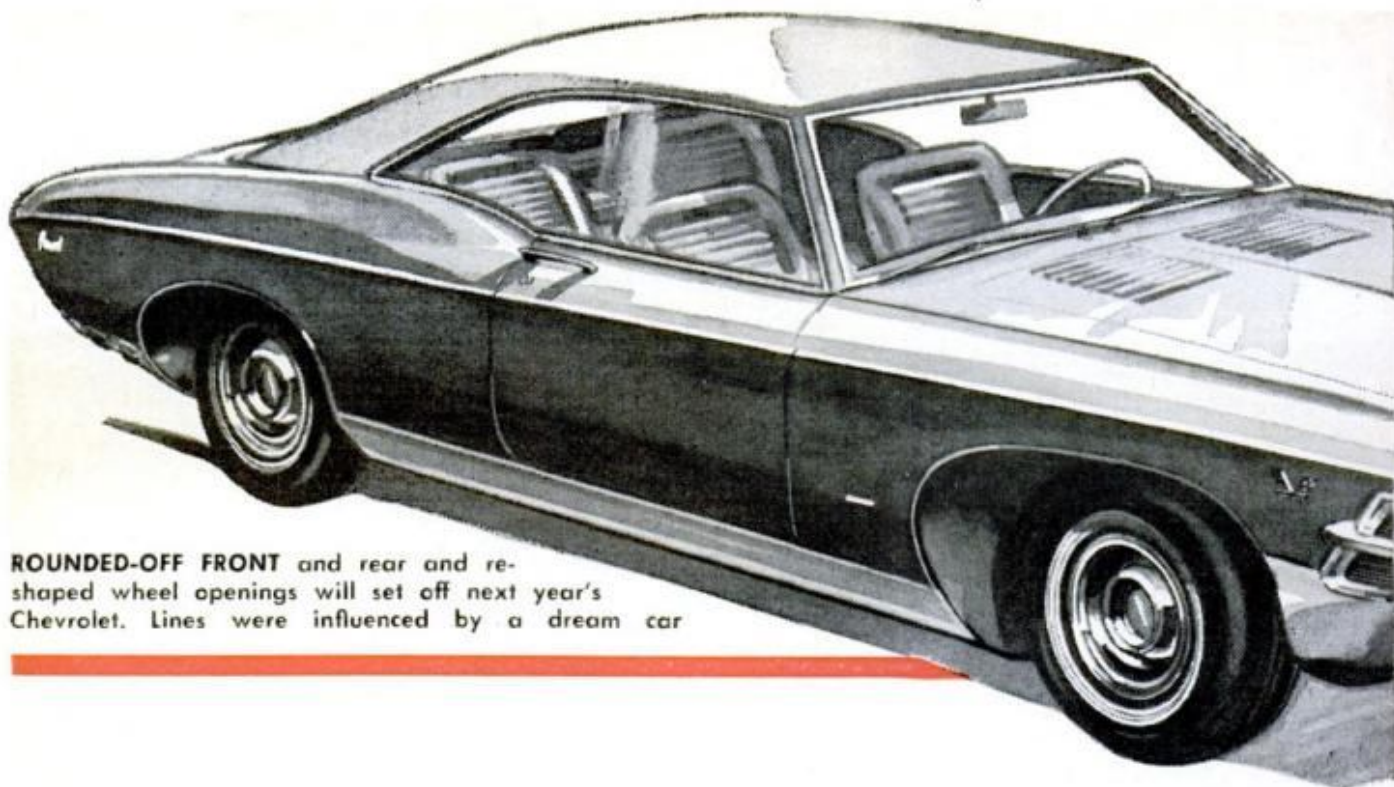
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plains the inventor, it doesn't behave like a radio wave, which is readily absorbed by water. He calls the signal "hydronic radiation" and thinks it is part of a "new spectrum" of radiation. He discovered it while doing research on underwater sound transmission, tracing it to fish. They apparently have their own version of radar.

Minto uses special antennas that emit and receive hydronic waves. (On page 68 he is seen holding an antenna underwater during a demonstration.) The senders and receivers use "conventional transistors, capacitors and resistors" and can be built compact enough to fit around a diver's neck (as you can see in other photo).

Minto says he has picked up hydronic code signals at a range of 30 miles and a voice transmission at 5 miles. In addition to obvious applications (communications between divers, or between subs and mother ships), Minto envisions hydronic radiation being applied to underwater radar as well as to transoceanic telephone and television service.





ROUNDED-OFF FRONT and rear and re-shaped wheel openings will set off next year's Chevrolet. Lines were influenced by a dream car

Detroit's '66 Surprises

More sporty fastbacks, a dramatic overhead-cam engine and a wagon's swing-or-drop tailgate are among entrees PM scouts found on the menu

By Alex Markovich

Associate Automotive Editor

THERE MAY BE A "MUSTANG" in your future—but not necessarily built by Ford. Other car makers, eyeing Mustang's success, will bring out new fastback "personal" cars. Next year, even sedans will have more slippery lines and near-fastback roofs.

The greasy-nuts-and-bolts department also holds some surprises for '66. One manufacturer is ready to spring a production overhead-camshaft engine; other engines will be bigger, guttier and more sophisticated. Front-wheel drive will make a comeback. More disc brakes are coming. Even the combination shoulder harness and lap belt may make an appearance.

Why is Detroit on a sports-car kick? It goes back many years, when we all drove big, bumbling sedans—and liked it. Everyone, especially Detroit, laughed at the funny little foreign roadsters that had begun sneaking into the country.

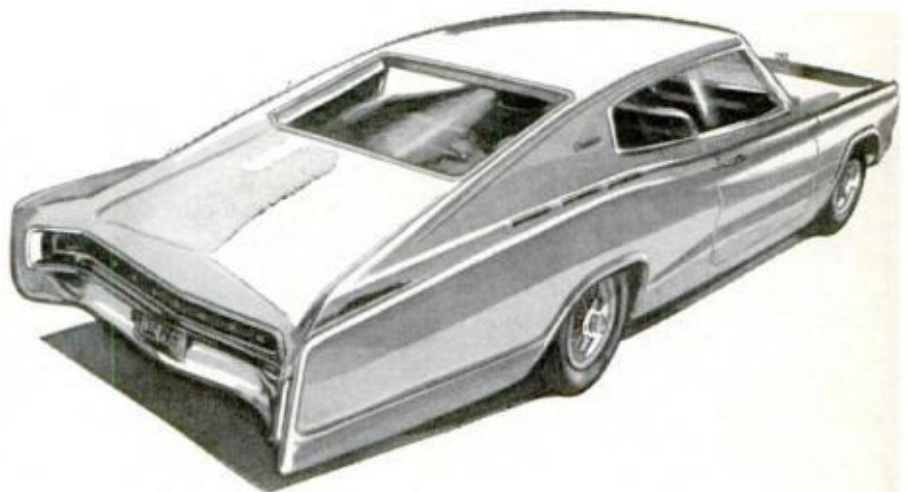
But the imports made rude noises when they passed. Soon everyone, especially Detroit, stopped laughing. Car builders got busy thinking up sexy foreign names like *Luh-Mahnz* and that helped sales. Then they staged a parade of assorted,



FIBERGLASS MAY FIND limited use in bodywork of Mercury's '66½ fast-back. Styling resembles that of Cougar II idea car, but middle is stretched to make room for four seats. Car will be slightly longer than Mustang



FRONT-WHEEL-DRIVE OLDS has an unusually low silhouette, a wheelbase slightly larger than F-85's, a long, sloping hood, abbreviated tail section and fastback roof. Headlights recede into hood's leading edge



ANOTHER DREAM-CAR TAKEOFF, the Dodge Charger will have fastback roof flowing into a single full-width taillight. Skimpy bumpers on the show-car version will be beefed up, and trim will be juggled slightly



JEEP-LIKE four-wheel-drive Bronco will be introduced by Ford. Base price will be low, but civilized extras such as a hardtop will jack it up

vicious critters: wildcats, mustangs, barracudas, sting rays; along with tighter suspensions, safer brakes, gobs of power and, most important, sporty styling. Sales soared.

This is the cozy position in which Detroit finds itself today. Sales are still soaring, and Detroit isn't about to give up its stranglehold on the youthful exuberance of the American car buyer. It adds up to big news for '66.

Lincoln-Mercury's upcoming fastback four-seater, tentatively named Cougar, will be slightly longer than Mustang, with styling resembling that of the Cougar II idea car of a couple of years ago. It will be a '66½ model (but you register it as a '67).

Chevrolet and Pontiac also have "'67" fastbacks for '66½. Both will share the same shell, probably on a 110-inch wheelbase, but will have different styling.

Rambler's Marlin fastback will stay pretty much the same, but a longer Ambassador-wheelbase version will debut next fall. Working name: Marlin II.

Mustang will stay as is except for snout,

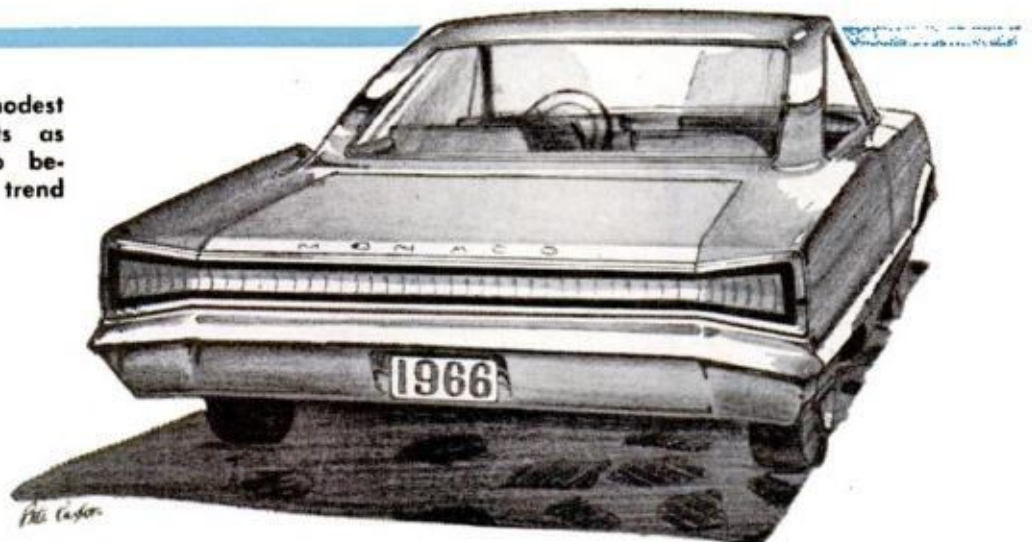
trim and taillights. More options will be offered, but not the long-rumored independent rear suspension. Carroll Shelby (that man who builds Ford Cobras) improved handling by modifying the live-axle rear suspension on the Mustang GT 350 at far lower cost than that of an independent setup. Eventually, when Ford reaches the bottom of its bag of handling tricks, i.r.s. may come.

Barracuda is due for a new front end and other new sheet metal, but will continue sharing mechanical parts with Valiant. Corvette will stay basically the same next year, but will be redone in '67—picking up the styling of the Mako Shark II, a way-out dream car that's as friendly looking as its namesake.

Cinderella Look for 'Little Sister'

Generally, 1966 styling and engineering changes won't be as sweeping as this year's on full-size cars. There will be new sheet metal, but most body shells will be carried over. The compacts, however, face big changes and a new image.

BIG DODGES will rely on modest facelifts. Full-width taillights as on the Monaco promise to become an industry-wide style trend





CRISP LINES will distinguish Fairlane. It will be bigger, heavier, and will be advertised as a true "family sports car"

There's not much market for a poor man's car, so compacts will grow like crazy. Comet, for example, will gain seven inches in length, two in wheelbase. Falcon will stretch too, bringing both these cars up to the Fairlane class and allowing parts interchangeability. They'll share a unitized body shell with Fairlane, which also will be bigger.

All three will have simpler front ends and possibly concave rear windows, and will resemble the present Pontiac GTO. Comet will have two hood scoops and optional power windows. The three cars also will offer an optional 390-cu.-in. V8—part of a package including heavy-duty suspension, bucket seats and trim. The middle-line Comet 404 will be re-named Capri. Lincoln once used that name, remember? All three cars, along with Mustang, may offer a stroked 325-inch version of the 289 V8.

New sheet metal, grilles and taillights are in the offing for Dodge Dart and Plymouth Valiant. Their big changes come in '67. There's been talk about a V6

replacing the slant-Six; this may be in '67.

Corvaire just had a big change. Next year, only trim will be juggled. Discount rumors that Chevy II will die. It will be around at least two more years. It's the only GM car due for a new shell. Styling will be less boxy, more like Corvaire's.

The B-O-P compacts—Buick Special, Olds F-85 and Pontiac Tempest—will be completely facelifted, and, along with Chevelle, will get four-door hardtops.

Valve Train's Last Stop?

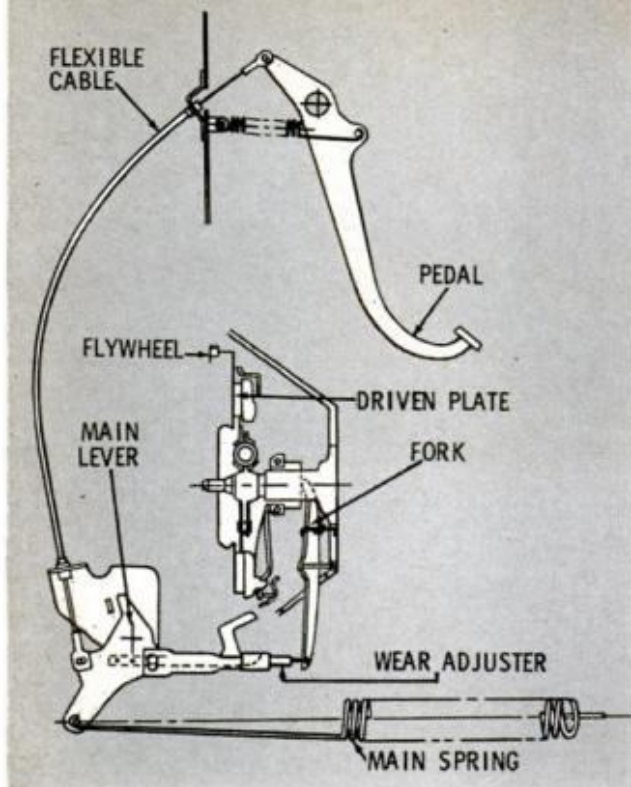
The big news is a Tempest overhead-camshaft Six. It's basically the present 232 Six, with about the same cubage. OHC design is definitely the coming thing; by eliminating push rods, tappets and followers it offers simplicity, better breathing and higher revs. This Six won't come from Chevrolet, as today's does, but will be made by Pontiac.

The current Chev Six may replace the Special and F-85 225-inch V6, and displacement of the Special V8 will grow.

Olds 4-4-2 and Buick Skylark Gran

HORIZONTAL QUAD headlights, kicked-up quarter panels and curved side glass will appear on the '66 Coronet. Entire body shell will be changed





PEDAL EFFORT is cut in half by a new Rambler clutch that pivots a spring on the main lever. An automatic adjuster is used to compensate for facing wear

Sport will offer more optional speed goodies to counter the Pontiac GTO triple carbs. Dual four-barrels and hot cams are likely. Also, they will get the more efficient Turbo Hydramatic automatic in place of the two-speed.

Rambler sedans will have minor sheet-metal changes, new grilles and new taillights. Wagons will drop the stepped roof line. The Marlin influence may be felt in sedans through larger rear windows.

Classic and Ambassador six-cylinder stick-shift models will get a new Borg & Beck "S" clutch, the newest in 30 years. It needs less pedal pressure because of a different linkage, placed between the clutch levers and main load spring. The clutch is also lighter and less expensive. The Big Three are expected to pick it up in '67.

Rambler will retain the dual master brake cylinder, which it pioneered. Other manufacturers will also pick up this safety feature because of government pressure. In fact, Merc Comets competing in the East African Safari Rally used double master cylinders. Wagner Electric Corp. is tooling for the unit but won't name the buyer.

A Rambler engineer admitted that the metal trim along the edges of the curved side windows of hardtops was almost

dropped for '66 to save on cost, but at the last minute was retained. *PM Owners Reports* on other cars have drawn many complaints about trimless windows.

Styling changes will be minor at Studebaker. Emphasis will be on interior luxury, with wood-vinyl dash and door paneling and extended carpeting. The double master brake cylinder and optional disc brakes will continue. Incidentally, Studebaker says their disc linings average 20,000 to 25,000 miles.

A new body shell and radical styling are in store for the Chrysler intermediates: Dodge Coronet and Plymouth Belvedere. Coronet will get horizontal quad headlights and a high rear-end kickup. Both will get curved side windows. Dodge will also bring out a new '66½ model, the Charger, on the Coronet wheelbase. It will feature extreme fastback, full-width taillight and exposed roof rails.

Chevelle will have a new roof line and sheet metal closer to the rounded lines of larger GM cars.

Push or Pull—Which Will It Be?

Among full-size cars, Oldsmobile's front-wheel drive (fwd) will be the most radical. The "Toronado" will share a body shell with Buick Riviera. Buick, however, will hold off on fwd for at least a year.

The car will be a fastback hardtop on an intermediate wheelbase, weighing 4500 pounds or so and costing about a dollar a pound. Styling features include a long, drooping hood, abbreviated rear deck and disappearing headlights. The avant-garde interior features a speedometer with a red line and revolving drum.

The engine is a hotted-up 425-in. V8



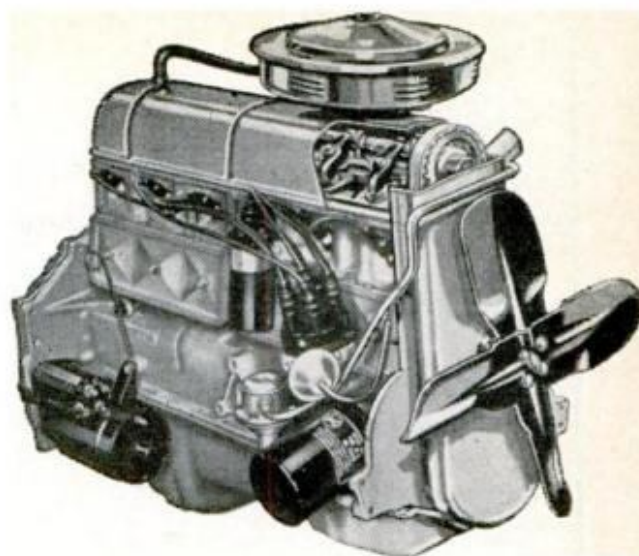
No performance options are planned immediately, but displacement may be jacked up to 447 by '66½. The engine is set far back for better weight distribution, and offset to the right to make room for the automatic transmission. The torque converter behind the transmission is chain-driven from the crankshaft. The chain is reported to be silent except when the car is cold. Short U-joint shafts, about the length of the lower A arms, drive the front wheels. A short cross shaft at the right of the differential, in pillow bearings, drives the short right final shaft. U-joints carry large rubber boots. The oil pan is deeply notched for clearance.

Front suspension is by longitudinal torsion bars on the lower A frames, and the two-leaf rear springs mount on a simple dead rear axle stamped from sheet metal in a general hat section. The frame is a typical GM low-height perimeter type, heavily reinforced at the front.

The main advantage of front-wheel drive is the absence of a floor hump. There's no driveshaft running to the rear wheels.

The car is reported to have uncanny directional stability and heavy understeer, typical fwd characteristics. Cornering is said to be no better than that of current rear-wheel-drive cars. Steering is light, and it has some self-centering action, but transmits little road feel, according to reliable sources. Traction is excellent in mud and snow. Ride is said to be comfortable and pitch-free.

Ford Motor Co. has been toying with fwd, but isn't ready for production. A '65 Galaxie and three six-cylinder Falcons all have been scurrying around Dearborn



HOT-ROD VERSION of Pontiac overhead-cam Six will rev past 8000 and develop over one hp per cu. in.

lately. The Falcons have suffered from excessive gear noise, but this could be corrected with different gears and additional insulation. Handling around the Ford test track and in snow is reported excellent.

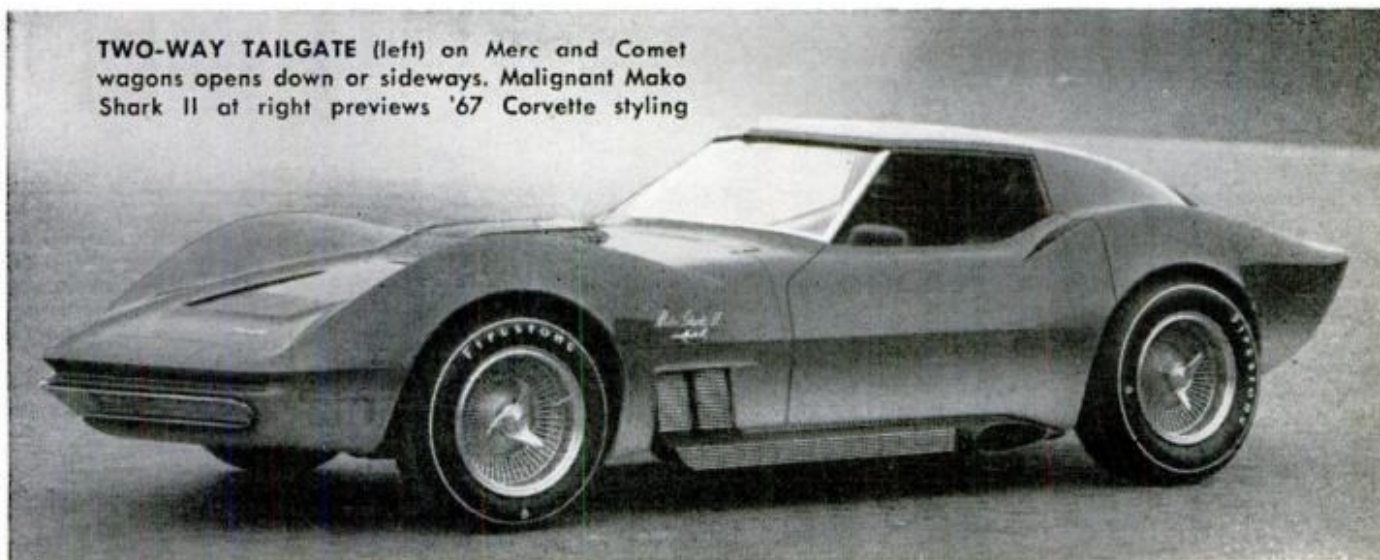
Designing a Safe Front-Wheel Drive

When the French Citroen fwd was designed, engineers started with the front end, then jiggled the rear wheels back and forth until the package handled—which explains its weird styling. Length of wheelbase is especially critical with fwd.

One problem is that cornering behavior tends to change drastically with throttle opening, ranging from marked understeer when cornering under power to sudden oversteer while braking. The rest of the industry still regards fwd as a bit of a handful to throw in the lap of the average motorist—even though foreign motorists

[\(Please turn to page 192\)](#)

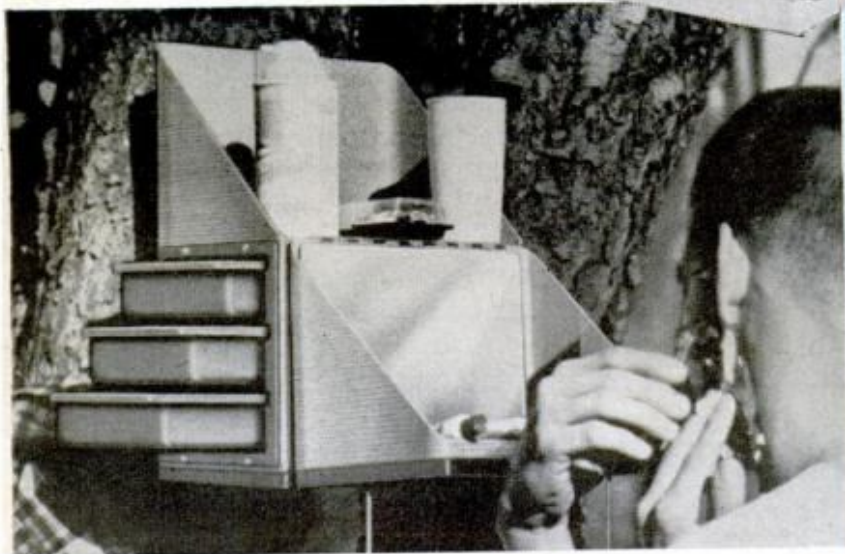
TWO-WAY TAILGATE (left) on Merc and Comet wagons opens down or sideways. Malignant Mako Shark II at right previews '67 Corvette styling





Campers' Cabinet

Incorporating a mirror and compartments for a variety of toilet and first aid articles, the Medi-kit is a traveling medicine cabinet. Made of aluminum, it is equally at home in camper or hung on tree. Price \$18.75 from Vesely Co., Lapeer, Mich.



Smoky Starts

Using explosive cartridge charges, a flight of Air Force B-57 jets starts up somewhere in Southeast Asia.

The cartridges energize the engines, allowing the bombers to operate from forward bases without electric power cables or generators.



Love and Kisses



For a Baseball Bat

It's just a stick of wood, but a ball player will pamper it, sleep with it, cure it and caress it, rub it with a turkey bone, and then swear that it's magic

By Sam Elkin

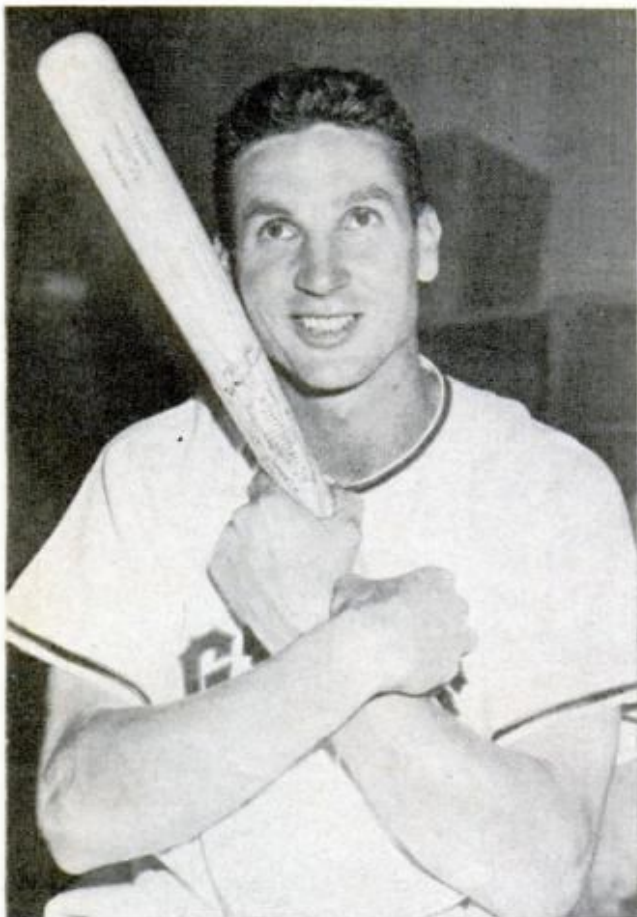
"IT'S ALL SUPERSTITION," said Peanuts Lowrey, a former baseball star who is now a coach for the Philadelphia Phillies. "There's nothing to it. It's all in a guy's head."

He was offering his opinion on a mystique that prevails among baseball players—that a bat can develop supernatural powers, giving its owner a decided edge at the plate.

"It's like a slump," Lowrey added. "A slump starts with your swing, goes to your head and ends up in your guts. Same thing with pampering a bat. It's all nonsense."

What he said made sense, except for the fact that while he talked he was performing an extra service for one of his players—rubbing the barrel of a bat with the rounded inside curve of a turkey bone.

"Ah, this don't mean nothing," he explained when I drew atten-



BOBBY THOMPSON hugs the bat that belted pennant-winning home run for the New York Giants in 1952. The factory superintendent (below) for Hillerich & Bradsby displays a quartet of famous bats (left to right), a stock model, Heinie Groh's bottle bat, a model belonging to Pete Browning, Wee Willie Keeler's 31½-incher and a mammoth 42-inch club



tion to the odd ritual. "I'm just humoring the guy. This is the way he tones up a bat."

When I mentioned that the ball player was not there to watch him he said, "Yeah, I know. But the kid's hittin' good, see, and I don't wanna take no chances."

Ambiguous? Of course. But that's what makes baseball. Take Ted Williams, for instance. Couldn't ask for a more down-to-earth guy. Solid businessman. Loaded with brains. Very practical. But he would rub resin and oil into the handles of his bats until they were black. And every day of his playing career he lovingly bathed the handle of a bat that was hitting in alcohol to keep it cool. Or take Frankie Frisch, the old Fordham Flash who played for the New York Giants under John J. McGraw. He used to hang his bats up in a barn like Italian sausages and massage them with bone all winter.

I remember a pitcher in the minor leagues who had a real case of bat voodoo. This was back in 1938 and we were both playing for the Monessen (Pa.) Redwings, a farm club of the St. Louis Cards. This fellow was a competent pitcher and weak at the plate, but as far as he was concerned he was a long ball hitter and as soon as his bat got in tune we'd all see his true value. He had one bat and he owned it. He bathed it in linseed oil, rubbed it down with liquid wax, wiped it dry when it got caught in the rain, and at night he took it to bed with him, the handle peeking out from beneath the covers and resting next to his head on the pillow. Still, he wasn't getting any hits.

I was his roommate and I kidded him plenty about that bat, but one night I said, "I've figured out what's wrong. You gotta turn that bat around. You've got all the sap running to its head."

His eyes bugged with understanding. He sat up in bed, turned the bat so that the barrel was on the pillow, then nestled down next to it and went to sleep with a blissful smile on his face.

The next day he pitched himself a no-hitter, and in the last of the ninth he went up to the plate, took a cut at the first pitch and belted it out of the park for a grand-slam homer. This is the sort of thing that makes you wonder about superstition.

The two major manufacturers of baseball bats for the big leagues will not lend credence to any claims of bat voodoo, but even they hedge around the subject.

A spokesman for Hillerich & Bradsby

Co. of Louisville, makers of the famed "Louisville Slugger," said, "If a batter feels extra bat-coddling will raise his average, that's his business."

Hal Schumacher, a former New York Giant pitcher who worked in the shadow of the peerless Carl Hubbell, is now a vice-president of the Adirondack Bat Co. of Dolgeville, N.Y., second largest bat maker in the country, and he takes a cautious stand.

"A good eye, a level swing and a strong follow-through will get a hitter more than his share of base hits," Schumacher said. But when he talked about his playing days he said, "When I was on the mound and facing a good hitter, I always tried to put a curse on his bat."

"A fine bat is a combination of the best wood and the finest craftsmanship," said Jack McGrath, advertising manager of Hillerich & Bradsby. "This is the only sorcery we indulge in."

Pampered from Birth

Big league baseball bats are made from northern white ash. The trees are grown in special groves where they are evenly spaced and pampered to assure a grain that is straight and even. The soil is enriched and kept moist to insure a high tensile strength and resiliency in the wood.

When a tree is felled, it is cut into 40 to 42-inch bolts and then divided into splits which are turned into roughs or billets. The billets are then stacked outside to dry. After 10 to 18 months of aging, each billet is turned on a semi-automatic lathe, rough-sanded by automatic machine, the end trimmed, and then it is automatically stained, filled, lacquered and burnished.

But this process, the manufacturer admits, is often preempted by superstition. The big leaguer who has a "thing" about his bats will make a trip to the factory and select his own billets. His bats are hand-finished to his exact specifications.

Ted Williams used to spend hours looking through timber stacks for narrow-grained wood because he believed the narrower the grain, the stronger the wood. On the other hand, Dick Bartell and Al Simmons were certain the widest grain made the wood less likely to splinter.

Eddie Collins used to choose his bats from half red and half white timber, while the legendary Hugh Duffy had to hear a certain ring from the wood when he bounced it off a concrete floor. The great

Babe Ruth wanted wood with pin knots at the center of percussion because he believed the ball would get away faster.

But once the ball player carries his bat into the box the voodoo almost always comes into it. In many cases the personal care is supposed to make the bat stronger or livelier. Honus Wagner boiled his bats in creosote to harden the wood, but most ball players will swear that the "juice" from the inside curve of a turkey bone will do the same job. Then there is tobacco juice, tar and any number of secret salves. And then there's just plain affection.

"You get one that's hitting good," said Richie Ashburn, ex-Phillies' batting star, "and you nurse it along, and son-of-a-gun if you don't develop a real affection for it."

This was illustrated last year when Nellie Fox of the Houston club singled home the winning run off Gaylord Perry of the San Francisco Giants. While Fox loped down the first base line, Perry rushed to the plate, grabbed the offending bat and shattered it against the dugout steps. Fox was stunned. When he came to the dugout he dropped to his knees and cradled the broken bat. "I just had her where there was some base hits in her," he wailed.

But, of course, not all the great hitters were superstitious. When Billy Goodman was belting them for the Boston Red Sox he was once asked which side of the bat he held up when hitting—the label or the blank side.

"I don't go up there to read," he snorted. "I go up there to hit." ★★★

ORIGINAL MODELS of special big league bats are stored in a large vault in Louisville, the specifications a top secret between the maker and the player





Cabin Rests on Air

Substituting a fan for tent poles, campers may take to the outdoors in a four-room cabin supported only by air.

Operating on the same principle as large commercial units such as greenhouses, it is kept erect by maintenance of slightly more pressure inside the structure than outside.

The 14 x 17-foot cabin weighs 100 lbs., and can be erected in three minutes when a fan operating off a $\frac{1}{3}$ -hp gasoline generator blows air into the doorway. To strike the cabin, one simply turns off the fan and folds it up.

Available from Economy Air Structures, Box 914, Dothan, Ala., it is priced at \$295.



Scootboard

Designed to take any outboard up to 12 hp, a new stand-up novelty boat is steered through control lines. The 140-pound hull is 12½ feet long, 39 inches wide and carries enough built-in flotation to support up to 400 pounds. It's equipped with an automatic cut-off switch for safety, and has a top speed of about 40 mph.

Priced at \$395 without motor, the fiberglass Ski-Flee is available in a number of colors from Penguin International, 14920 S. Main St., Gardena, Calif.



SKATEBOARD ACROBATICS



Experts do headstands, barrel and people jumps; some hop up mounts with gas engines

By John Boykin and Bob Grant

A PROMINENT PSYCHOLOGIST says that "the skateboard is a symbol of defiance, the young people showing their elders that they have scorn for all the things that they have been taught about the preciousness of life and safety of limb."

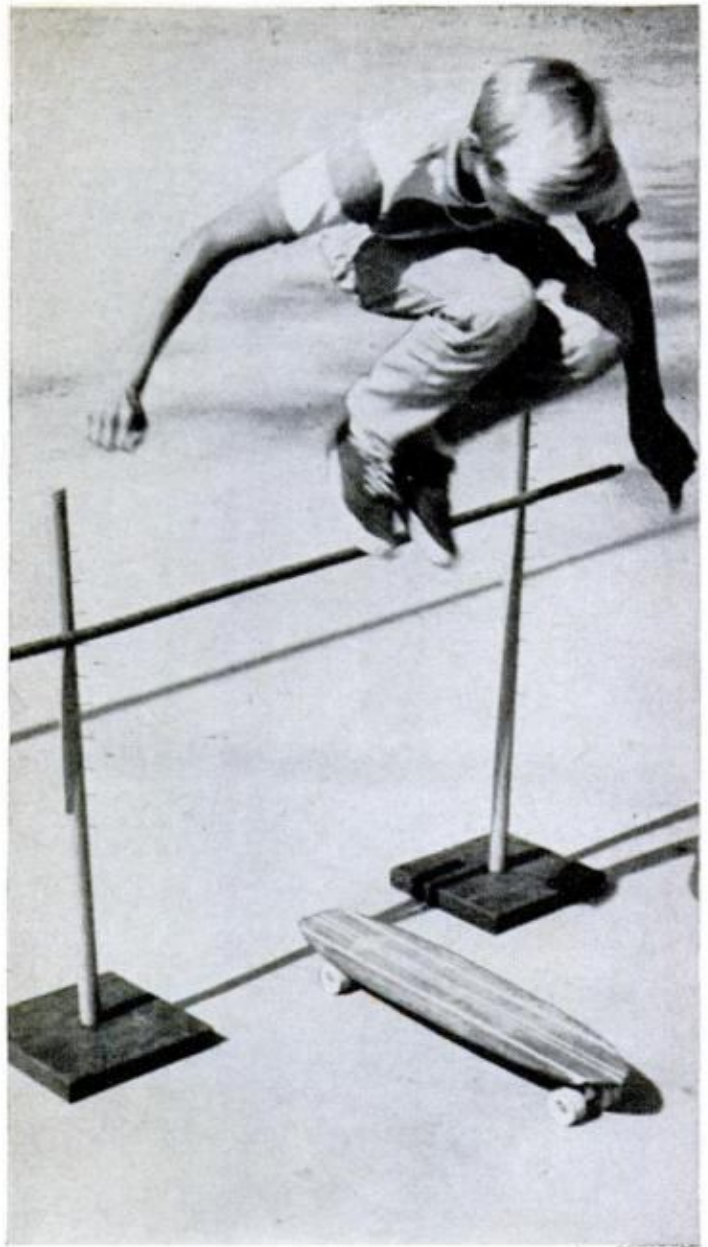
If this is true, then the youth of America is in full-scale rebellion, because nowadays the youngsters are going from the



teething ring to the skateboard with hardly a hitch. And besides using them to whiz through an intersection and see how many motorists they can terrify, the skateboarders have added some new wrinkles: handstands, high jumps, kick turns and riding along with a board on each foot. For competition, they run a slalom course set up like a ski slalom.

The best of the stunt skateboarders are a group of youngsters gathered together by the Vita-Pak Co., a California manufacturer of the boards. They are currently touring the country giving exhibitions.

Two of the hairiest stunts they perform are the high jump and the curb jump. In



RECORD FOR HIGH JUMP is four feet. In this stunt the skateboarder rolls up to the bar, makes the jump and lands on the board in complete control

IF YOU CAN do a handstand on the ground, you can do it on a skateboard. The trick is to have the board moving at a good clip to maintain balance

the high jump the skateboarder rolls up to a crossbar suspended on two sticks. As his board goes under the bar he jumps over it and then lands on the moving board. Curb jumping is like the ski jump—riding off the end of a ramp and keeping the board in control, both in the air and after it lands.

And if skateboarding wasn't enough as it was, now they have added a motor and are racing an 18-pound board like a go-kart. These are steered by shifting body weight. Although they only go 16.6 mph, on a plank and a skate wheel a few inches off the ground this speed can feel like the back stretch at Daytona.



JUMPS ARE DONE by shifting weight to rear wheel to keep front up, and then shifting weight forward in the air to bring the board down on four wheels

DOING THE COFFIN between the legs of a skateboarder on two boards requires skill. It takes about four months to learn to control a pair of boards

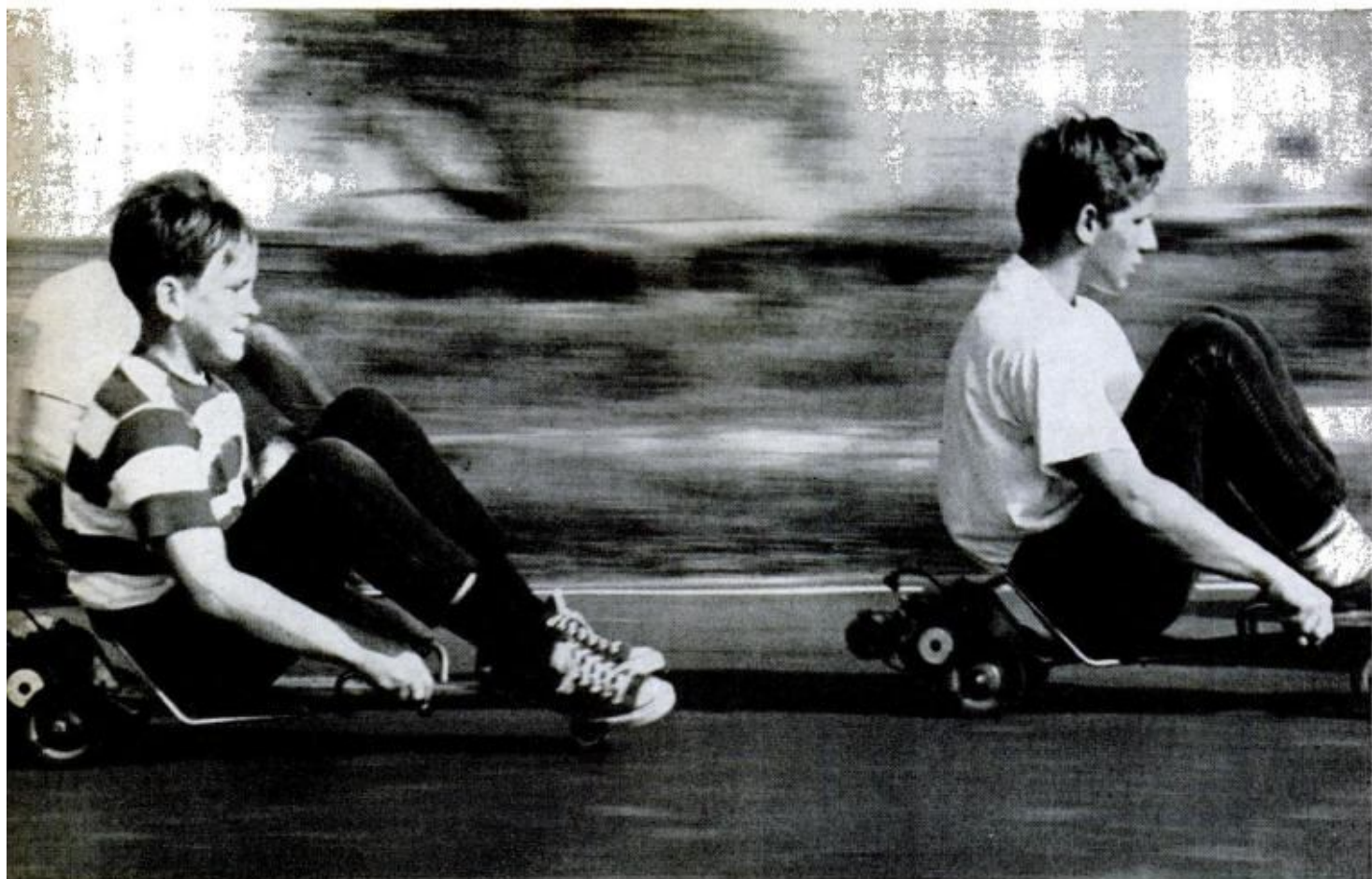


ONLY EXPERTS can try this one. While one boy does the coffin sideways, another makes a jump over his legs and lands on his board in complete control

SPEED AND TIGHT TURNS are the main ingredients in the slalom race. The course is generally set up on a hill and tin cans are used to make the "gates"



Gravity and Man-power Yield to Gas . . .



MOTORIZED SKATEBOARDS are steered by shifting the weight of the body. They have a top speed of only 16.6 mph, but when you're riding a slender board close to the ground, it feels as though you're "hauling the mail"

CUSTOMIZED skateboard has been equipped with headlights, taillights and a horn to make it eligible for a legal highway registration in California



NOT EQUIPPED FOR RACING, this skateboard uses a motor to get it up the hills. Gears are disengaged at the top and it is ridden like a regular board





ROUGH TERRAIN doesn't stop the motorized racing models and they will go just about anywhere that the driver has the skill and nerve to take them. Since the drivers are close to the ground, there are few major injuries

REAR WHEELS on the 18-pound motorized model are five inches in diameter, and the front wheels are Chicago roller skates. Most of them are powered by an .85-hp two-cycle gasoline engine that runs on outboard motor fuel





GOING UP, a sand sailor hauls on his sail in a desperate move to right his craft as he tries to make a tight pylon turn in a long distance oval race



AND OVER HE GOES, as the wind takes the sail and capsizes the rig. This is all part of the excitement when the sand sailors are in racing competition

Desert Windjamming: A

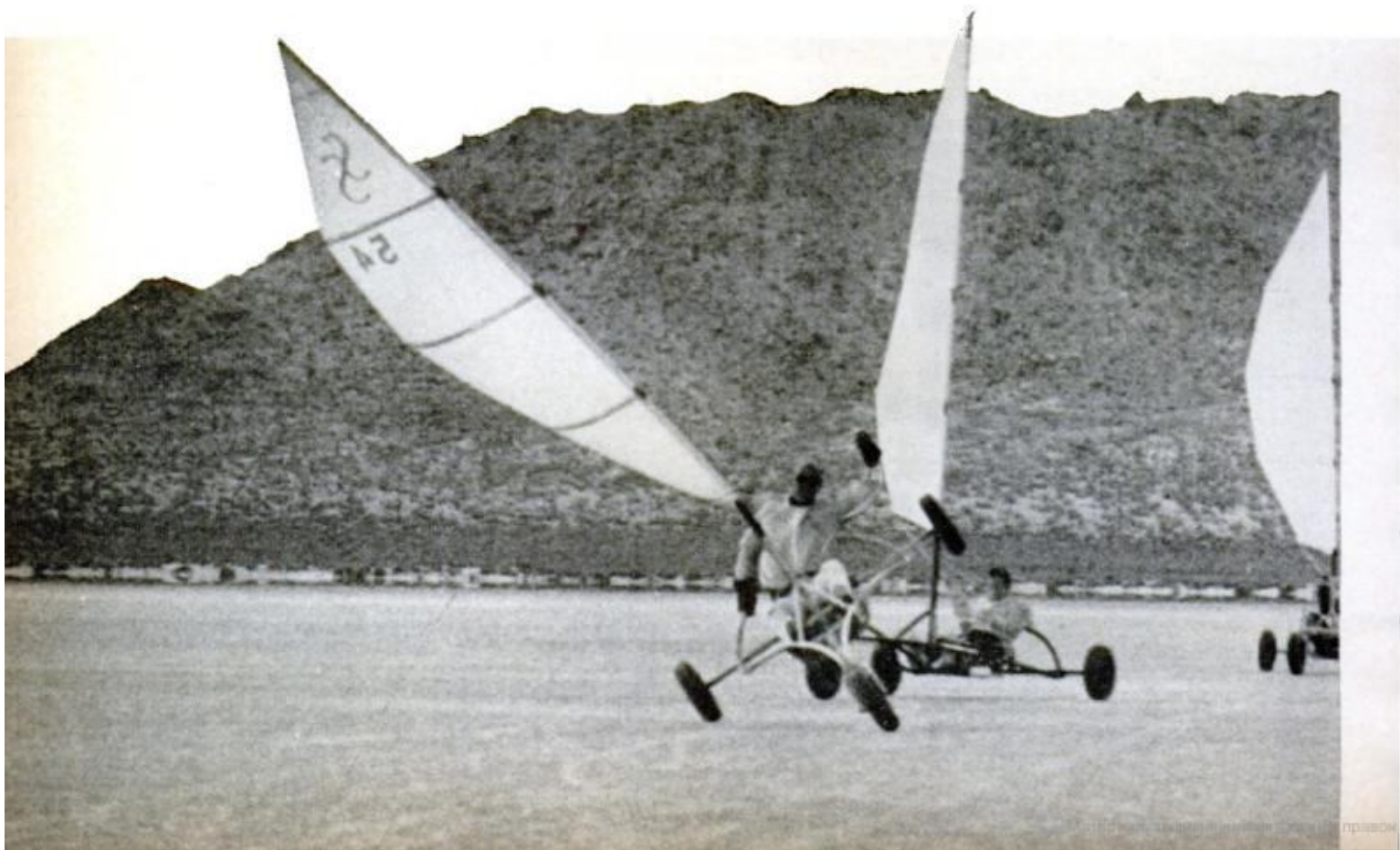
For acrobatic thrills there's nothing like rocketing over sand flats at 65 mph in a three-wheel bucket seat with 45 feet of sail

By John Boykin and Bob Grant

IT WAS A strange-looking machine; a three-wheeled tubular steel frame with a bucket seat and a 45-foot spread of Marconi-rigged sail.

The newcomer had never seen a sand sailor before, but they couldn't tell him anything. He was a "deep water" man and if the thing carried canvas he could sail it.

They were cruising the hard flats of





HUNG UP IN HIS SAFETY BELT, the sand sailor has to be helped out of his predicament. The belt and the bucket seat have been responsible for the perfect record of no major injuries in this new sport of sand sailing

Sport You Can Flip Over

California's El Mirage Dry Lake, five of them, taking it close-hauled in the 25-mph wind. Then the "deep water" man decided to show his skill. He angled for the wind, the canvas bulged, and he was off like a shot. The others tried to stop him, but there was no doubt about it, he could sail.

He was up to 50 mph when he reached the "tullies" at the edge of the lake and

darted between two islands of sagebrush, into a slight draw—and a dead end.

There was a thud as he hit a four-foot-high clump of sage and sun-baked dirt. The machine leapfrogged into the air, turned lazily on its side and "flew" another 25 feet like a one-winged bird before it crashed upside down in the sagebrush. He was still dangling in his safety





WEIGHING only 129 pounds, a sand sailer is easily lifted atop a small car. The ease of transporting has been a factor in the sport's growing popularity



TWO FULL YEARS of trial and error testing resulted in the 45-square-foot Dacron sail that makes the sand sailer safe, highly maneuverable and fast

belt when they reached him minutes later.

And that's sand sailing, a California cousin to iceboating, and a modern rendition of land cruising, a sport popular in Europe for the past 200 years.

The man behind the new popularity in windjammer highjinks is John Schindler of Los Angeles. He designed the sand sailer.

"I didn't know it was an old sport," Schindler explained, "so I wasn't handicapped by trying to follow existing designs. I wanted something small and light that would be highly maneuverable and fast, and would not be expensive."

The result was the 129-pound frame that will get up to 65 mph, has a steerable front wheel and one-hand sail control.

"It wasn't as easy as it sounds," Schindler said. "The first prototype was made of fiberglass and carried 105 feet of sail. It took two men to handle it, and even then it was continually getting wrecked."

On a final run with the large rig Schind-



THROWING HIS WEIGHT and close-hauling the sail, a sand sailor tries to bring his wheel down and still make a turn that will keep him ahead of the pack

ler and a partner hit some brush stumps at 50 mph, snapped the rear axle, ruined the sail and skidded across the desert in the fiberglass bucket until they finally crashed into a Joshua tree.

"That was the end of that," Schindler says, "but we learned a lot even if it was the hard way. We finally got the sail area down to where it is manageable. On the early test rigs we didn't have safety belts. We do now. One of the test drivers was flipped out and the machine ran over him. I'd say we've been real lucky that we haven't had any serious injuries."

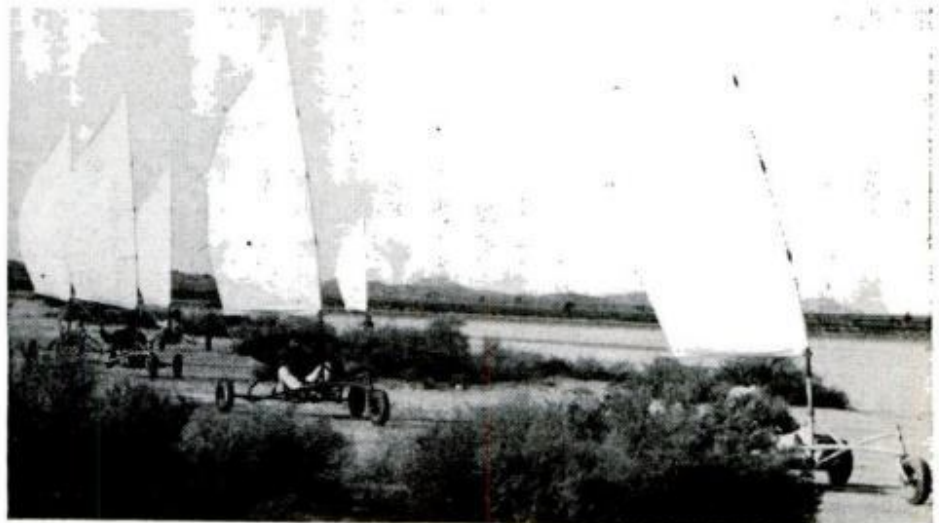
And even with several hundred sand sailers now whipping across the sand flats every weekend they still have a perfect safety record.

When the sport began to grow in popularity the National Sand Sailing Assn. was formed, and they now hold regularly scheduled meets and races.

"We have several types of races," Schindler explained. "There's the figure



WITH THEIR WIVES HOLDING the sails steady, a group of sand sailors race for their crafts in a LeMans start. Sand sailer owners have formed an association and they gather at specified dry lakes for weekends of racing



HARE AND HOUND is a popular racing game. The leader takes a 100-yard start and when the others give chase in an effort to catch him he leads them a merry chase at high speed in and around the islands of sage brush

"8" which is the most popular with beginners, because all turns are made into the wind. But it's plenty fast and exciting.

"Then there's the slalom course, oval racing, a triangular course and a hare and hound event. The oval is the toughest and requires the most sailing skill because of the downwind turns and the long oval calls for a real knowledge of the wind."

The most popular event with the more experienced sailors is the hare and hound. One of the best sailors in the group is chosen to lead the pack on a merry game of follow the leader. He is given a 100-yard head start and then the others give chase and try to catch him. But they must follow his tracks. This sounds simple, but when several dozen rigs are battling for position in an effort to be the hound that gets the hare, and they're rocketing over an unplanned course at 50 mph, it can turn into a wild frolic of two-wheel turns, somersaults and head stands.

The new sand sailers are most active in

California, but the sport is expected to spread.

"We have good wind out here and plenty of dry lakebeds," says Schindler, "and these are ideal conditions. But we have already held competitions on several large parking lots and they were successful. They can be raced on a beach at low tide, and an athletic field offers plenty of room."

Although he plans no changes in the stock model of his sand sailer, Schindler is going to make slight modifications for racers. "The present rig has a top speed of about two and a half times the speed of the wind. I'm going to add stays to the sails that will increase the speed to three times wind velocity. I also plan to build a two-man craft with plenty of sail for the real adventurers."

But what happened to the "deep water" man?

"Haven't seen him since that day," Schindler said, chuckling. "But I think he went back to the deep water." ★★★

THE PECCARY MEN

The Treasure They Hunt Is Bones

Young scientists from a school in California have combed deserts and canyons for fossils. One find earned them their unusual name

By Jack B. Kemmerer

A PALEONTOLOGIST at the University of California, an associate curator of fossil mammals at New York's Museum of Natural History, a geologist doing important work with the U.S. Geological Survey—they're all former Peccary Men.

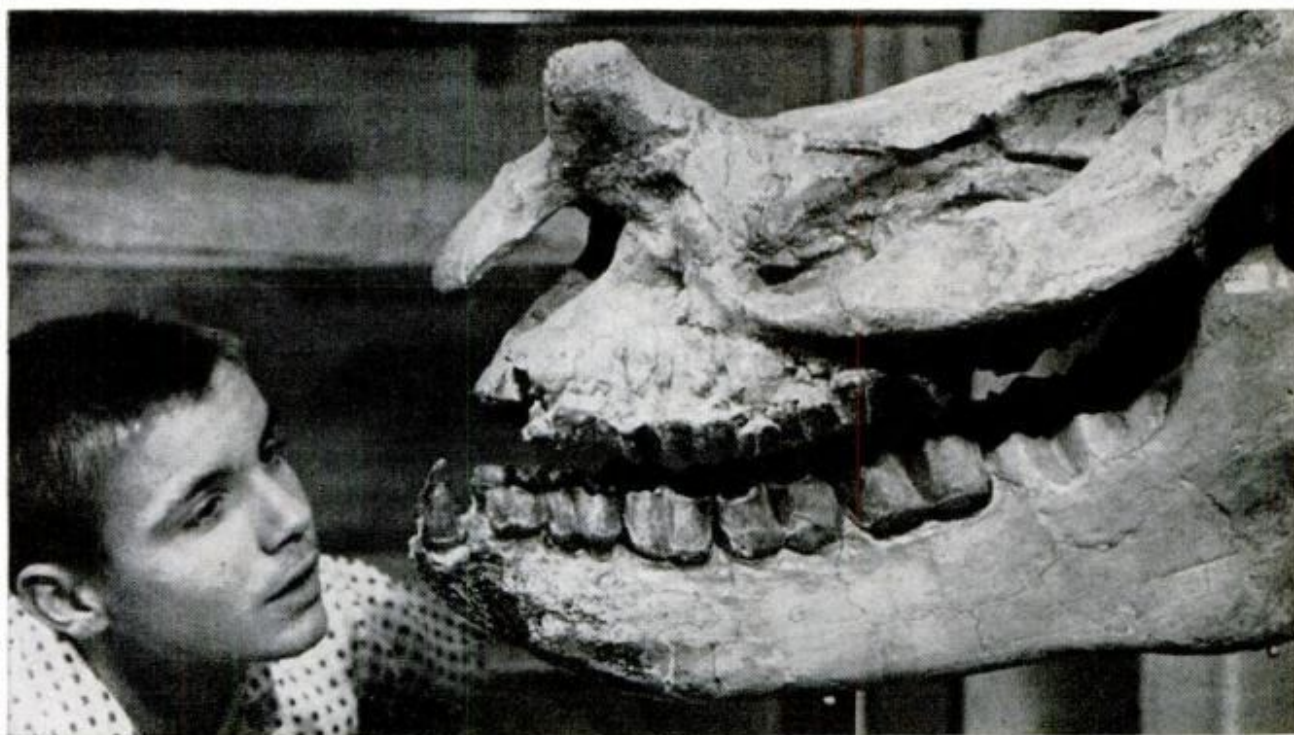
They joined that select group when they prepped for college at the Webb School in Claremont, Calif., and came under the stimulating influence of one teacher, Raymond M. Alf. A mathematician and geologist, Alf has been at Webb for over 35 years, and fascinated by fossils for almost equally as long. To him, paleontology—the study of fossilized remains—is almost a way of life.

For better than 25 years Alf has been taking Webb students on weekend trips to mountain and desert areas in California as well as on extended summer trips to Arizona, Nevada, Utah, Wyoming, Nebraska, South Dakota and Colorado. His boys have dug in such fossil-rich locations as the Big Horn Mountains, Dinosaur National Monument, the Black Hills and the Grand Canyon.

It was on a weekend trip in June, 1937, that the Peccary Men earned their unusual name. They were scouting an area in the desert country near Barstow, Calif., when one of the boys stumbled and fell. He spotted a fossil fragment almost right under his nose. When he found a small tooth, he yelled and the rest of the party came running.

Digging with extreme care, the boys unearthed a skull complete with fossilized





HUGE RHINOCEROS HEAD dating back millions of years was turned up on a Peccary-Man field trip. All exhibits in Webb School museum are Peccary finds

brain. They encased their find in plaster of paris and took it back to the school for cleaning and examination. An expert from Cal Tech made a thorough study of it. Without doubt, he said, the students had discovered the head of a young female peccary—a relative of the pig—dating back to the Miocene period. That meant that the skull was about 20 million years old!

That notable find aroused international scientific interest and produced a name for the students.

The treasures gathered by the Peccary Men through the years include an awesome collection of teeth; 96 camel, saber-toothed tiger and horse skulls, and a variety of other bones, some of which date back about 35 million years.

Discover Brontothere Skull

Another big find was made in the northwest corner of Nebraska in 1947. It turned out to be the skull of a Brontothere, a distant cousin of today's horse and rhino that's thought to have roamed America



40 million years ago. The head was so big that the young scientists didn't have enough plaster of paris to make a proper matrix for it. One party had to scour nearby towns for a supply of the "precious" white powder.

That night the boys sat around a campfire learning about their find. Their leader told them that the Brontothere was known to the Indians before the arrival of the first white man in America. The Sioux, when hunting bison on the vast prairies of South Dakota and western Nebraska, would come across huge bones that had washed out of faults during heavy rainstorms. Having no notion of extinct animals, they believed that the bones belonged to

the "thunder horses." These powerful beasts jumped from the sky to earth during thunderstorms to hunt bison, which they slew with their sharp hooves. From this ancient Indian tale came the name Brontotherium—"beast of thunder."

Four-wheel-drive trucks, loaded with picks, crowbars, plaster of paris and other equipment, carry the young scientists on their trips. There are no guides or camp hands, so each boy has to cook his own meals and wash his own clothes.

During the long drive to a "prospecting" area, Alf will lecture his charges. Before the actual hike begins, he briefs them on the geology of the terrain they'll encounter.

PECCARY MEN are shown how to apply a plaster of paris matrix to fossil. Plaster protects fossil during trip back to the school museum-laboratory



FINDS MADE on one trip include part of leg bone of horse (left hand) thought to be 15 million years old. Other hand holds bone chips and snail fossil



DENTAL TOOLS are needed for the delicate work of cleaning fossilized bones. The young scientists do all of the cleaning and mounting of specimens



The boys know what they're looking for. Their quarry may be in one of three forms. The first type of fossil is a part of the actual body of an organism that has been preserved from decay and is found in its true form (bones and teeth).

Another type is a mold or cast of the organism that remains after the plant or animal has decayed. Finally, there are the footprints or trails left by animals in soft mud and clay millions of years ago.

Rebuild Skeletons

Upon their return from the field, the boys' work continues in the school's museum. The museum not only houses the various exhibits, but serves as a prepara-

tion center for the specimens as well.

Skillfully, using dentist's tools, the young scientists extract the fossilized specimens from the clay or stone. Rebuilding missing parts with plaster, they assemble whole skeletons for exhibition.

Every student who has ever been along on a trip automatically becomes a Peccary Man, a member of a unique scientific society.

But the experience of fossil hunting is still the big thing. One young Peccary Man put it this way. "You feel sometimes that you're standing on top of the whole past. You can reach down and touch it, dig for it, and then hold a piece of it in your hands." ★ ★ ★

PICKS, SHOVELS AND CROWBARS are the tools used in uncovering bones and other fossils. Here, four Peccary Men chip away at the side of a sandstone hill in an area in California that has yielded some good finds



HAVING FOUND A LIKELY SITE, two young paleontologists begin to probe it. Classroom instruction comes alive for them in the field. One lad put it this way: "You feel that you're doing something really important."



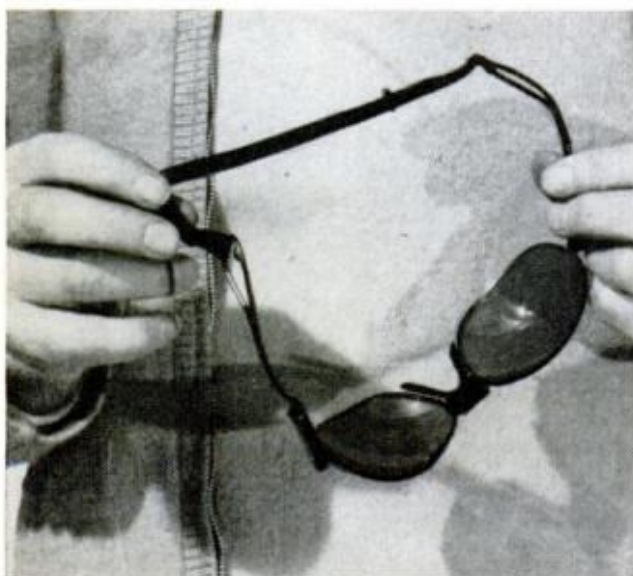


Fire-Walker Is Always Blowing Bubbles

Looking like one of the shapeless monsters that stride through horror movies, the wearer of a new fire-protection suit is kept covered—and cool—by liquid foam. A tube carries three gallons of foam per minute to him from a nearby tank. The suit was developed by Union Carbide.

Snap-Together Glasses

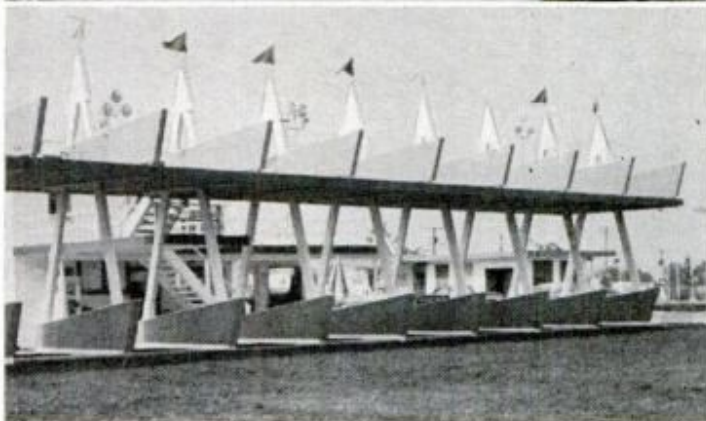
Snap-in parts for shatterproof sports glasses are adjustable so the wearer can custom fit them. Glasses kit with case, cleaner and headband is \$4.95 from Safemaster, 103 W. 7th Ave., Homestead, Pa.



Airlift for Overparkers

Illegally parked autos in Rome may well end up being toted off in this spectacular fashion. The truck-borne crane was recently placed in service in the Italian capital. It also removes wrecked cars.





Double-Deck Golf

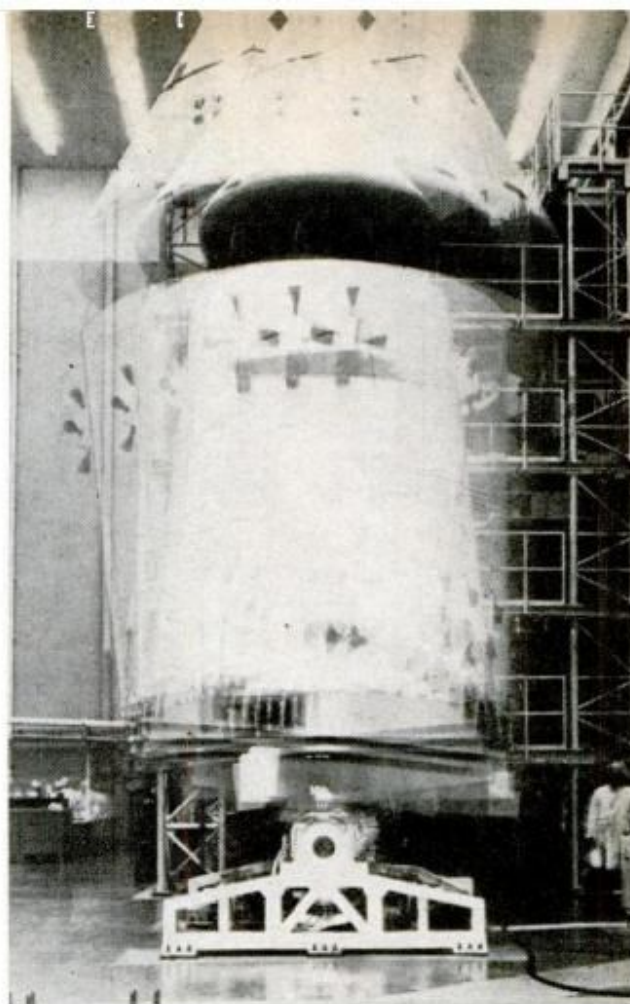
Golfers can tee off from two levels on new double-deck driving ranges that are being set up around the country by Arnold Palmer Enterprises. Each golfer has a tee mat and is protected by dividers.

Handbag Road Sign

An overnight bag that's also a warning sign in case of an auto breakdown is carried by an English lady when she goes on a trip. The reflector is an international warning for caution, hazard ahead.



JULY 1965



Apollo Discotheque

The guidance and navigation unit of an Apollo spacecraft gets a workout on a "polarity checker" that pitches, rolls and yaws the craft. It's how North American's Space Division tests gyroscopes.

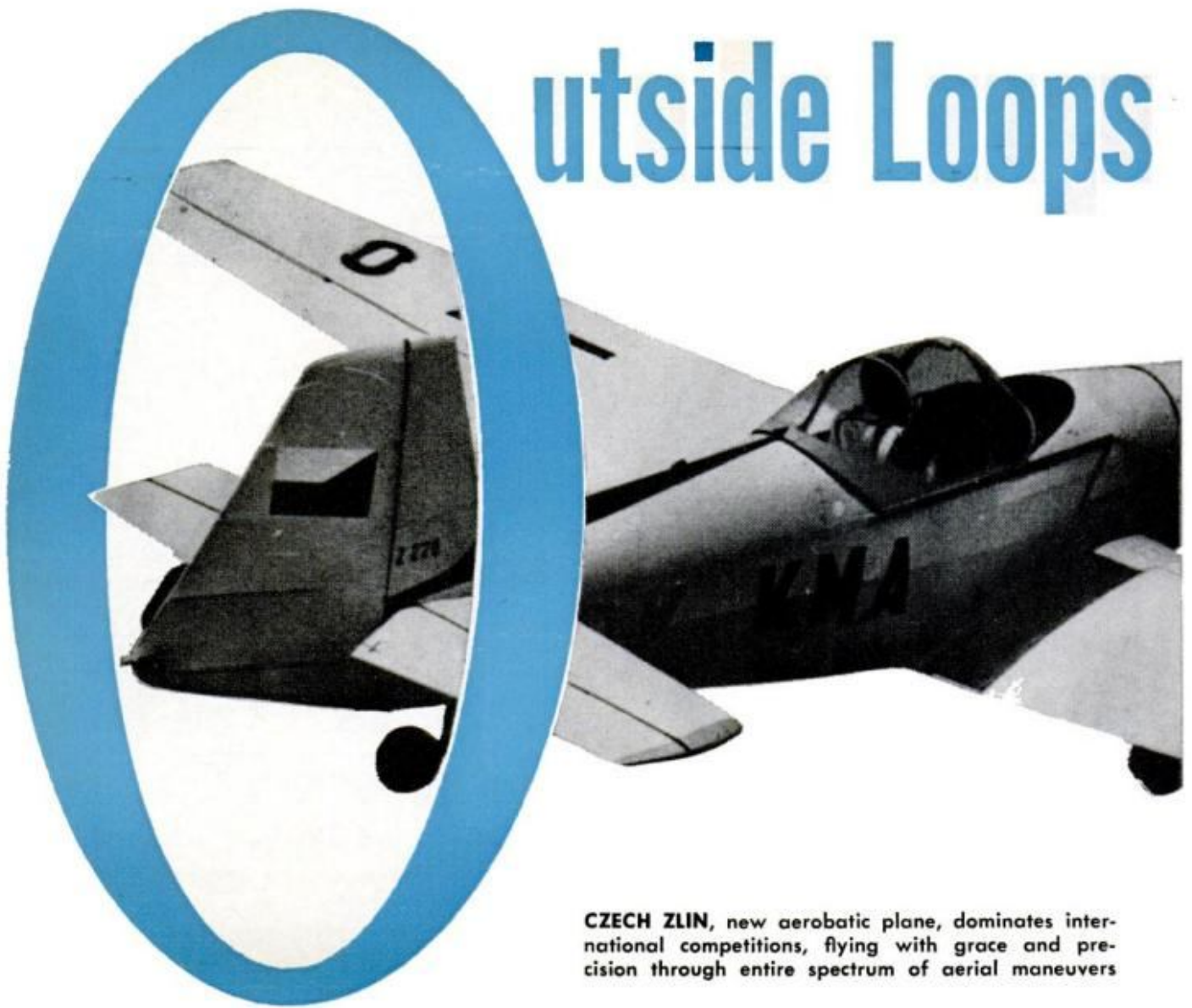
Sipper for Brusher

It's as easy as sipping a Coke for a youngster to rinse his mouth after brushing his teeth with a new hollow-handle toothbrush. Made by Renco Labs, Box 3442, Anaheim, Calif., it sells for 89 cents.



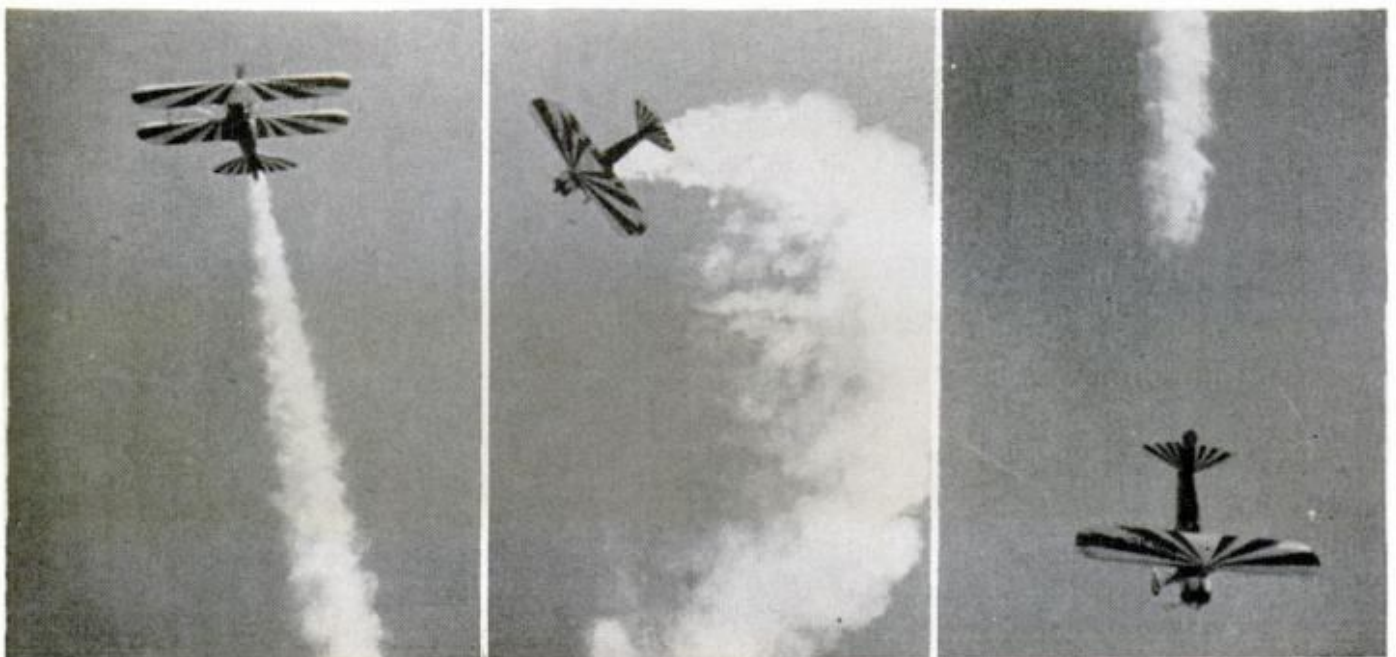
95

outside Loops



CZECH ZLIN, new aerobatic plane, dominates international competitions, flying with grace and precision through entire spectrum of aerial maneuvers

HAMMERHEAD STALL, performed here in exhibition with trailing smoke, is relatively mild maneuver in contests. Plane goes straight up, almost stalls, tips over on one wing and comes back down. In contests, a pilot might be asked to enter a maneuver and recover from it while flying upside down



with Inside Problems

International stunt fliers are back in the blue, with Americans pitting their ancient hardware against the sleek competition from overseas

By Frank A. Tinker

ONLY A FEW SECONDS LEFT. Hurriedly, but ever so smoothly, you press one of the pedals to which your feet are strapped. Immediately you are hurled sideways against the restraining harness. Push another pulsing lever between your knees and suddenly the world goes berserk, spinning violently past your vehicle. Exactly two revolutions and you try to stop it with opposing thrusts on the sensitive controls. Vertigo attacks your senses; the horizon is now an obstinate vertical line in front of you. Blood is driven from your head by a monumental downward force

as you try to bring everything back to normal.

At this point, even though you know this violence is creating a unique beauty, you wonder: Is this sport?

Indeed it is—one in which the participant absorbs the pounding of football and internal pressures of water polo while performing with

the grace and precision of a ballet dancer. There is an additional distraction—it all takes place a thousand feet off the ground!

The sport is aerobatics, the unforgettable aerial dance now enjoying a surge of renewed popularity.

Since most private planes are registered here, any American will immediately claim world supremacy for his countrymen. Yet at last September's international aerobatics competition in Bilbao, Spain, the highest-ranked Yankee finished 35th! We didn't even reach the finals.

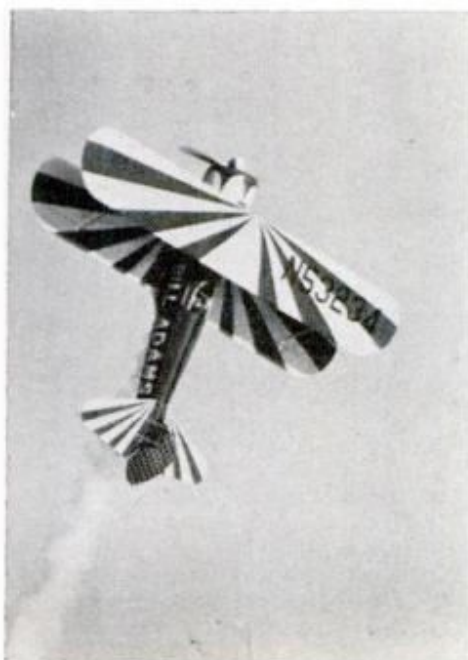
During the decade since the last real national contest went down the drain with the big air races, there has been a deliberate downgrading of aerobatics in civil and military flying. A private pilot taking a Federal Aviation Agency check ride no longer must demonstrate ability to handle his craft in odd attitudes. Recovery from spins, a standard of flying since Lincoln Beachey proved it could be done, has not been part of this ride for years.

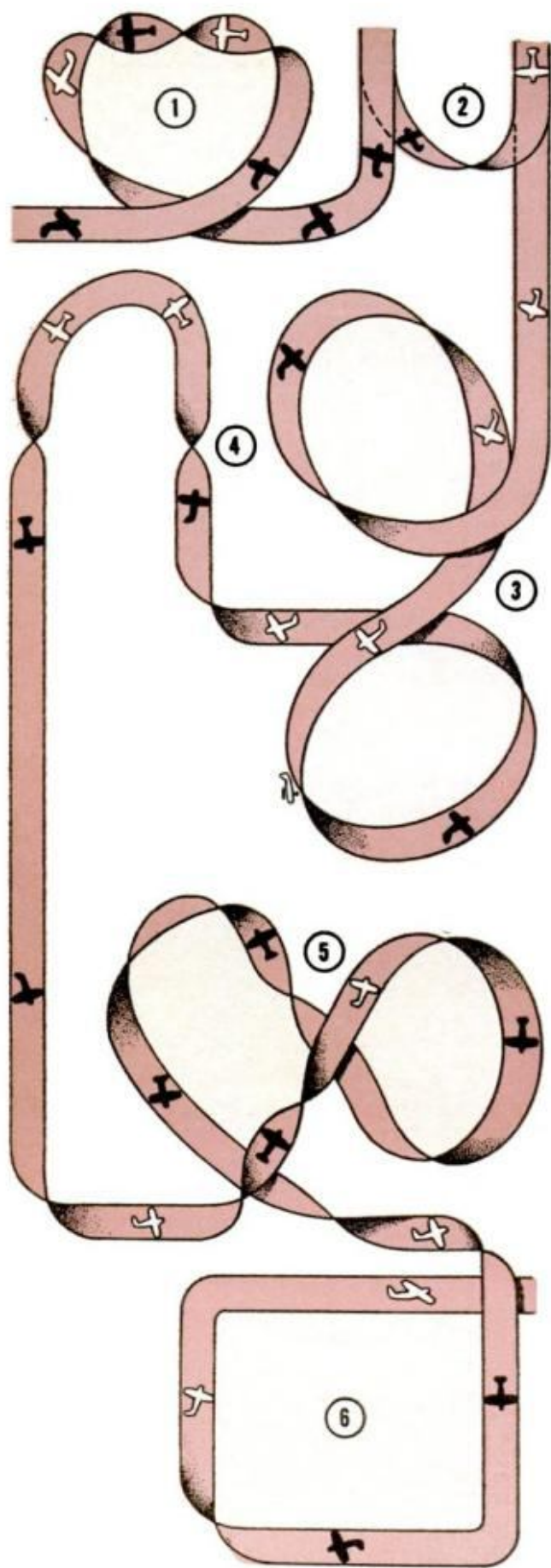
Government inspectors say that a safe pilot in a stable modern plane will probably never fall into a spin. Furthermore, most light planes are not stressed for such maneuvers and their expensive gyro-navigation instruments would be ruined by inverted or violent flight.

Whether this relaxation of standards is wrong from a safety standpoint, one consequence is that aerobatics has



OLD STEARMAN primary trainer, fitted with oversize 450-hp engine, is best United States can offer to international meets





CONTEST MANEUVERS include: 1. outside loop with snap roll on top; 2. inverted whip stall; 3. inside-outside vertical eight; 4. inverted hammerhead with half roll going up and half roll coming down; 5. outside-inside Cuban eight with full rolls, and 6. square outside loop. European planes seem to fly slow maneuvers more gracefully than Americans

become a forgotten art among most younger pilots.

Even if an airman had a craft capable of such maneuvers, he would have difficulty finding a place to practice. Anything remotely resembling aerobatics is banned in controlled airspace over the more settled parts of the country.

Vietnam Changes the Thinking

Compounding the problem, military aviation cadets since World War II have usually gone straight into advanced, high-performance planes in which standard aerobatics are impossible. Even spins and snap rolls are banned. Dogfights of previous wars, which were aerobatics put to very practical use, were supposed to have been eliminated by supersonic jets and homing missiles. Only recently have the lessons of Vietnam and other brushfire wars jolted this thinking. Relatively slower, more agile craft are now being developed and military pilots are again scheduled to begin training in light planes with more maneuverability.

Significantly, the winner of 1964's world competition was a Spanish Air Force pilot. Many European competitors are also members of their countries' military forces. In the United States, numerous air bases now have civilian flying clubs. Some are acquiring sport planes, and they may prove a fertile training ground for aerobats.

Meanwhile, a small, dedicated group of pilots has carried on the high traditions of American aerobatics. Mostly, they are associated with air shows or other branches

1939 TAYLORCRAFT, modified for aerobatics, was used by Duane Cole to win the national championship this year, but failed to make finals in internationals



POPULAR MECHANICS

of aviation and have private incomes sufficient to afford this expensive sport. Duane Cole, Hal Krier and Bill Adams have worked much of their time in air exhibitions. Bill Barber and Rod Jocelyn are airline pilots, Bevo Howard runs an aviation school, while Lindsay Parsons was a stockbroker.

What draws these professional pilots to their busman's holiday aloft and the grueling routines required in this sport of angels? Those who still gape at the simple loops and rolls of World War II aviation have a real thrill—and perhaps a shock—in store. Such maneuvers remain as basic aerobatics, but they have been reduced to kindergarten status. An inside loop rates only 12 points on the international difficulty scale devised by the Spanish civil air chief, Count J. L. Aresti. An outside loop, once considered the most harrowing maneuver, scores a low 24. It takes an outside-inside Cuban eight with full rolls to score more than 40 points, with every segment done so precisely a bored judge cannot spot a single flaw.

Stalls, Rolls, Loops to Order

Duane Cole, who won the U.S. aerobatics contest last September at the Reno Air Races, says, "I began to wonder if I was on the wrong airport," when he looked at the international list handed him two years before in Budapest. "I felt that at least 10 percent of these maneuvers were impossible and a fourth of them beyond the capability of any airplane I had ever seen perform."

Most competitions, like the biennial world championships are divided into obligatory and free-style groups. Imagine flying hammerhead stalls, snap rolls, whip stalls and outside loops—all inverted and all with inverted recoveries—referring only to a list handed you a brief time before by a contest official! In their free-style performances, top aerobats add embellishments and combinations to the basic figures which must be pictured to be appreciated.

Here is the routine which won Duane Cole the Reno contest last year:

1. Outside loop with slow roll on top
2. Hammerhead stall, inverted recovery
3. Outside Cuban eight
4. Outside-inside loop (vertical eight)
5. Outside-inside Cuban eight
6. Inverted hammerhead stall
7. Hammerhead turn with half rolls going up and coming down
8. One-and-a-half snap roll
9. Outside square loop
10. Slow roll in a 180-degree turn

Twenty maneuvers of this caliber were performed in about seven minutes, more than one every 20 seconds. No wonder bloodshot eyes and headaches are common ailments of aerobats. No wonder Cole tapes his glasses to his face when he performs.

The grading and coding system of Count Aresti, who can be truly called the father of modern international aerobatics, is accepted as the standard for future competition. Understandably, the routines and scoring favor European planes and styles,

[\(Please turn to page 178\)](#)

PITTS SPECIAL, one of the best home-built aerobatic planes, is becoming more popular among Americans. Don Pittman, shown here, flies one, is one of the young hopefuls that might bring championship to the United States





Paddleboat Tour of the Sewers

It's quicker that way, say sewermen of Bonn, Germany, using paddleless paddleboats on inspection tours of subterranean sewage canals. Paddles are removed so boats fit the narrow channels. "Inspectors" let current take them to purification plant.



Ride-em Erector

Today it's a Jeep, tomorrow a 3-wheel scooter, then a runabout, a tractor and a racer. All five of these child-size vehicles can be built with A. C. Gilbert's new Erector set which includes giant multi-color panels, girders and wheels.

Aerator on the Wheel

Want to aerate your garden while you mow the lawn? Hook up Dedoes Industries' Wheel-Aerator to a wheel of your garden tractor. It aerates the soil and prevents compacting by making clean, sharp holes and removing the plugs.



Angler's Tube Boat

Take a truck-size inner tube, drape it around an old washtub, inflate the tube and you've got a tube boat. Developed by S. Sgt. L. N. Eller at Wheeler Air Force Base, it's the ideal way of getting to the middle of the lake where the big ones live.





Safe While Seated

Tired of seeing his youthful customers slipping away from him, barber James Collier designed this safety seat. Not only can't a child climb out deliberately, he can't fall out either. The seat fits most any barber chair and locks into place.

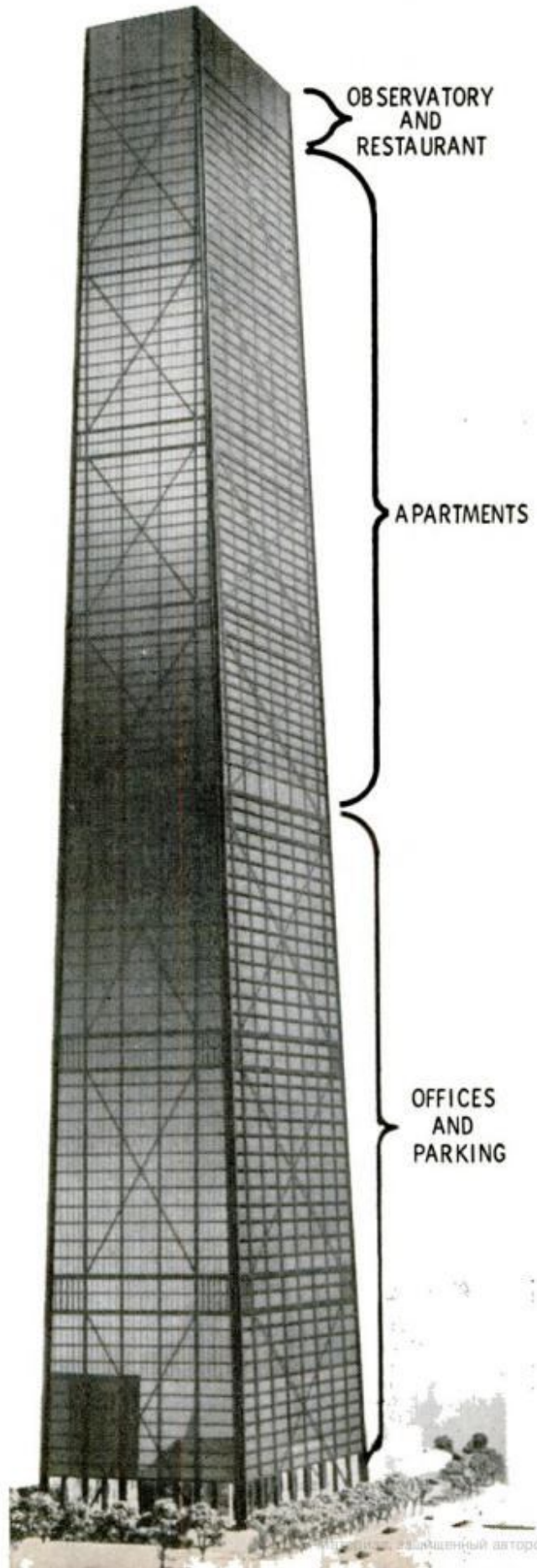
Rocket-Firing Rifle

Foot soldiers' artillery now comes in a 15-pound automatic weapon. Firing 40-mm rockets in rapid succession, Avroc 15-40 is one of a series of weapons being developed for the Army. It accommodates a variety of warheads.



High Living for Tomorrow

The world's tallest residential-office building started its way 1,100 feet skyward this year in Chicago. Tapering as it goes, the needle-like, 100-story tower will boast a "sky lobby," ice rink, and a 45-second elevator ride to the sky deck.



OBSERVATORY
AND
RESTAURANT

APARTMENTS

OFFICES
AND
PARKING

STEP RIGHT UP,

Here's How to Get a Fair Shake

Hoop toss, baseball throw, fortune wheel—they all can be rigged to take your money. You can learn to spot the swindlers

By Charles Remsberg

GAMES OF CHANCE prove an irresistible lure for fairgoers like this avid dice player. The trouble is that many an operator leaves nothing to chance



THE CARNIVAL looked like a thousand other traveling shows. Against a background of canned music and the ping-ing of steel targets in the shooting gallery, it offered the usual attractions: the whip and other rides for the kids, a girlie show for pop, and games of "skill and chance" for everybody. Gravel-voiced barkers worked hard to put phony zip into the tired spectacle.

The only real excitement that day was to come from a dozen men who had wandered onto the grounds singly or in pairs. A couple of them wore Army uniforms. The others might have been workmen or nearby residents out for some fun. They played every game on the midway. They tossed hoops at wooden blocks, threw baseballs at canvas cats, put money down on the wheel of fortune, tried to knock down pins in a bowling game.

They were spectacularly unsuccessful. Either they had no skill—or the games were crooked. Since the dozen actually were undercover agents from the Cook County (Ill.) sheriff's office, they concluded that the games were rigged. They flashed their stars and seized every gadget in sight.

Days later—this time pretending to be carny workers—they appeared at the factory of a large manufacturer and distributor of carnival equipment. After buying

FOLKS...

at Carny Games

equipment there, they pulled their second raid, grabbing not only a truckload of phony games and gimmicks but the company's records as well.

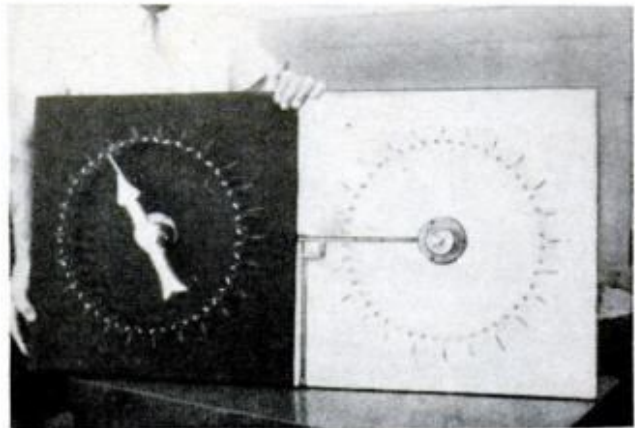
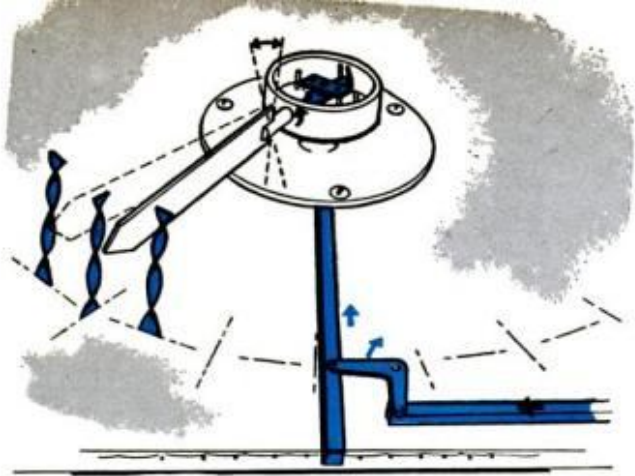
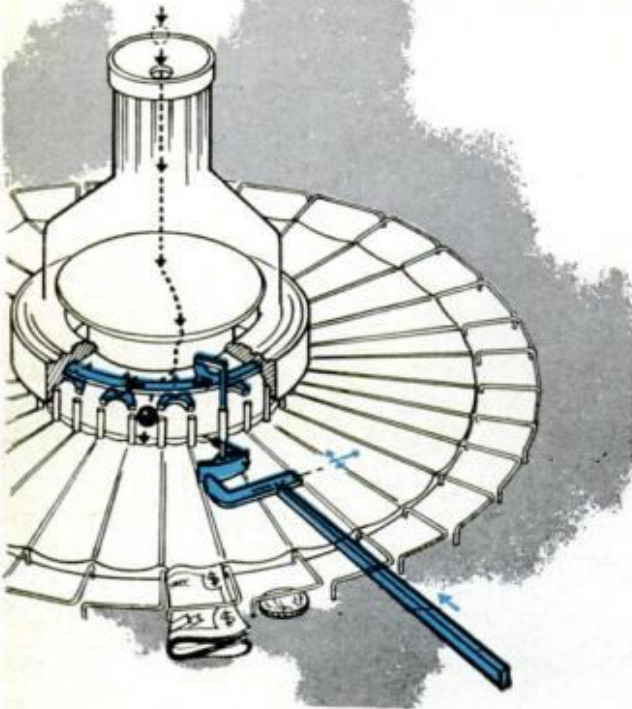
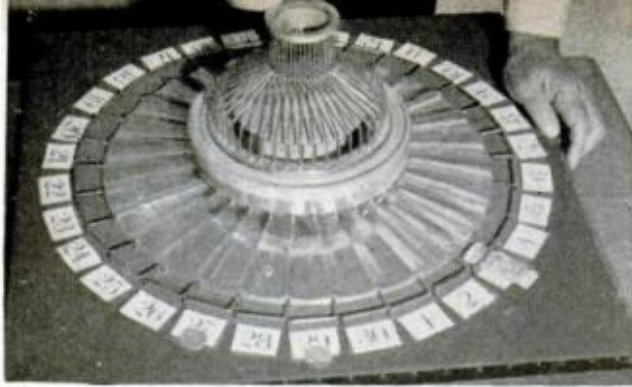
"Of all the stuff we confiscated," Sgt. Bill Witsman told me, "there wasn't a single item you could spot as fixed just by looking. Then we started tearing it apart. After seeing the *insides* of this stuff, there isn't a carnival game in existence that I'd play.

"Every small doll come-on can be rigged against you. Some of the people we arrested told us nine out of ten carnivals are running crooked shops."

With the help of Sheriff Richard Ogilvie's men, *Popular Mechanics* has compiled a report on how some of these midway games are designed to pick your pocket.

If you think the information doesn't apply to the carnival or amusement park you may visit, just bear this in mind: In examining the manufacturer's records, I discovered that "gaffed" equipment had recently been shipped to all 50 states and Puerto Rico as well as many Canadian provinces. Many of the carnivals were operated at local fairs, fraternal benefits and even church bazaars. Towns of every size, from New York City to tiny New Madrid, Mo., were victimized. And you can be sure that most of the "marks"





PINS ARE SET in board in such a way that arm hits only every second one. Lever (top, right) changes pitch of arm, making it strike other set of pins

OPERATOR'S HAND at side of board covers button that activates mechanism (diagram) controlling triangular deflectors. They change ball's path

never knew that they had been taken.

Consider, for example, the ingenious workings of a spin-the-arrow game that conned the residents of Laurel, Miss., St. John's, Nfld., and other communities. To play, you plunk down a quarter and whirl a flat, 30-inch arrow which finally crawls to a stop pointing to one of the prizes laid in a circle on the counter. Or, if you look like a good "mark," the operator may talk you into playing for money, in which case the prizes are replaced with colored squares or numbers that you lay bets on.

Either way, the most you'll walk away with is a piece of "slum," a souvenir item that cost the operator only a fraction of a cent. And some suckers sacrifice a week's pay or more before giving up.

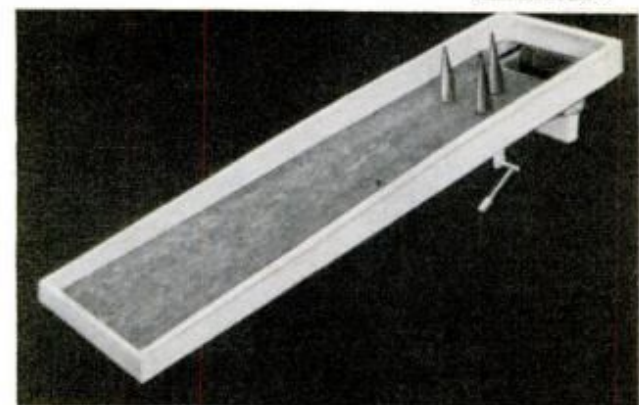
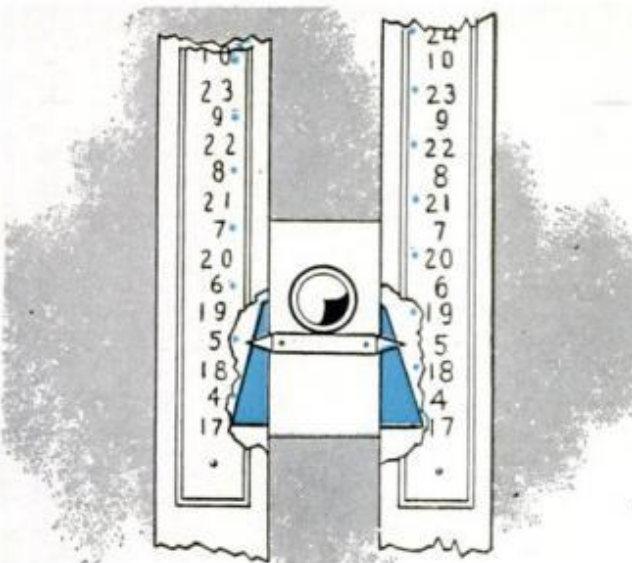
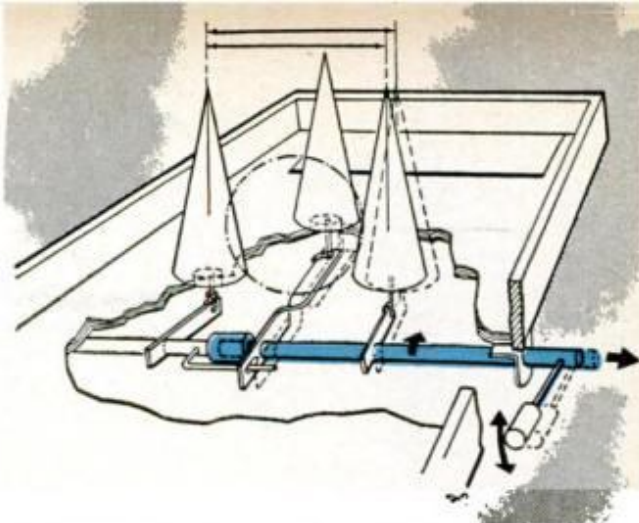
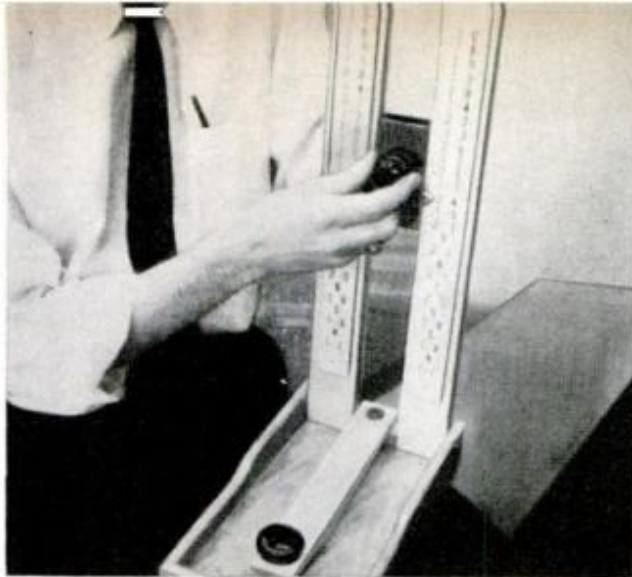
The reason you can't win, according to the sheriff's agents, lies in the vertical pin on which the arrow turns. When spinning fairly, the pin keeps the underside of the arrow from riding down on a metal brace that holds the pin upright.

However, if the game board weren't covered with cloth, you could see a hid-

den control rope or shaft. When the "flat-tie" (as carnival cheats are called) presses a footboard hidden beneath the counter, the pressure is relayed through a rope or wooden shaft to the pin, tugging it down imperceptibly. This causes the spinning arrow to drop a fraction of an inch and it rubs against the brace.

"This acts like a brake," Witsman explains. "By applying pressure very slowly, the operator can make the arrow creep around the circle and seem to die naturally at some crummy prize. Because the customer always spins the arrow himself and the operator usually stands well away and seemingly pays no attention, not one chump in a thousand suspects that he's being taken."

Equally deceptive is another wheel-of-fortune gadget that draws a big play. In this version, a celluloid indicator juts from beneath the arrow and flaps against twisted metal pegs set in a circle on the unit's felt-covered base. When the arrow stops at a particular peg, you win the corresponding prize.



IN SWINGING lever to set up pins again, operator can also pull it out slightly. This moves one pin to right (diagram), making a "strike" impossible

TWIST OF KNOB retracts either hidden pawl in sliding "rabbit" (diagram). With one of the pawls retracted, rabbit can't land on pin on that side

A casual glance misses it entirely, but Witsman points out that the pegs are set so that the convex portions of any given peg are at the same levels as the concave portions of the peg next to it. As it whirls around, the indicator strikes only the pegs that are convex at the level of its tip, thus missing every other one by a hair. You can bet that the flattie puts good prizes only at the pegs the indicator can't hit.

Shill Takes the Prize

"Occasionally, though, it stimulates business to let a shill win a good prize," says Witsman.

To do this, the operator simply presses a button hidden under the felt on the side of the base. The pressure, activating a series of concealed rods and gears, turns the celluloid strip at a slight angle. As it whirls around on the next spin in this position, it hits the pegs it missed before.

After the operator's man walks away with an electric blanket or transistor radio (which he returns at the end of the day), the flattie releases the button so that the

indicator will again stop only at junk. The unsuspecting marks will drop a bundle trying to duplicate the shill's amazing "luck."

Another contraption designed to tap your wallet consists of a funnel-shaped wire cage set on a sloping, circular wooden block above a 15-pound, grooved aluminum disc. The grooves are alternately numbered, odd and even.

After betting on all even or odd numbers or on a particular number, you drop a small steel ball into the cage and wait hopefully for it to run out from one of the holes in the base of the block into the corresponding groove.

The ball is in your sight except for the split-second that it passes through the wooden block. But that is enough. Sheriff's agents found that hidden in the block is a ring of triangular metal deflectors that blocks off all the even-numbered grooves. When the operator presses a hidden button, gearing shifts the little cheaters to the right, blocking off all the

(Please turn to page 188)

Wild Supermarket

Wisteria blossom fritters, rose petal jam, cattail pollen muffins—just a few of the wild dishes that are yours for the picking

By Euell Gibbons

*Author of *Stalking the Wild Asparagus**

WANT TO ADD SOME EXCITEMENT to your camp cooking on your next trip? Try going wild.

You really don't need all those canned and dried foods. If you'll just look closely you'll find that the woods resemble a smorgasbord—and it's all yours for the taking.

MARSH AREAS are the hunting grounds for cattails. The author gathers the roots, and when they are peeled the core is reduced to a flour that is used for muffins, biscuits or hot cakes and tastes as good as wheat flour



in the Woods

Here's a meal I served up last July and just about all of it was gathered within a half mile of our camp. We started off with a glass of mixed wild fruit juices and snapping-turtle soup. The main course was chicken-fried frog's legs and a water-cress salad. The vegetables were boiled day-lily buds and cattail bloom spikes in melted butter. There were golden muffins of cattail pollen spread with wild strawberry jam, and for dessert we had black-berry cobbler from fresh-picked fruit. We topped this off with dandelion coffee and

slices of candied calamus root.

And if that doesn't sound better than beans and canned meat, how about this menu I picked out of the fields in April: There was wild leek soup. The salad was a combination of blanched crowns of chicory, young sprouts of day lilies and the tender, inner portions of calamus stalks, served with a French dressing seasoned with just a hint of wild garlic. The main course was crayfish tails *tempura*, with a sour cream sauce containing the tender inner portions of wild green onions. Our

DANDELION CROWNS, the blanched leaf stems on top of the root, are cut off close to the root and they can be eaten raw or boiled like green beans



WHEN CATTAIL PLANTS are only one to two feet tall the outer leaves are peeled away and the tender white interior is prepared the same as asparagus



SUMAC BERRIES make a drink much like pink lemonade. The fruit is mashed in water for about 10 minutes, then liquid is thoroughly strained and chilled



WILD GRAPES grow all over the country. They can be eaten raw, but can also be baked into pies, and when properly handled they make excellent jelly





Watercress *Nasturtium officinale*

Range: Grows in thick clusters in shallow streams and springs, particularly where there is shade and the water is cold.

Form: Small, tender leaves are oval-shaped. Both the leaves and the stems are green.

Uses: In salads and sandwiches or as cooked green.

Cattail *Typha latifolia*

Range: In marsh land everywhere.

Form: Tall, reed-like plants with sword-shaped leaves. Seed heads are like brown cylinders.

Uses: Roots yield flour. Young shoots used in salad or cooked like asparagus. Bloom spikes eaten like corn. Pollen used as breadstuff or flour.



Arrowhead *Sagittaria*

Range: In shallow streams, marshes, ponds, throughout North America.

Form: Two or three feet high. Leaves shaped like arrowheads. Seed stalk grows small white flowers.

Uses: Underground tubers the size of marbles are peeled and prepared like potatoes.

Ground Cherry *Physalis*

Range: New York to Florida and from Minnesota down through the southwest to Mexico.

Form: Soft herb related to tomato. Fruit is in a paper-like husk shaped like Japanese lantern.

Uses: Fruit is good fresh, cooked, made into preserves or as a pie filler.



vegetables were buttered poke sprouts and boiled dandelion crowns. And for a beverage we had fragrant sassafras tea.

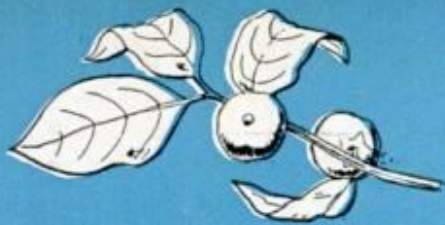
Now, before you start making faces, remember that for 200 years a tomato was cultivated as a flower, and it was an awfully brave man who sampled the first oyster. There are hundreds of wild foods that are delicious and nourishing. They have tastes that are different, but in most cases the taste is as good, if not better, than the foods you will buy in a store.

Wild rice, for instance, was once considered rather poor fare compared to the polished variety. Today it is a gourmet dish and a pound of it will shatter the best planned food budget. Wild barbarea, a delicious green that can be boiled or served fresh in a salad, grows in abundance all over the United States and is largely ignored. In Italy, it is popular.

Still not convinced? Well, then, start your adventures in foraging with wild blueberries, a food that you know is edible and delicious. They grow almost everywhere, from mountain to swamp. There are many varieties and they're almost identical to the huckleberry, but don't give this a thought. If it looks like a blueberry it's good to eat. You can serve them plain or with cream or bake them into muffins, but to get yourself started in the sport of foraging, take a little time and serve them up as a gourmet item.

Festive Blueberry Pudding

When your family has eaten the beans and canned meat along with the corn bread taken hot from the reflector oven, and you then top the meal off with a festive, steamed blueberry pudding, the compliments will start you thinking about



Persimmon *Diospyros virginiana*

Range: Connecticut to Florida, west as far as the Great Plains.

Form: Tree about 10 to 12 feet high bearing orange-colored fruit the size and shape of a small plum.

Uses: Fruit delicious when thoroughly ripe. Use fresh in pies, puddings and fruit-nut breads.

Winter Cress or Yellow Rocket *Barbarea verna*

Range: New England southward, and found in old fields and along roadsides.

Form: Frost-resistant low herb of mustard family, later producing bright yellow flowers.

Uses: Leaves used in salad or as cooked green. Buds are prepared like broccoli.



Lamb's Quarter or Pigweed *Chenopodium album*

Range: In disturbed ground everywhere.

Form: Three to four feet high. Dark green leaves have a white, mealy appearance, particularly on the underside. Closely related to domestic chard.

Uses: Leaves and tops of young plants are prepared in the same manner as spinach.

Day Lily *Hemerocallis fulva*

Range: Common on roadsides in eastern states.

Form: Long-stemmed plant two to three feet high bearing trumpet-shaped orange flowers.

Uses: Unopened buds are cooked like green beans, and the entire flower in bloom can be dipped into a batter and fried.



the value of wild foods in a new light.

The cooking takes some time, but it is still a simple dish to prepare at the camp site:

Simply cream $\frac{1}{2}$ cup of butter with 1 cup of sugar. Add 2 beaten eggs and $\frac{1}{2}$ cup of buttermilk. In another bowl sift 2 cups of flour with 1 teaspoon of soda, $\frac{1}{2}$ teaspoon of salt and $\frac{1}{2}$ teaspoon of ground nutmeg. Stir 1 pint of wild blueberries gently into the flour until they are evenly coated.

Now, combine all ingredients and stir carefully until they are thoroughly mixed. Dip a square of clean muslin in hot water and wring it out, then spread it in a round-bottomed bowl and pour the batter into it. Tie up the corners to make a bag and suspend over boiling water in a large covered kettle for four hours. Serve warm with whipped cream.

Foraging for wild foods is not just a matter of trying to live off the land. It is important to choose foods when they are at their best for eating and to use some imagination in their preparation. This is when "weeds" become exotic fare.

I've heard many people say that they had tried boiled dandelion greens and found them too tough to eat, but on further questioning I've found that they had boiled some leaves from old flowering plants. Now nothing is tastier than the tender shoots of asparagus when it is cut early in the morning in the spring, but you try to eat the old stalks in midsummer and it's like chewing bark. It's the same with dandelion greens. Pick them in the early spring, boil them lightly in salted water, serve them with butter, and you won't find a tastier green.

The sour wild cherry or chokecherry

that grows so abundantly from Newfoundland to Georgia and west to Nebraska and Texas, and is easily recognizable by the way it bears its pea-size light red fruit in symmetrical clusters, figures as a prime example of what a little imagination can do to turn an almost inedible wild fruit into a culinary delight. And if you've never tasted choke cherry soup you're in for an experience.

Wild Cherry Soup

Take four cups of cherries and boil them in two quarts of water until the fruit is tender. Rub through a sieve to remove pits and skins, then return pulp and juice to the heat. Add a cup of sugar. Stir two tablespoons of corn starch into a little cold water to make a smooth paste. Add this to the soup and cook a few minutes, until it is smooth and clear. This soup can be served hot or cold and it is best when topped with a spoonful of sour cream.

Other wild fruits such as berries, elderberries or wild plums can be prepared in this manner, and if you want to get really exotic you can use the hips of wild roses, the part of the flower behind the petals that remains attached to the stem and turns a dark red after the petals are gone.

Roses are not the only wild flowers that make good eating. Violet blossoms are a

BARBAREA, or winter cress, is at its best from the fall to the last frost in the spring. It can be eaten in salad or cooked and served like spinach



PREPARING A MEAL in his kitchen, the author chops up the leaves and stems of freshly picked wild barbarea as the main ingredient in a tossed salad

colorful and pleasant-tasting addition to a tossed salad, or they can be boiled with sugar to make a lavender-colored syrup that gives glamor to hot cakes. Violet leaves make good cooked greens and they are rich in vitamin C.

The tiny blossoms of the red bud, or Judas tree, are pleasantly acid in flavor, as are the blooms of huckleberry and blueberry, and all three are decorative and tasty additions to a tossed salad.

To make luxurious fritters dip whole clusters of elderberry, black locust or wisteria blossoms into a batter of flour, milk and eggs, and fry to a golden brown in deep fat. Sprinkle with freshly squeezed orange juice, dust with sugar and serve piping hot.

After sampling a few of these glamor items of the foragers' larder you'll no doubt want to sink your teeth into some staples, and the best way to start is with the common day lily.

This is the trumpet-shaped orange flower that grows in profusion by the roadsides throughout the eastern states and the Midwest. The unopened buds, snapped off just above the ovary, are delicious when sautéed in butter or cooked like green beans. The entire opened flower can be dipped in an egg batter and fried in deep fat for a fine luncheon treat.

Now you should be ready for the one-plant buffet table of the outdoors—the ordinary cattail that grows wherever there is marshland.

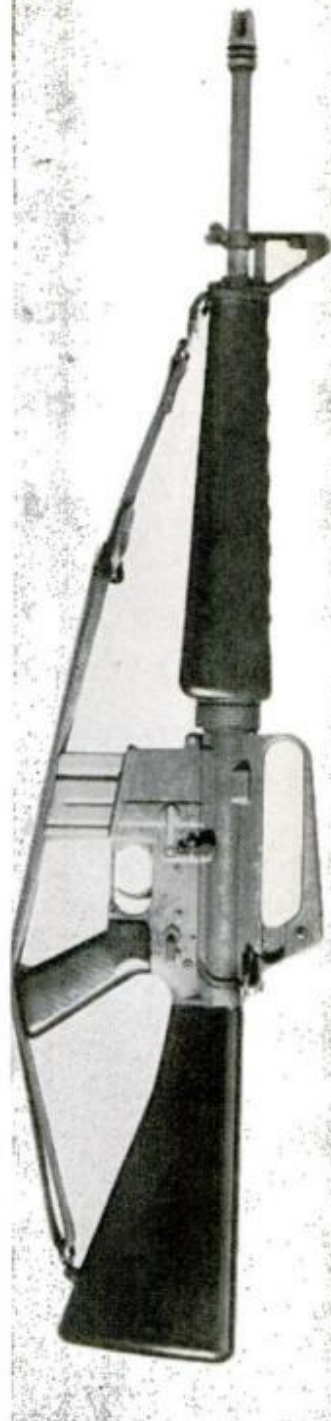
In early spring, when the young plants are only one or two feet high they can

[\(Please turn to page 184\)](#)

NEW TRICKS FOR A NEW GUN

THE AR-15 RIFLE—the centerfire .22 that won its battle star in South Vietnam—has sired a family of lethal offspring. Aiming at a complete weapons system, engineers at Colt Patent Firearms have tried such tricks as shortening the barrel, adding belt feed and hooking on a grenade launcher. The resulting “children,” some of which appear below, are still experimental. The standard AR-15 is used by the Air Force for guarding air bases, and the Army, for special purposes. Its high-velocity .223-cal. bullet has shattering impact.

SNUB-NOSED SUBMACHINE GUN for tankers, helicopter crews, was created by shortening barrel of original AR-15 (right) to half its length, adding a collapsible stock. With stock collapsed, weapon measures only 26½ inches in length



ONE-TWO PUNCH: This carbine, which is 5 inches shorter than original, fires standard rounds from top barrel, 40-mm grenades from an added launcher

FOR HIGH VOLUME of fire, the assault model can be fed from belt-magazines of 100 to 150 rounds. Its heavy barrel permits sustained “machine-gun” fire



Huff-and-Puff Grand Prix

Carnegie Tech's wild race calls for muscle, far-out design and claustrophobia-free drivers

EACH SPRING in Pittsburgh it looks as if a bunch of college lads have regressed to baby buggies. Shorts-clad young men roll weirdly shaped buggies onto the campus, and proceed to race them frantically up and downhill.

A bystander might wonder: Were they forsaking such college pastimes as goldfish swallowing and phone-booth cramming for the fad of compressing one man into the smallest possible buggy?

Actually, all the excitement is generated, not by a fad, but by the annual Sweepstakes Pushmobile Competition at the Carnegie Institute of Technology. Dating back to 1920 as an attempt to bolster school spirit, this race has proven more enduring than any fad. It has grown to be a focal point of campus rivalry.

The old boxy models of the Twenties have given way to sleek racers that are the result of many months' work carried on in secrecy nearly as intense as that of the Detroit auto makers.

In an age of near-sonic land speeds, this unusual race relies on simple human muscle power for buggy propulsion.

MODELED AFTER A RACING BICYCLE, Sigma Alpha Epsilon's entry is the only "buggy" not enclosed. It differs radically from the low-slung four-wheelers



Motorless buggies are pushed uphill by five consecutive sprinters and roll free downhill on a .84-mile course that winds through the streets of Pittsburgh.

The rolling course tests pushers' legs, buggy speed and skill of the drivers who, strapped inside coffin-size cockpits, must steer at speeds up to 45 mph.

Though much of the initial design, such as wheel size, suspension and body shape, is arrived at mathematically, final modifications are made only after trial runs. Since trials require blocking normal traffic from the streets involved, these runs can be conducted only after 2 a.m. To get in additional testing time, some teams even take their buggies to a nearby cemetery with comparable slopes.

Competing for a design trophy, in addition to the speed trophy—with representatives of the major automobile producers acting as judges—the buggies generally are designed for sleek clean lines and a sharp finish. Cost of a buggy ranges anywhere from \$100 to \$1000, excluding countless hours of highly skilled engineering labor.—*M. J. Pedersen*

WIRY, JOCKEYLIKE DRIVERS are strapped inside cramped vehicles. Driver lies either on his stomach with head forward or on his back with head at rear

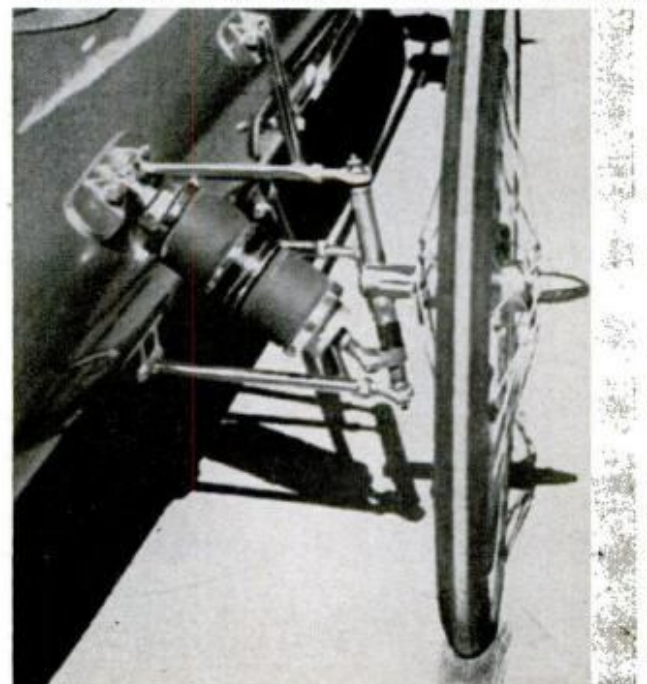
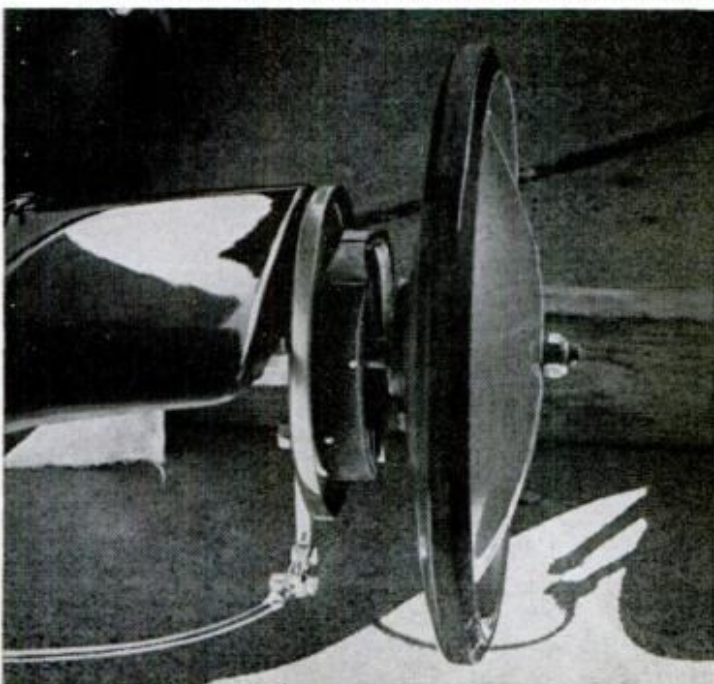


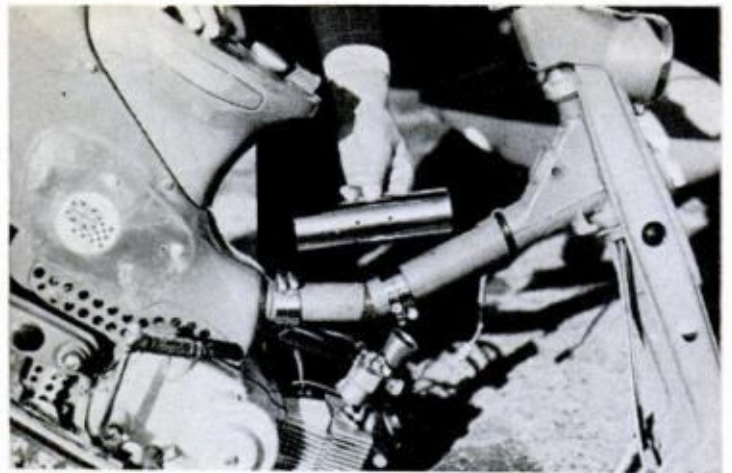


PUSHBARS transmit the power from the "leg-men" to these motorless buggies. Relays of five pushers sprint the vehicles uphill and send them free-rolling downhill in the .84-mile race

DISC BRAKES are typical of buggy innovations which interest spectators from the automotive industry. Brakes are required by rules but seldom used

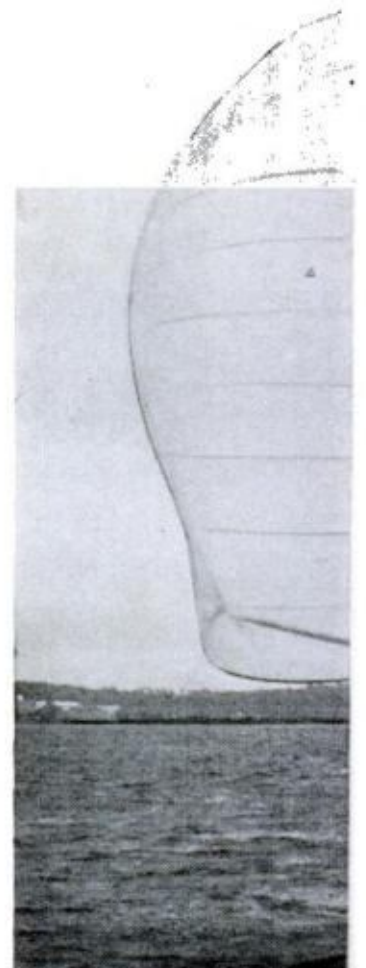
SUSPENSION SYSTEMS and other design features may involve mathematical calculations plus a great deal of ingenuity. Design secrets are guarded jealously





New Twist in Weightlifting

Designed to develop balance and coordination, a new weightlifting device is well suited to swinging and twisting exercises. The "Tee Bar" sells for \$15 from Barney Fry, 1014 Pier Ave., Santa Monica, Calif.



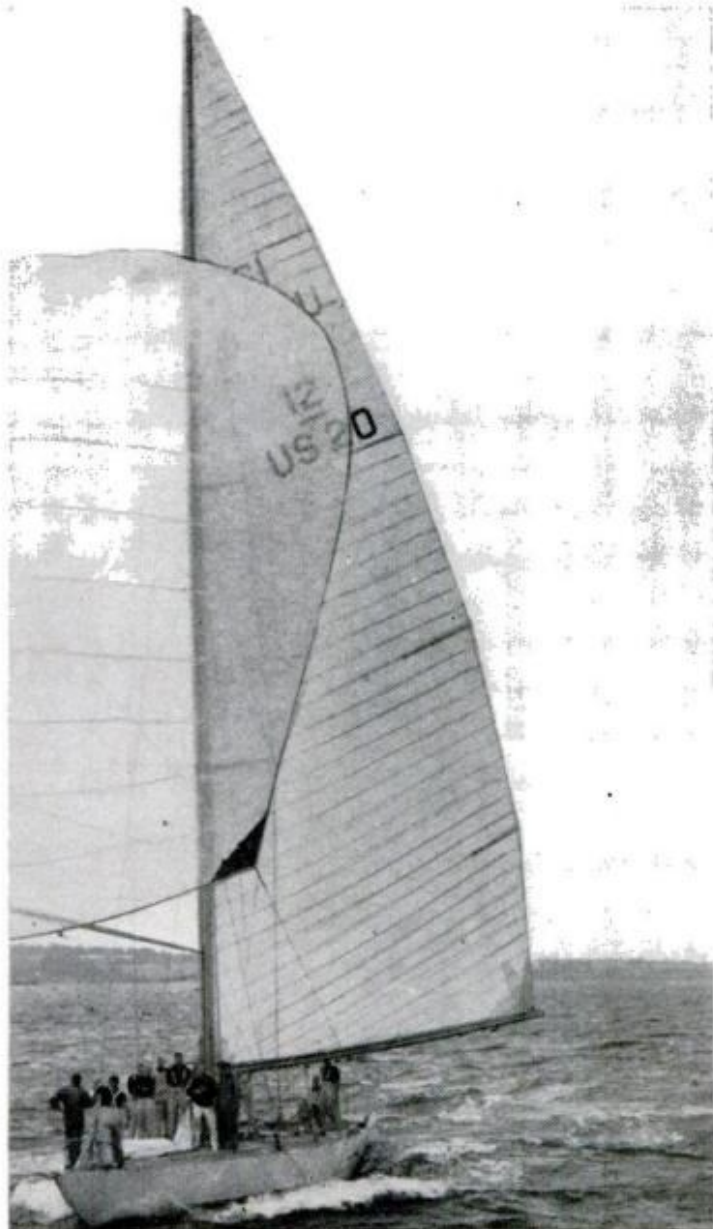


Motorcycle Cut-Up

How can you fit a motorcycle into the baggage compartment of a light plane? Cut it up, according to Honda dealer Pete Adams, San Rafael, Calif. Adam's rebuilt bike breaks down into five pieces and weighs 25 lbs. less than a stock model. To trim weight, he removed all excess equipment, including the battery (ignition and lighting are now direct), and drilled frame and seat support wherever possible. The collapsible cycle carries two people.

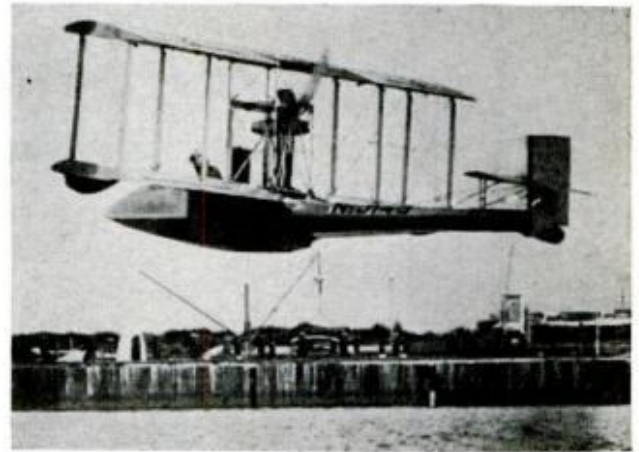
Experimental Sailcloth

A combination of Mylar and open-mesh Dacron fabric has outstanding possibilities for mains and jibs, according to Hard Sails, Islip, N.Y. It's tough, lightweight, nonporous and doesn't stretch.



Fly Copy of 1914 Airliner

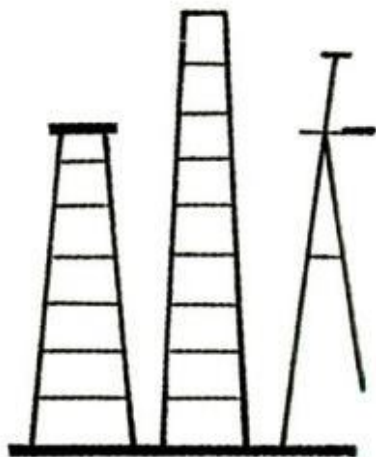
A replica of the plane built by Thomas W. Benoist for the world's first scheduled airline was recently flown at St. Petersburg, Fla. The original operated on a 21-mile run between that city and Tampa, Fla.



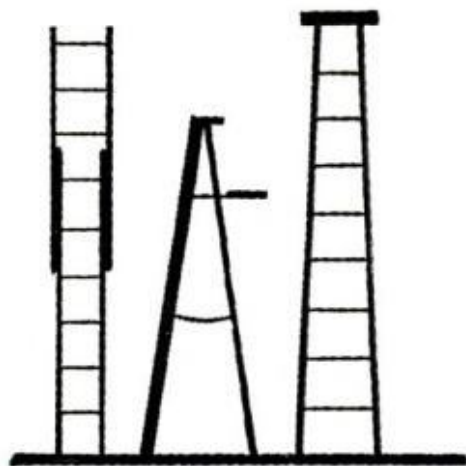
Copters Compete in Bottle Alley

Maneuvering a bucket of water through a winding alley of bottles without spilling a drop was the final test of skill in a recent competition among helicopter pilots from West Germany, Belgium and Britain.





a
short
course
in



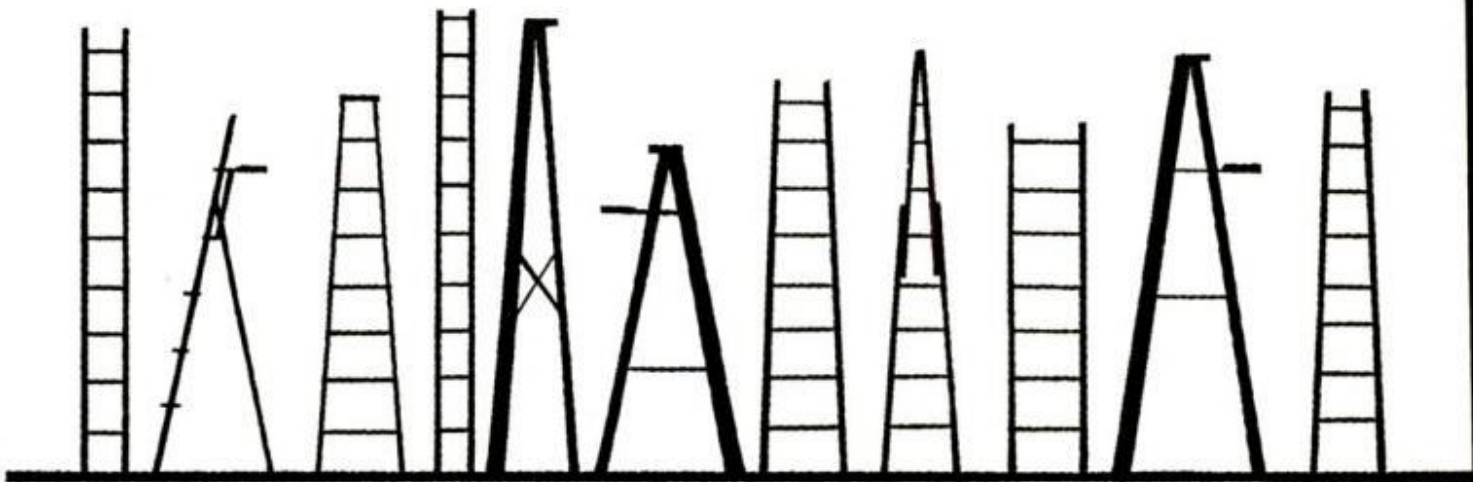
LONG LADDERS

*Is that ladder a bargain or
a shortcut to the hospital?
Does it have enough rungs,
enough muscle? Will it give
the length you're paying for?*

By Jackson Hand

COMMON METHOD of fastening aluminum rungs in place makes a giant rivet of each rung. Collared rung goes in rail (left), is then peened over (cutaway)





THE LADDER BUSINESS is suffering an infestation of cheap manufacturing and merchandising methods. In their scramble to undersell each other, many dealers search out ladders they can sell cheaply. At first glance, these rigs seem as good as those costing 25 percent or so more. But, let's take a closer look.

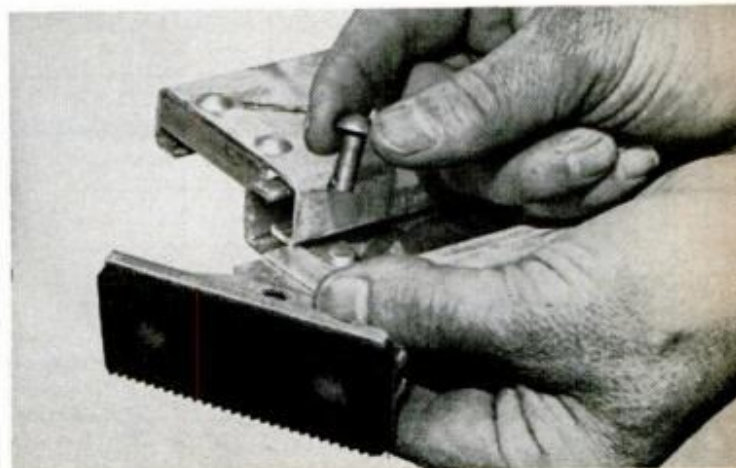
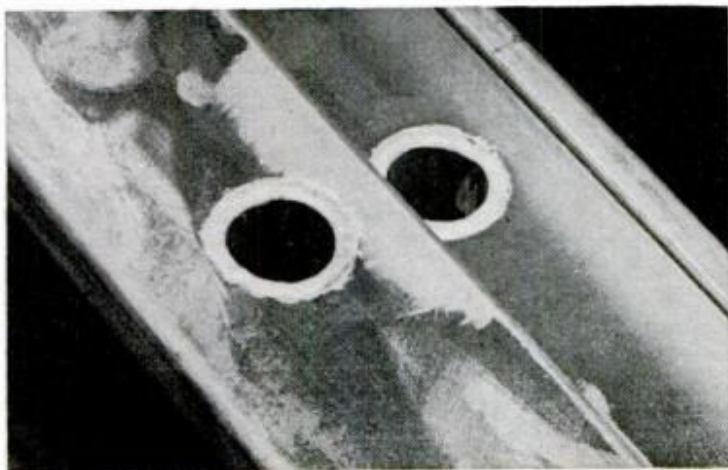
The matter of length, for example, is trickier than you might think. A 24-foot extension ladder has two 12-foot sections—the “base” and the “fly” (see drawing, page 118). According to the American Standards Assn. (A.S.A.), these sections should overlap 3 feet, giving you 21 feet of usable length. Sometimes, especially in cheaper ladders, this overlap is greater to increase rigidity. A tip-off here would be the location of the pulley. Normally, it would be on the top or second rung of the base. On a cheap ladder, the manufacturer may put it two or three rungs away to prevent you from extending the ladder farther than is safe.

The best ladders have one rung per foot of nominal length. For instance, a 12-foot section of a 24-footer has 12 rungs, the lowest one 7 inches from the bottom, the top one 5 inches from the top. Cheaper ladders may have 11 rungs, starting up a foot from the bottom and ending a foot from the top. This is no great inconvenience, but it leaves a foot of side rail at each end which is not supported by a rung. To reinforce the unsupported rails, some such ladders may have a brace beneath the bottom rung. While the braces may give added strength, check to be sure they don't prevent maximum extension by interfering with the operation of the pulley.

Add Strength for Length

Experts say that the longer a ladder is, the more you should pay for it, by the foot. One ladder component manufacturer puts it this way: “The longer the side rails, the stronger they must be. The extra

IN MAGNESIUM LADDERS, rungs are often welded in place (left). Before buying a ladder, try to twist every rung. They should not budge. Photo at right shows well-made swivel mount for ladder feet, thick rubber non-skid “soles”



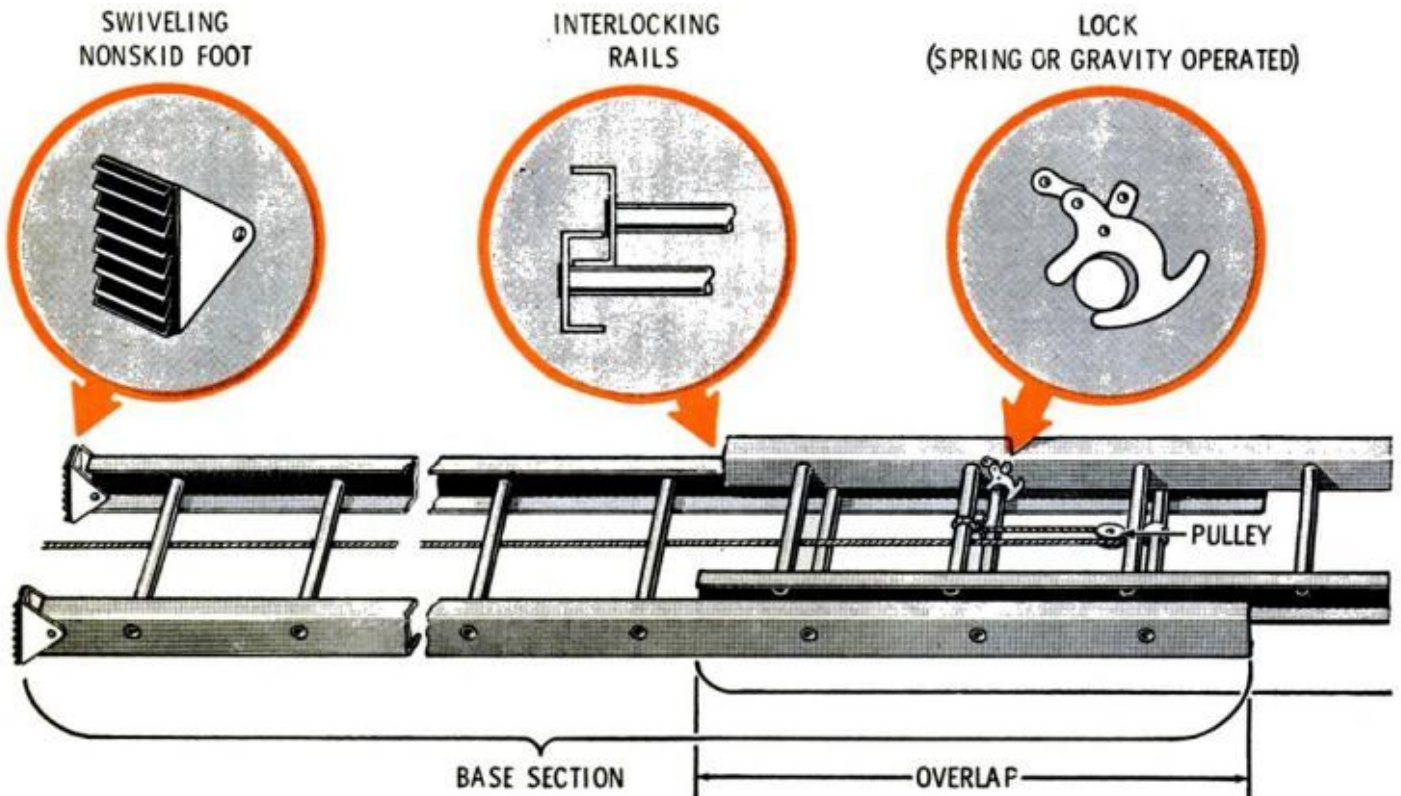
strength can come from only one thing—extra metal or wood.”

Of course there is nothing to keep someone from making a cheap 32-foot ladder using rail stock meant for a 24-footer. As long as such a ladder is never twisted, never set up on uneven ground, never overloaded and never set up at too flat an angle everything may be fine and dandy. But the limitations easily cancel out the low price.

Metal ladder stock is graded by weight per running foot of rail. A good 24-footer

may have rails that go .391 pounds per foot. A higher ladder or a better 24-footer may go .440 pounds per foot. Tops for home owner equipment is around .550. There is no way you can measure this weight on the dealer's floor, of course. All you can do is appraise the gauge of the metal by studying the ends of the rails. There are, in addition, two ways you can approach strength intelligently.

First, don't be so all-fired interested in lightness. Any good aluminum or magnesium rig is light enough. If it is too light,



REPRESENTATIONAL DRAWING (above) shows basics of metal ladder assembly. Many ladders you'll find in stores will have different-shaped rungs and feet. Some short models have no pulleys or ropes

CHART (below) lists the approximate specifications of well-made metal extension rigs. Differences between nominal height and height in place result from overlap and the fact that ladders are used at an angle

TYPICAL DIMENSIONS OF METAL EXTENSION LADDERS									
NOMINAL HEIGHT	ACTUAL HEIGHT IN PLACE	Utility-household grade				Industrial-commercial grade			
		WIDTH	CROSS SECTION OF RAIL	SIZE OF RUNG	WEIGHT	WIDTH	CROSS SECTION OF RAIL	SIZE OF RUNG	WEIGHT
16'	12'	15"	2½" x ¾"	1¾"	20 lbs	18-20"	3" x 1½"	1¾"	36 lbs
20'	16'	15"	2½" x ¾"	1¾"	25 lbs	18-20"	3" x 1½"	1¾"	44 lbs
24'	20'	15"	2½" x ¾"	1¾"	30 lbs	18-20"	3" x 1½"	1¾"	52 lbs
28'	24'	15"	2½" x ¾"	1¾"	35 lbs	18-20"	3" x 1½"	1¾"	59 lbs
32'	28'	15"	2½" x ¾"	1¾"	40 lbs	18-20"	3½" x 1½"	1¾"	73 lbs
36'	32'	Not recommended				18-20"	3½" x 1½"	1¾"	82 lbs
40'	34'	Not recommended				18-20"	3½" x 1½"	1¾"	90 lbs

it may also be too weak for safety.

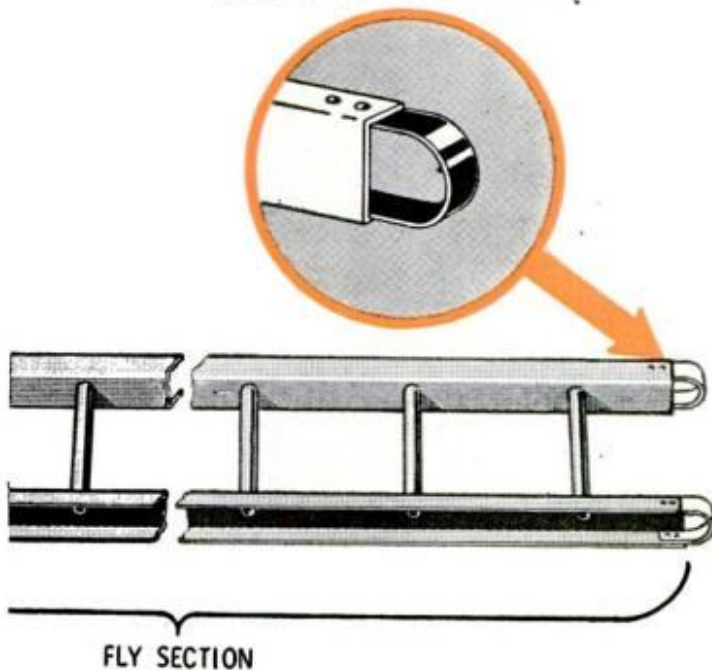
Second, here is an A.S.A. test for ladder rigidity: Extend the ladder to its permissible overlap. Place it flat on two supports spaced 6 inches from each end. Put a 2x4 or something similar across the ladder at midpoint and apply a 200-pound load. The ladder must withstand the load without permanent bending or other visible weakening. Obviously, few dealers will let you perform this test on their merchandise. But it's worth a try.

Ladder experts agree that you should buy a ladder long enough to reach the



WHY STRAIGHT GRAIN is important: Break in this ladder followed the grain where it ran from edge to edge on the side rail, instead of from end to end

SKID
(SOMETIMES PLASTIC COVERED)



RATIO OF HEIGHT TO WEIGHT is an indication of quality in both stepladders and extensions. Rigs that are much lighter than indicated on charts below and at left may sacrifice strength, stability and safety

Stepladders: typical sizes and weights		
Light duty	3 feet	6 lbs
	4	9
	5	10½
	6	12
Utility	3 feet	7 lbs
	4	10
	5	11½
	6	14½
	7	18
Industrial	8	21
	4 feet	14 lbs
	5	16½
	6	20
	8	26½
	10	35
12	42	
14	50	

highest point around your home. But, think twice about skinning up a 32 or 40-footer to reach the gable ends of a two-story house, especially if you're overweight, under-agile or inexperienced.

How wide should a ladder be? They generally run as narrow as 12 inches, which is a bit skimpy. Good ones run 15 inches or more. A worthwhile industrial grade goes 20 inches. Extra width, of course, provides greater stability and comfort for the user.

Incidentally, the once common practice of flaring the base section does little, if anything, for stability. It's impossible to flare the interlocking sections of a metal ladder, anyway, and the practice has even grown rare among wood-ladder makers.

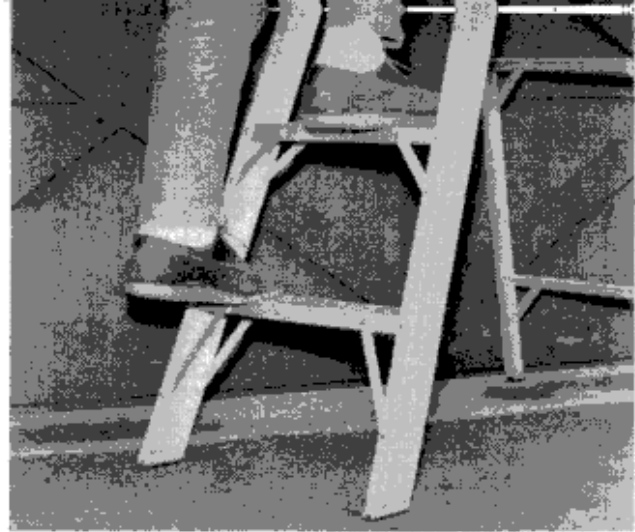
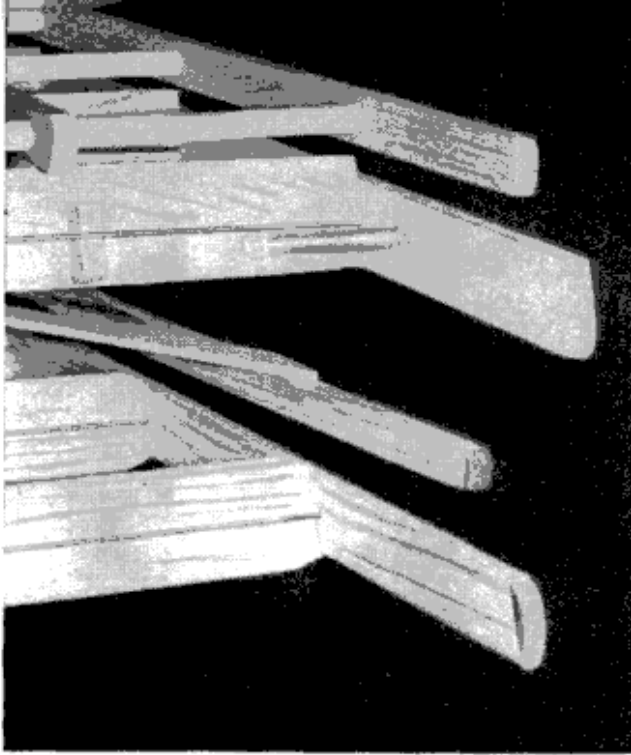
Check the Rung Diameter

Good rungs are important to quality. Wooden rungs should be pretty close to an inch and a quarter in diameter. Grain should be straight and clear. Edge grain should face the top of the ladder.

Metal rungs should be closed tubes which may be round or D-shaped, with the flat surface upward. Cheap ladders may have tubular rungs with open seams. A metal rung under 1⅜ inches in diameter is too light. Good ladders usually have 1⅝-inch rungs.

Some ladders have flat treads, riveted to the sides, or tubular rungs with flat treads welded on top. Both are more comfortable than plain rungs. The rivet construction, however, does not give the strength found in properly made round-rung ladders, and should, therefore, be reinforced with braces under several steps.

A ladder derives its basic strength from



TO STRENGTHEN SIDE RAILS, the bottom two or three rungs of a metal stepladder, depending on the ladder's height, should have diagonal braces like these

GOOD AND BAD POINTS are disclosed in underside view of two wood ladders. While both have straight grain, strong bracing on back and reinforcing rods under the steps, only one has non-skid rubber feet

its side rails. In metal rigs, it's immaterial whether these are channel, I-beam, etc., as long as the metal is properly distributed between flanges and web. In simplest terms, the web provides the strength to keep the ladder from "bellying" when you stand on it. The flanges keep the ladder from bending sidewise. More critically, they hold the web in perfect plane, because the slightest bend or wave might let the web buckle.

Be suspicious of a side rail that measures less than $2\frac{1}{2}$ inches by $\frac{3}{4}$ of an inch overall. Also, compare the dimensions with the weights in the chart mentioned previously; because a rail can be made with good dimensions, but with thin webs and/or flanges.

Hardware varies greatly from ladder to ladder. Feet should swivel freely, to seat firmly on the ground. In some good ladders, they fasten to toothed projections. In icy conditions, you remove the rubber-soled feet and let the teeth take over. Locks may be gravity-operated or spring-loaded. In either case, try them out. If they are tricky or temperamental, the fly section might crash down unexpectedly as you raise or lower it.

Some metal ladders have little wheels at the top to facilitate raising and lowering of the fly. Make sure such wheels are solidly made. An alternative to wheels is skids, usually in the form of an arch over the top of each rail. Sometimes these are covered with plastic to keep aluminum from marking the side of the house. Mag-

nesium doesn't mark; needs no such cover.

Metal Vs. Wood

So far, we've talked mostly about metal extension ladders. What's the story on metal vs. wood? Essentially, wood ladders cost less and weigh more, as shown by this comparison of typical "homeowner" grade rigs:

	Wood	Aluminum	Magnesium
Height	24 ft.	24 ft.	24 ft.
Weight	48 lbs.	29 lbs.	27 lbs.
Price	\$26	\$31	\$47

In judging the quality of a wooden ladder, look for side rails of straight-grained fir, hemlock, pine or spruce. Spruce is best, but getting scarce. The edge of the grain must fall on the edge of the rail. Ash or oak (especially red or scrub oak) make the best rungs. There are probably fewer bad wooden ladders on the market than bad metal ones, since there is less price competition.

Is wood safer than metal around high voltage wires? Well, it is true that you can electrocute yourself by touching a metal ladder to a high-voltage wire, but the antidote is to avoid the wires, not the metal ladders.

A Line on Stepladders

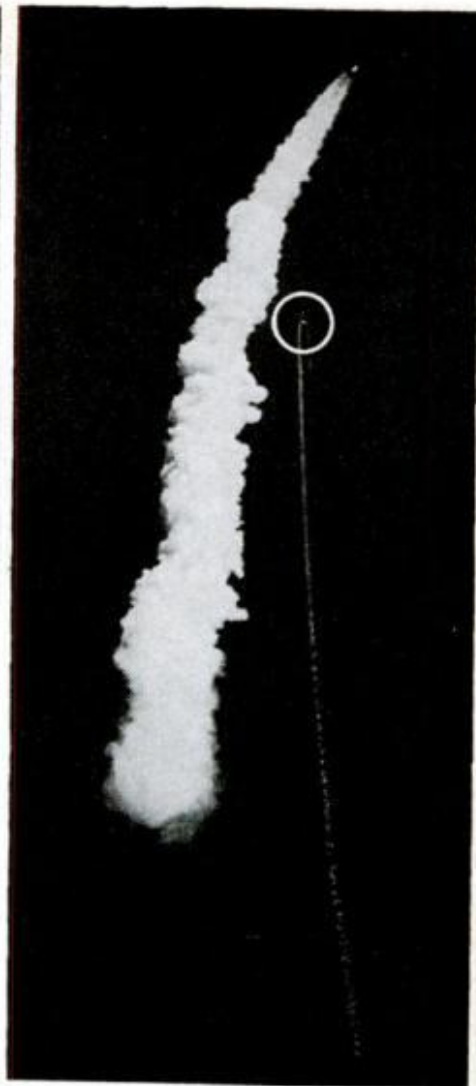
Which brings us to stepladders. Because women frequently buy and use them, there has been considerable effort to reduce their weight. As a result, many stepladders now available are worthless—even

[\(Please turn to page 186\)](#)



What Ails Space Birds in Max-Q?

Close-up photos taken by high-speed jets are helping scientists analyze stresses on space rockets in Max-Q—the area between 35,000 and 50,000 feet where defective rockets usually falter. The planes, lugging wing-mounted movie-camera pods (above), follow the space birds from two miles away. Pilots aim cameras via closed-circuit TV. At right, contrail of camera jet parallels flight of Titan II.



Pooch Gets Radio Control

Tiny electrical shocks from a box on this dog's collar (left) remind him not to misbehave. The box contains a radio receiver and voltage relay. To deliver shock, British trainer Dennis Hayward (above) throws switch on transmitter up to three-fourths of a mile away. Dog suffers no ill effects, avoids whipping.

Presto!—a Picture Window

THAT HOUSE across the page used to squint at its neighborhood through pairs of narrow double-hung windows. They cluttered up its face and robbed the interior of both light and view. Then, in *one afternoon*, the house got a face-lift that made it look years younger and opened its eyes to everything it had been missing.

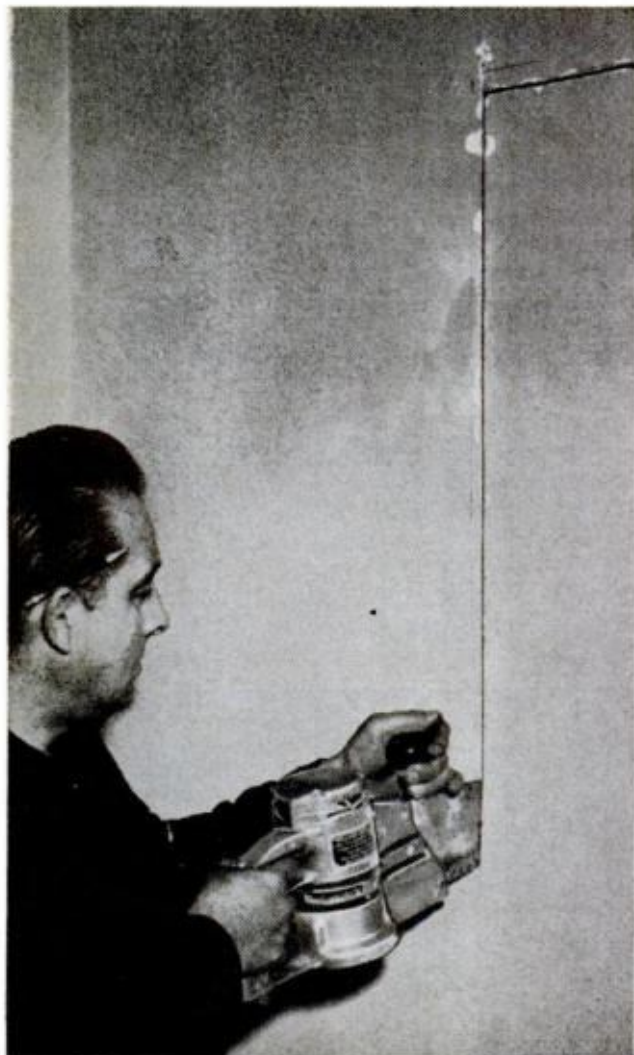
Normally, this kind of transformation is a costly, dragged-out business that tracks plaster all over the house and leaves you with patching chores both inside and out. But—if yours is a frame structure with conventional siding—a new technique made possible by a rugged power saw lets you slice out the old window much as you'd "plug" a melon, then tip the new picture unit into the enlarged opening with a minimum of finish-up fuss. Plan to buy a new window unit of about the

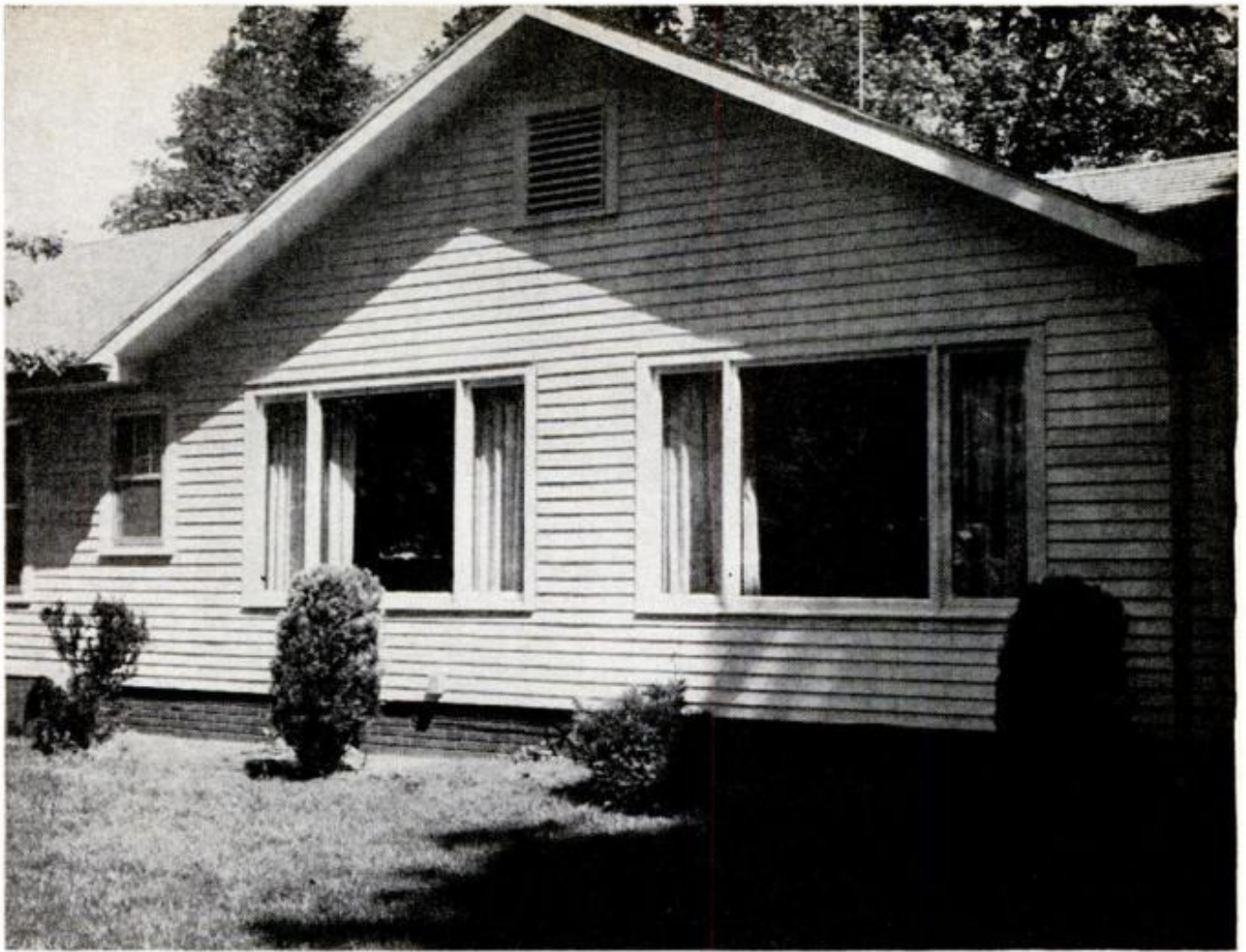
same height as the old, then the new trim will cover the cut edge of the plaster inside and the siding outside.

Fitted with a 16-in. blade, the saw makes so clean a cut through both faces of the wall at once that you shouldn't have to do any replastering or siding patch. In the example shown, openings were cut for two identical picture-window units in the same gable wall.

In this case, the structural stress wasn't critical; in a load-bearing eaves wall, however, slicing out such large sections would require the insertion of new headers or lintels. If this is your situation, the job will involve some plaster patching, since you'll have to chop holes above the opening to gain access for trimming back the studs for the new header. Toenail the cut-back studs to this header through

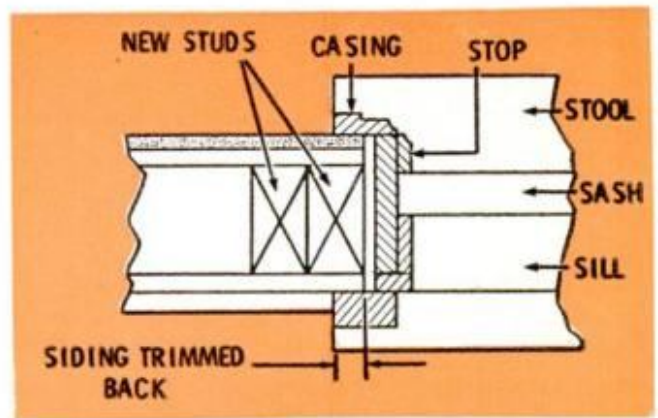
WITHOUT STARTING HOLES, Wellsaw 400 zips through plaster, lath, sheathing and siding simultaneously (left). Entry was made with simple plunge cut. Before section is removed, finished cut is hardly seen (below)



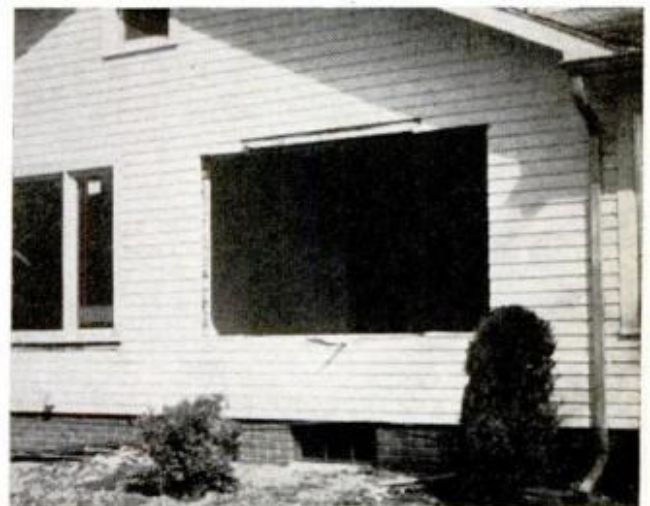


the access holes. If you're cutting out an existing window, the way the original opening was framed will clue you as to how much new framing you'll need.

The sketch at right shows a lateral section of a fixed-pane unit installed with conventional casing and trim. Here a doubled stud has been inserted in the hollow wall to anchor not only the window but the cut edges of the sheathing and interior lath. You may be able to position your new opening to take advantage of an existing stud at one side. ★★★



OUT IT TOPPLES (left) with hollow-wall section breaking free of old window frame. Removal of this 5-ft. 8-in. by 9-ft.-8-in. piece leaves neat opening (right) ready for insertion of new framing (sketched above)



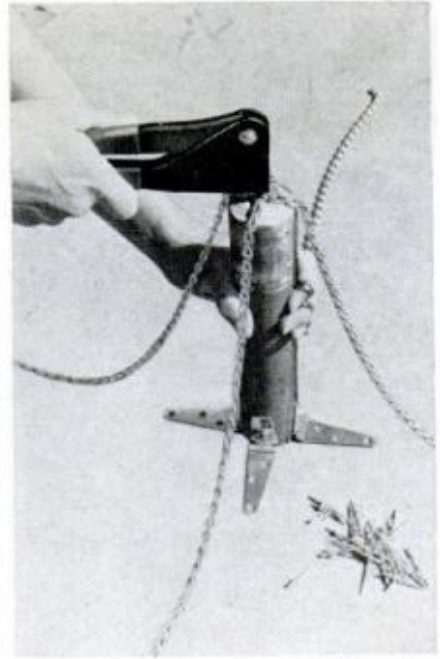
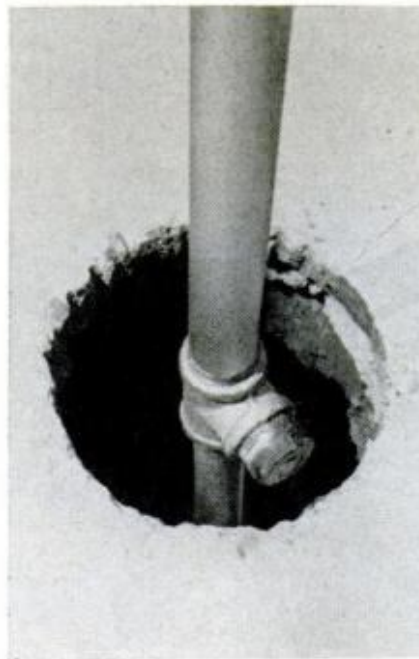


Hurry Mom and Get Those Clothes Down . .

By Bob Gilmore

200 FEET of line is within reach without taking a step. To string them, stake the arms in position on ground, and start cord at center

PLANT THE POLE by means of a threaded coupling and you'll be able to unscrew it to clear the area. In existing concrete, drill ring of holes with masonry bit (left), sledge out concrete within circle and dig into earth about 18 in. Short length of pipe screwed into coupling (such as tee in center photo) is propped up in hole, with top of tee 1/4 in. above surface before pouring concrete. Right photo shows how to blind-rivet chains



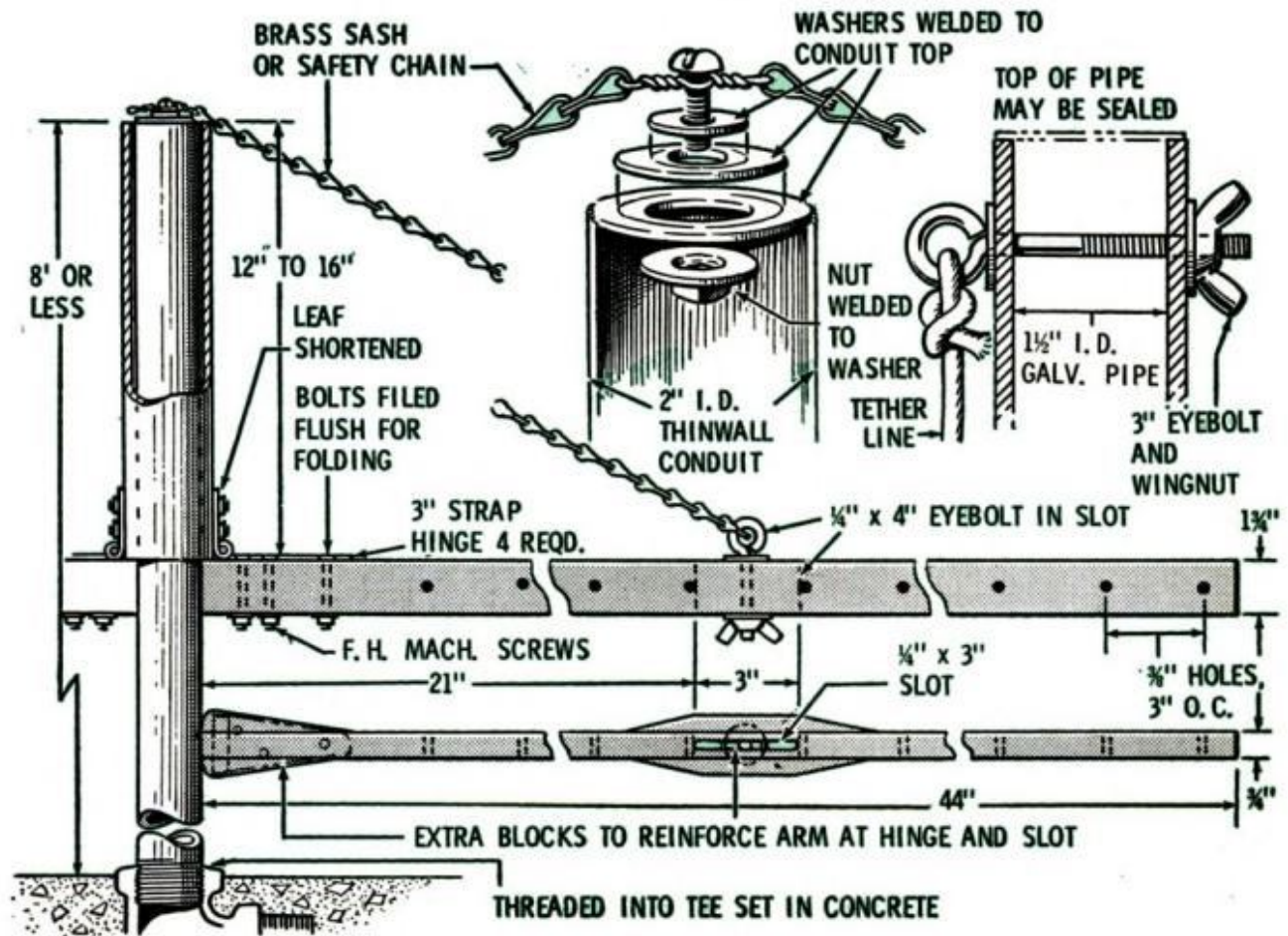
IT'D BE HARD to find a project that'd rate you more cheers from the family than this double-duty work-play unit. In one fell swoop you provide your wife with a step-saving revolving dryer—and treat the kids to a rousing sport that's sweeping the country. For all its practicality, the dryer has been losing out to other types of clotheslines because its a space-hogging eyesore when it's not in use. But in this version, the whole top folds and lifts free, stripping the pole for action.

The pole is 1½-in. galvanized pipe, with the top plugged against rain. If your wife's a shortie, you'll have to compromise on the pole height, but even a 7-footer makes for lively tether ball (though 8 ft. is best).

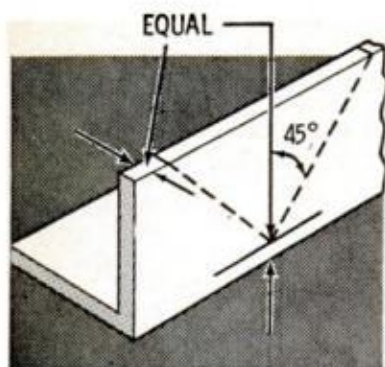
The sheathe that slips over the pole to support the dryer arms is thinwall conduit, its top end closed with a steel disc. A hole in this disc takes a bolt or rivet that's passed through the center link of both chains. Spruce is the best wood for the hinged arms, which are fastened to the bottom end of the sheathe with rivets. The arms are reinforced as shown. ★★★



... So We Can Play Tether Ball



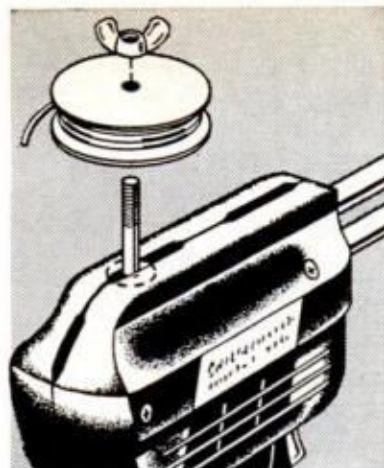
TAKE A HINT FROM READERS



TO OBTAIN a neat square joint when bending angle iron for welding, mark the axis, strike a line at right angles to indicate the thickness of the leg, scribe two 45° lines from the intersection, cut and bend gap shut



OUT OF TEES? If you make the discovery when you're all set to go out and sock a few around the park, borrow a couple of caps from toothpaste tubes—the type with a concave top. They don't even require soft ground



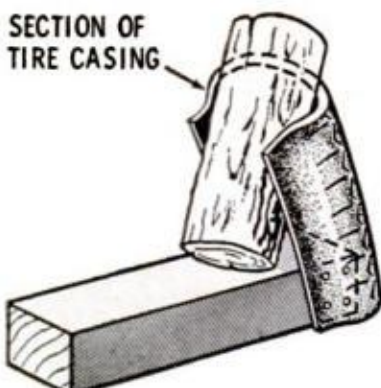
YOU'LL ALWAYS HAVE solder handy if you keep a supply coiled on a typewriter ribbon spool bolted to your gun. Loosen the casing and slide the bolt head into the vent slot, then tighten casing and mount spool

ALLIGATOR CLIP

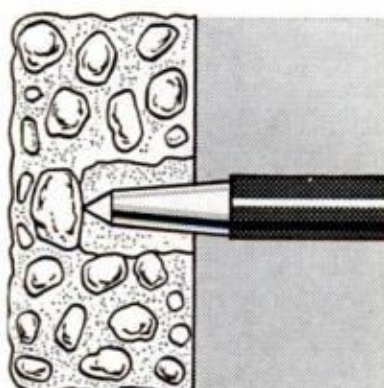


EASY WAY to keep track of the chuck key used with a portable electric drill is to store it in an alligator clip mounted on the drill. The key is easy to remove or replace, and you'll always know where to find it quickly

SECTION OF TIRE CASING



SPLITTING BLOCK holds chunks of wood at just the right angle while you wield the axe. Just nail a section of auto tire casing to a scrap of 2 x 4. Force the chunk to be split between the beads of the casing, as shown

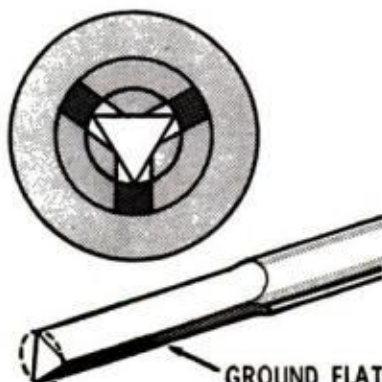


WHEN YOU'RE DRILLING holes in masonry and the bit appears to have stopped cutting, you've probably hit a pebble. To split it, insert an old center punch in the hole and give it several heavy blows with a hammer

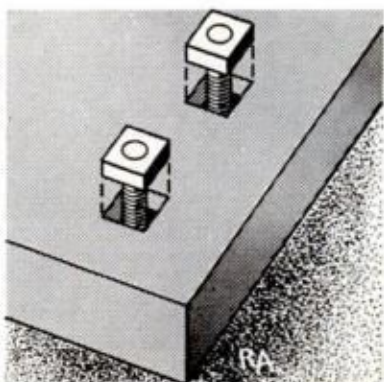
TO LOCK TRIGGER of a soldering gun in the "on" position, slip a heavy rubber band up over the handle. This will allow you to place the gun in a vise if you need both hands free to hold or manipulate the work



IT OFTEN HAPPENS when drilling small holes in bronze that the drill binds so that you have to keep tightening up on it. If you grind the shank to a triangular shape, you'll find that it fits jaws too snugly to slip

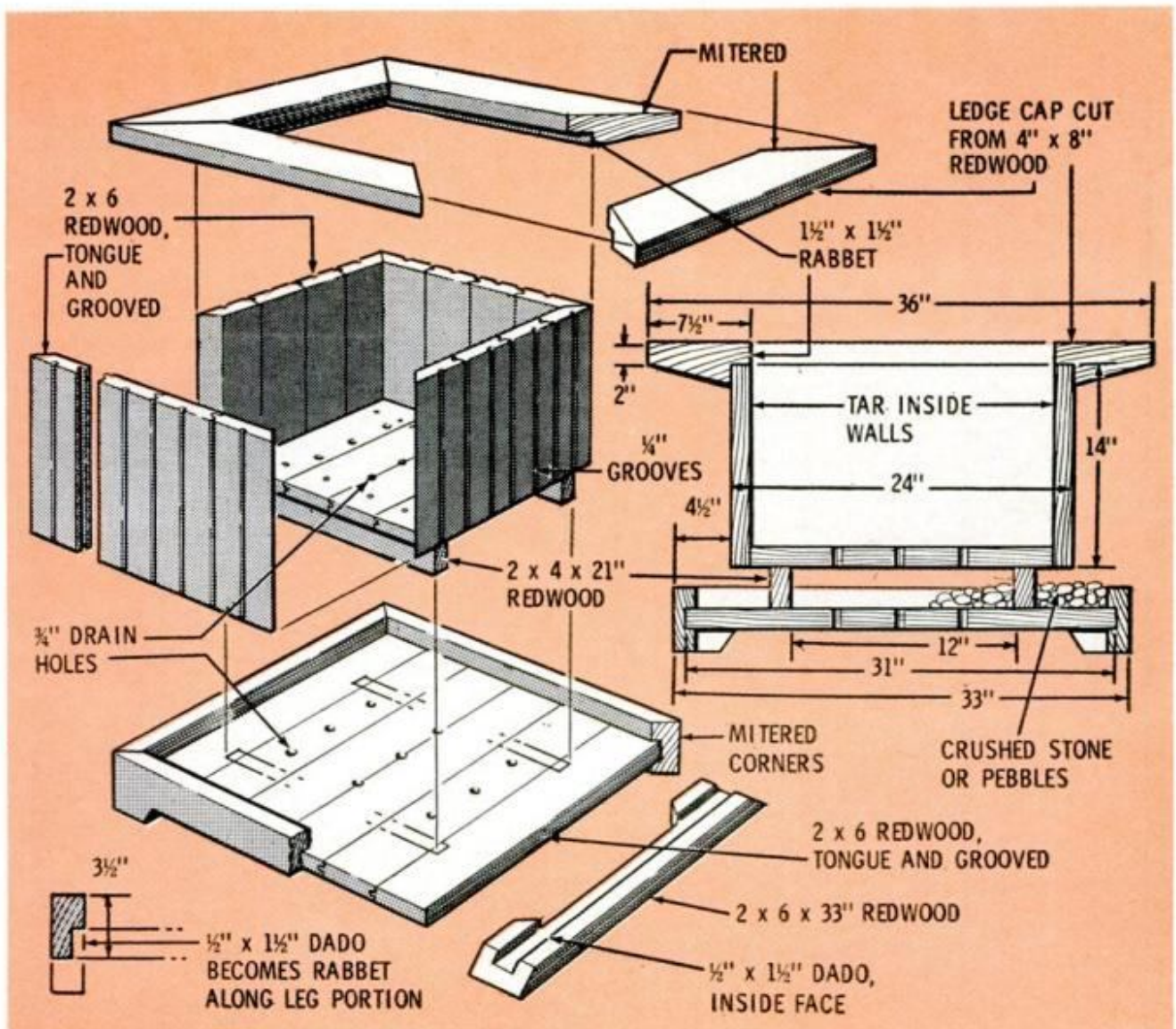


USE PRE-POSITIONED bolts recessed in bench top to mount seldom used tools, such as a pipe vise. When not in use, bolts extend below bench top and nuts fit into sockets cut in the surface where they're out of the way



Redwood Planter

NOTHING ADDS more style and richness to home landscaping than a large shrub or small tree in a redwood planter. But having one delivered from the local nursery is beyond the budget of many homeowners. Detailed below is a planter designed to be built in a home workshop. Use kiln-dried Clear All Heart redwood for durability. Since redwood needs no preservative treatment, you're not risking root-burn damage to sensitive plants. No finishing is required, beyond tarring the inside face of the sides and bottom before shoveling in the dirt. Each side consists of four 2x6 tongue-and-groove planks with 1/4-in. center grooves. The foot is open at two sides for ventilation and drainage.





By Robert Talley

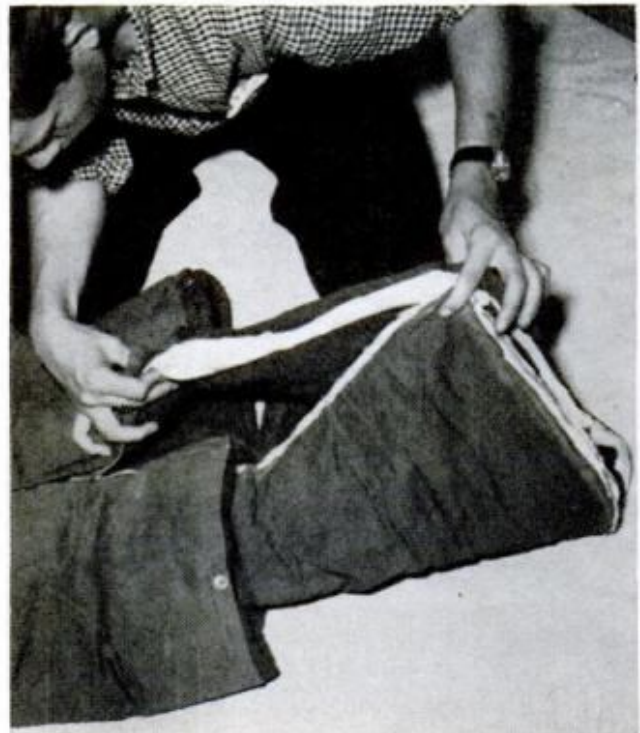
WE HAD EXCITING PLANS for our family vacation—a week of camping in California's rugged Cascade Mountains. But there was a problem—our old Dacron-filled sleeping bags weren't warm enough for mountain use, and their weight would make backpacking pretty hard work.

So I went to work with scissors, razor blade and sewing machine. When I was finished, each bag had a snug-fitting "parka" hood to keep body heat from escaping. Weight and bulk were pared to a minimum by tapering the bag into a "mummy" shape.

If you'd like to perform similar surgery, begin by laying the bag on the floor, with zipper face down and centered the length of the bag. Then chalk a cutting line as indicated in the photo. With a razor blade, cut the threads holding the zipper to the excess material, beginning at the bottom and continuing to where the zipper intersects the chalk mark at the foot of the bag. Keeping the bag flat, cut the outer cloth along the chalk line. Then using this cut as a guide, mark the padding underneath and cut it; do the same with the other layers until the bag is cut away from the excess material.

LIFT MATERIAL by the unzipped fold and mark for cutting about 4 in. above user's body. Don't forget to allow for adequate turn-over room inside the bag

TO FIT HOOD on bag align sides of face opening with the flaps above the zipper. Check alignment, then press hood flat and sew it to the front and back of bag



CHALK MARK indicates cutting line. Area marked off at lower left corner provides more than enough material for the hood

To make the hood, lay out the bag, with zipper up. As before, have the user get into the bag, keeping the unsewed seam closed as much as possible. The end of the scrap from which the zipper was removed forms the base of the hood. Insert this piece into the bag, under the user's head. In fitting the material, leave about 3-in. of slack. After cutting out the hood, unzip the bag and sew the outer cover together, with raw edges on the inside. Then, keeping the outer cover turned back, overlap the padding and liner about 1 in. and sew them together. The end of the zipper is tucked in the lining and cut off, leaving

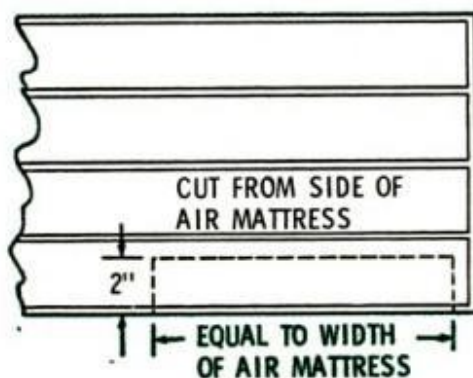
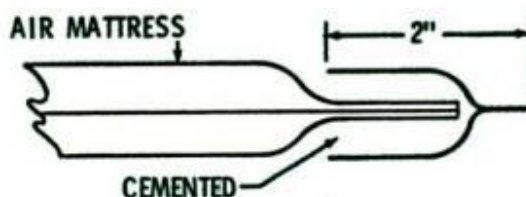


about 1 in. hanging; liner and outer cover are hand stitched around the zipper. The hood is sewed in the same manner as the bag. To attach the hood, first pin it in place, then sew the back and two front flaps to the bag. The openings at each shoulder are closed with hand stitching. The bag is now complete—smaller, warmer and lighter. ★★

Cut Down Air Mattress Folds to Sandwich Size

A fitting companion for a lightweight sleeping bag is a $\frac{3}{4}$ length air mattress that can be folded to sandwich size. It is cut from an inexpensive plastic mattress of standard length. The first step is to measure from the top of your shoulder to just below the hips; add about 3 in. and mark this length on the mattress. With scissors or razor cut on the line, then cut off a strip from the scrap material to seal the open end of the mattress. The strip, about 2 in. wide, should be cut from the

side of the scrap so that you have the sealed outer edge and both top and bottom layers of material. Fit the open end of the mattress between the layers of the strip and attach with plastic cement. It's best to apply the cement liberally, particularly around the ends of the strip and between the tubes, where the material may not adhere well. When the cement has dried thoroughly, inflate the mattress and check for leaks. If you find any gaps, give them an extra squirt of cement.



Building PM's Patio-Garage

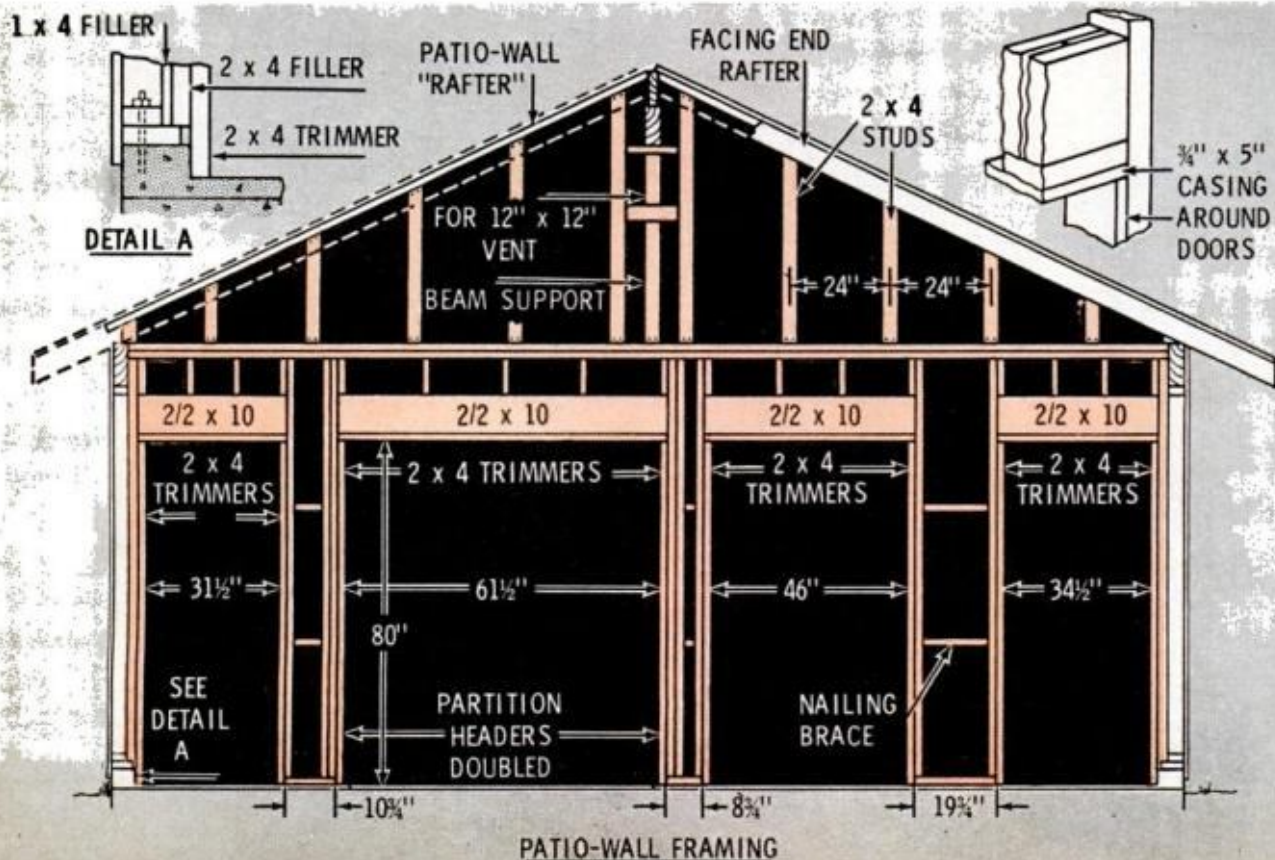
By Manly Banister, with Dick Chilson



GAPS BETWEEN BOARDS needn't be uniform since battens hide them, but errors in alignment compound

IF YOU STARTED to build your garage from the first installment of this article in our April issue, you're probably impatient, by this time, to get that final wall up! Especially since that wall is the feature that gives this garage its special distinction. It's a two-faced, dual-purpose wall that provides practical storage *inside* the garage while turning a face of fun toward the patio, as shown in the drawing at the right.

In last month's issue, we roofed right past that missing wall (and on out 7 ft. over the patio) because the wall is compartmented in a way that requires a number of partitions, and it's simplest to erect it last. This fourth and final installment, then, will concentrate on that patio wall. The quickest way to grasp its construction is to refer to the floor plan of the architect's blueprint, reproduced on page 141 of the April issue (and available in a larger one-sheet form—see note at the end of this article). As we've noted in previous installments, when we tackled the actual construction, we made certain changes you won't find on that blueprint. One of these involves the four door openings in the patio wall; to simplify framing, the architect called for 8-ft.-high door

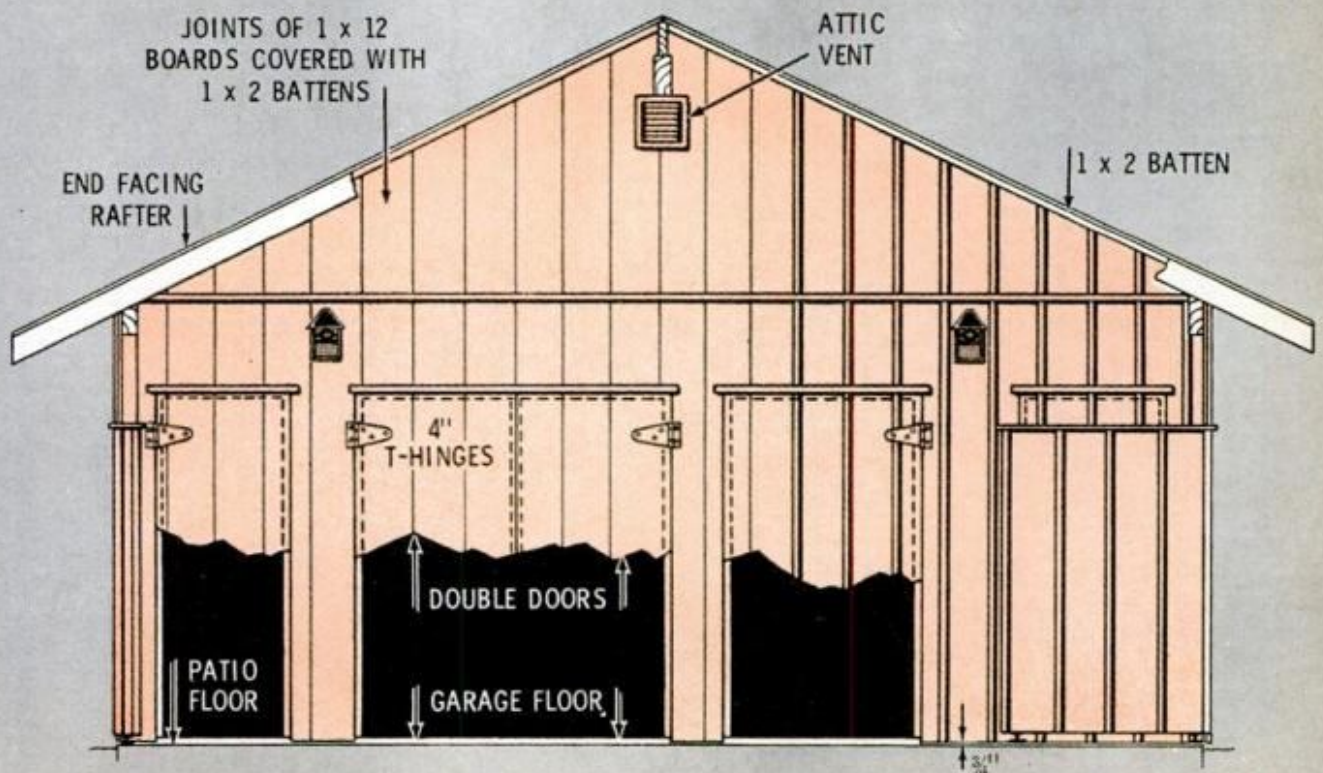




panels. Since we raised the top plate all around, if we'd made our doors full height, they'd have been even taller, and I felt such panels would be unwieldy and space-wasting. So we used regular dropped-header framing: As shown below left (where the framing of the *outer* wall is indicated in color), 2x4 trimmers 80-in. long support doubled 2x10s; these are spaced apart with $\frac{3}{8}$ -in. shims to increase thickness, and spiked to a 2x4 for greater height. The board-and-batten doors, therefore, are a standard 6 ft. 8 in. in height. In the case of the two doors to the storage room (right) and the garage entry (far left), this permits installation of

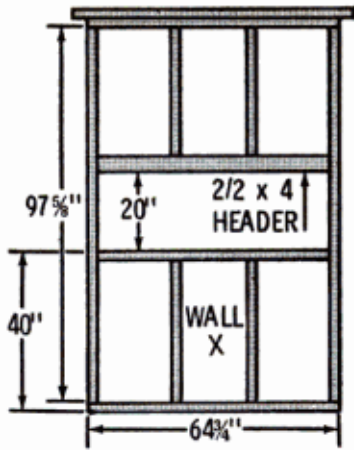


GABLE FRAMING of patio wall has studs installed sideways for easier toenailing to under-roof cleat. Note beam support ties into framing for 12x12 vent



PATIO-WALL TREATMENT

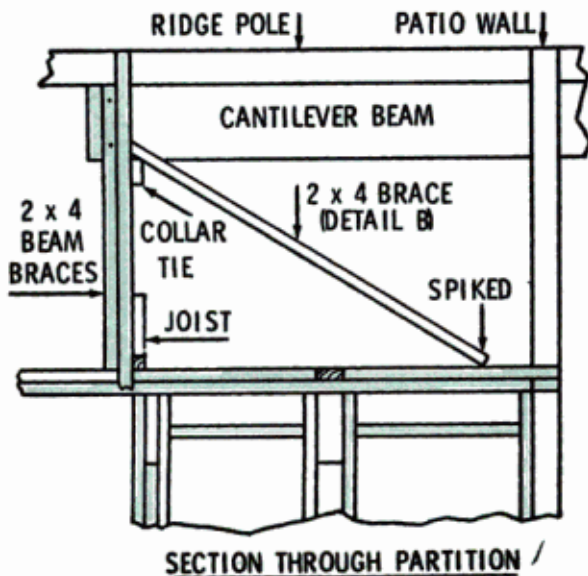
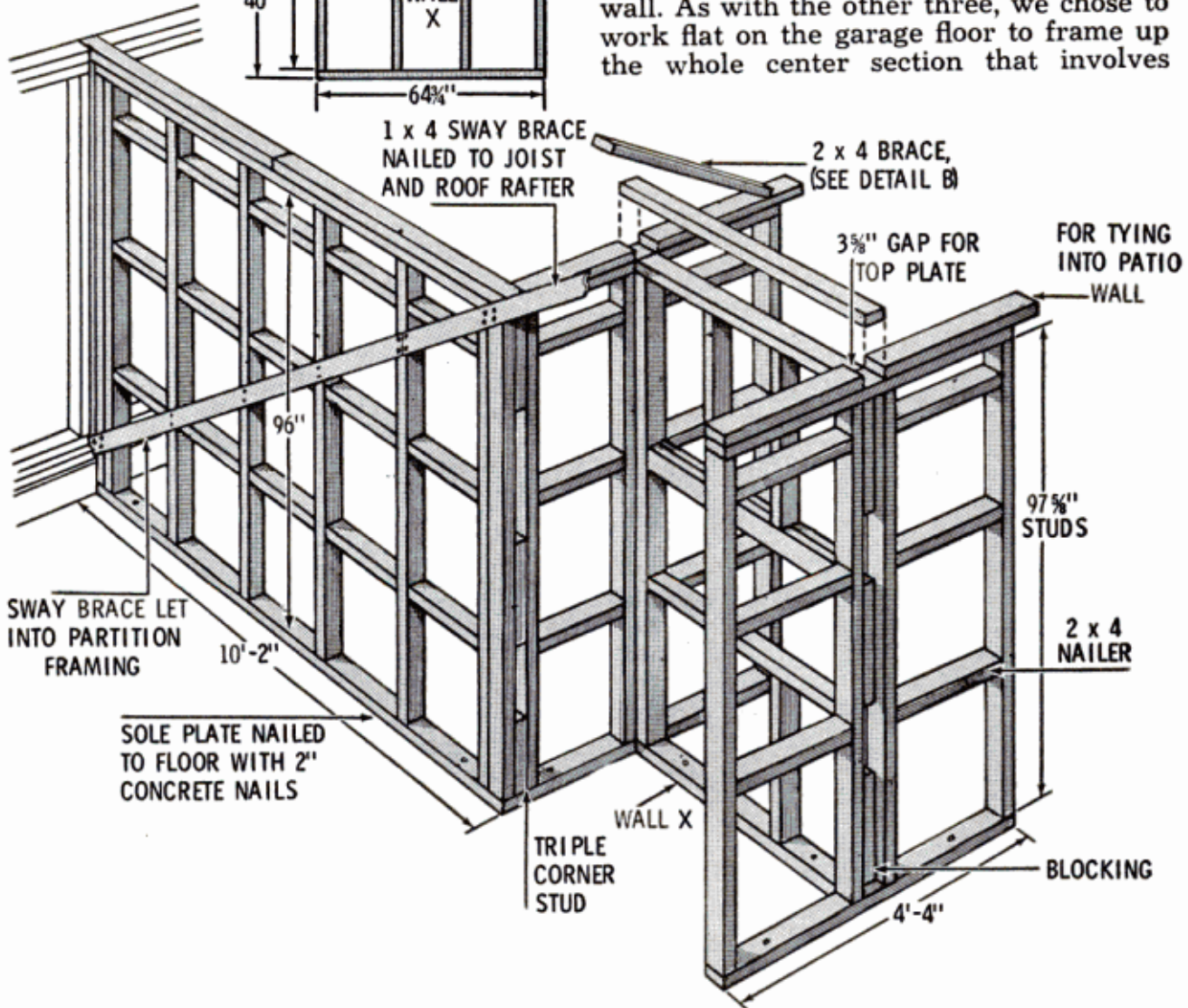
WALL X runs parallel to patio wall; view from inside garage (below) shows how it sets between storage closet (left) and entry partition (right)



storage shelves above the doors, inside.

The other colored sketch (page 131) shows how, with careful planning, you can apply boards and battens to the doors to carry through the siding pattern. The lower-right section that's off alignment is a short "return" of the patio privacy fence. The wall siding starts just inside the fence, where it joins the garage.

There are several ways to erect this wall. As with the other three, we chose to work flat on the garage floor to frame up the whole center section that involves



sole plates, and includes two center door frames. The trimmers and header of the far-left (entry) door were installed in place, as was the right trimmer of the right-hand door. The center section has a single full-width (from front to back wall) top plate—in fact, the best way to space the studs is to lay out the door openings on this member as the first assembly step. When the framing is swung upright, this top plate should slide neatly beneath the 3-ft. crossies we left projecting inward from each eaves wall, at the end of the May installment. Nail these ties, now, to the top plate, then measure the gap between them and cut a 2x4 to fill it, forming a full-width doubled top plate. Plumb the wall and spike the sole plates to the floor with 2-in. concrete nails. Finally, add the

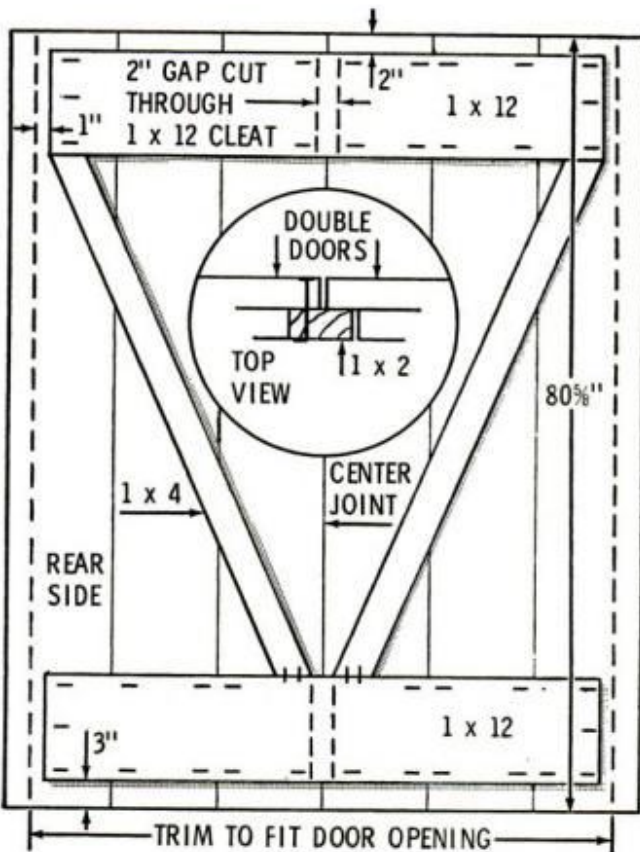
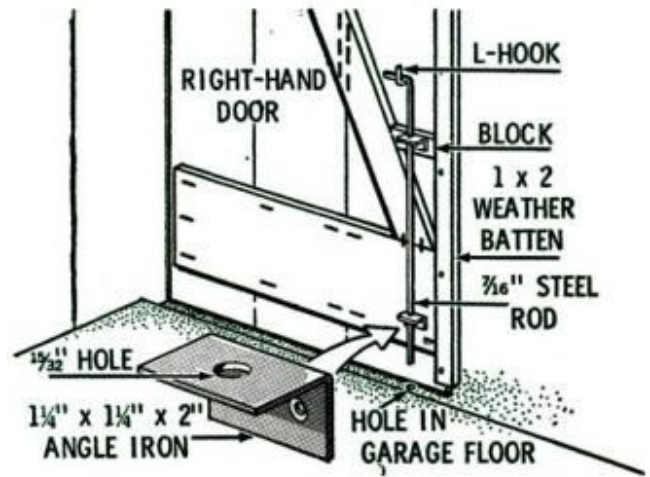
DOUBLE DOORS MADE AS ONE, THEN CUT DOWN MIDDLE



QUICKEST WAY TO MAKE PAIR OF DOORS for sink compartment is to assemble single panel, larger than opening, attaching braces with 6d nails at slant so they won't penetrate. Flip panel over, square it, and nail through front with 8d finish nails. Trim four edges to fit opening, then scribe centerline and slice panel in two with portable circle saw (right). Turn each half over and clinch 8d nails before hanging

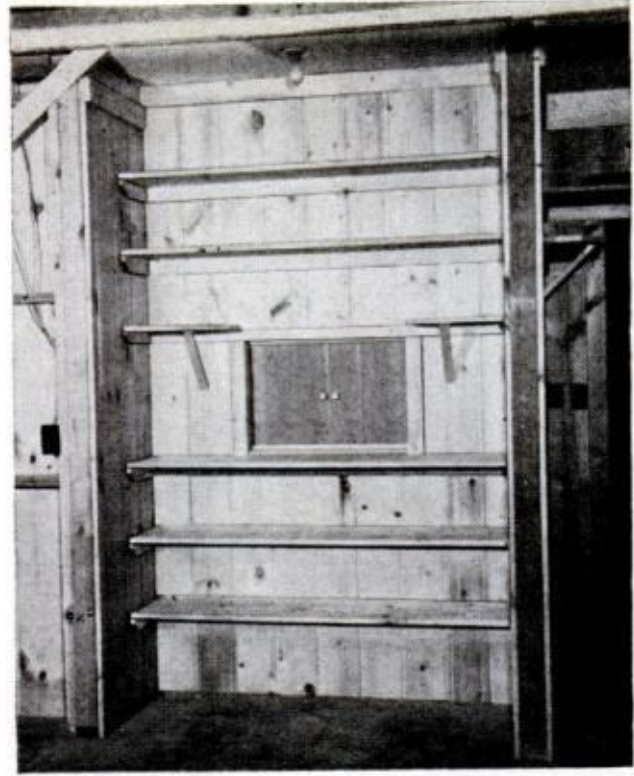
gable framing, as shown on page 130.

But the exterior facade is only one plane of the patio wall. Unconventional construction calls for special solutions to framing problems and when it came to sway-bracing the main partition wall (behind the two righthand doors) I was grateful for the professional know-how of my contractor neighbor, Dick Chilson, since the door openings in the exterior wall prevent any angle-bracing. His solution is sketched at left. The partition brace is set against the mud sill and sole plate of the rear wall, and extends up to tie



DOUBLE DOORS must have one panel anchored for latching other one. Install pair of angle brackets as above, hold door shut and drop rod sharply through holes to mark concrete. Drill 2 in. deep hole with 1/2-in. carbide masonry bit at this point (below)





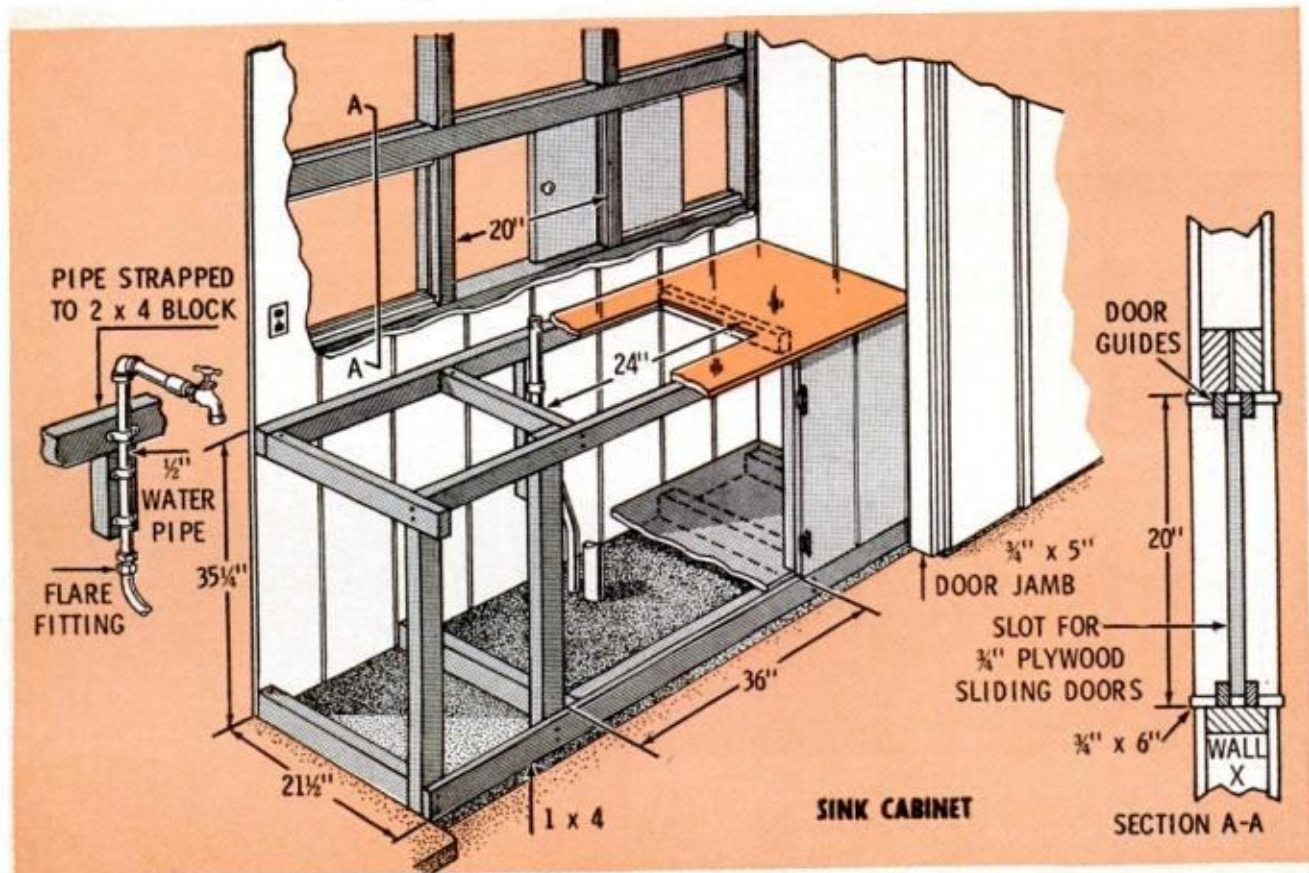
SINK ALCOVE, seen from patio (left), shows faucet, and duplex wall outlet left of pass-through. Back face of same wall (right) is paneled, has 1x12 shelves. Pass-through is handy when you need water inside garage

into the joist and rafter on the far side.

After this partition is erected and plumbed, the other three partitions are set in place, to define the sink alcove and storage closet. The only extra bracing here is the 2x4 shown in white in the colored sketch on page 132; this is spiked near the patio end of the center partition and to the collar tie that helps support the ridge

beam. (This construction, incidentally, brought a whistle of approving surprise from the building inspector.)

If you don't feel a pass-through feature is of value to you, you can simplify the framing of divided wall X. Since my garage doubles as my shop, I thought it would be handy to have access to the sink tap without having to go out onto



the patio. The pass-through doors are panels of exterior plywood that slide into wall-pockets at either side.

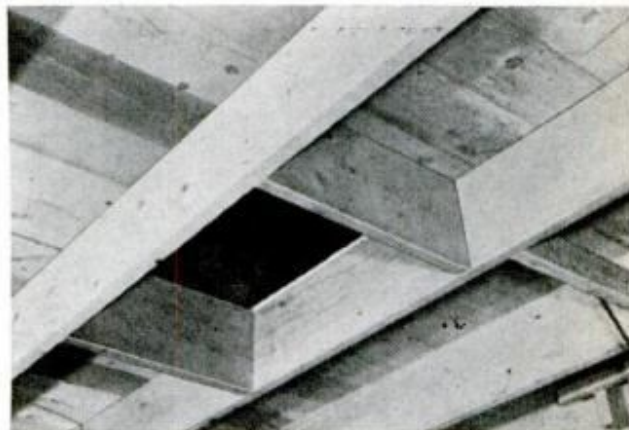
The double doors that grant access to the sink from the patio are easier to make as a single panel. You trim this panel for a good fit in the opening, stand it in place on $\frac{3}{4}$ -in. shims laid on the concrete, tack it temporarily while you locate and drill for the hinges. After attaching the door-frame leaves of these hinges, knock the panel out of the opening, slice it down the middle, cut back both 1x12 cleats on each side the cut, apply a weather batten and hang the doors on their hinges. They'll mate perfectly.

After I'd framed up the sink cabinet, as shown at left, I applied the plastic-laminate-faced countertop, marked it for the sink opening and cut it out with a saber saw. No matter how carefully you measured when you installed the sink drain pipe before pouring the slab, it'll be a miracle if it's exactly centered on the drain once the sink is installed (unless, of course you don't mind shifting the sink off-center to compensate). Since my sink is serviced by a dry well—into which only clean water should pass—no trap is necessary. So I merely joined the neck of the sink drain to the pipe with a length of radiator hose and a couple of hose clamps. I installed a faucet with hose-threads, for convenience in watering nearby plants.

I did all the wiring myself, with a good "simplified" book on household wiring in

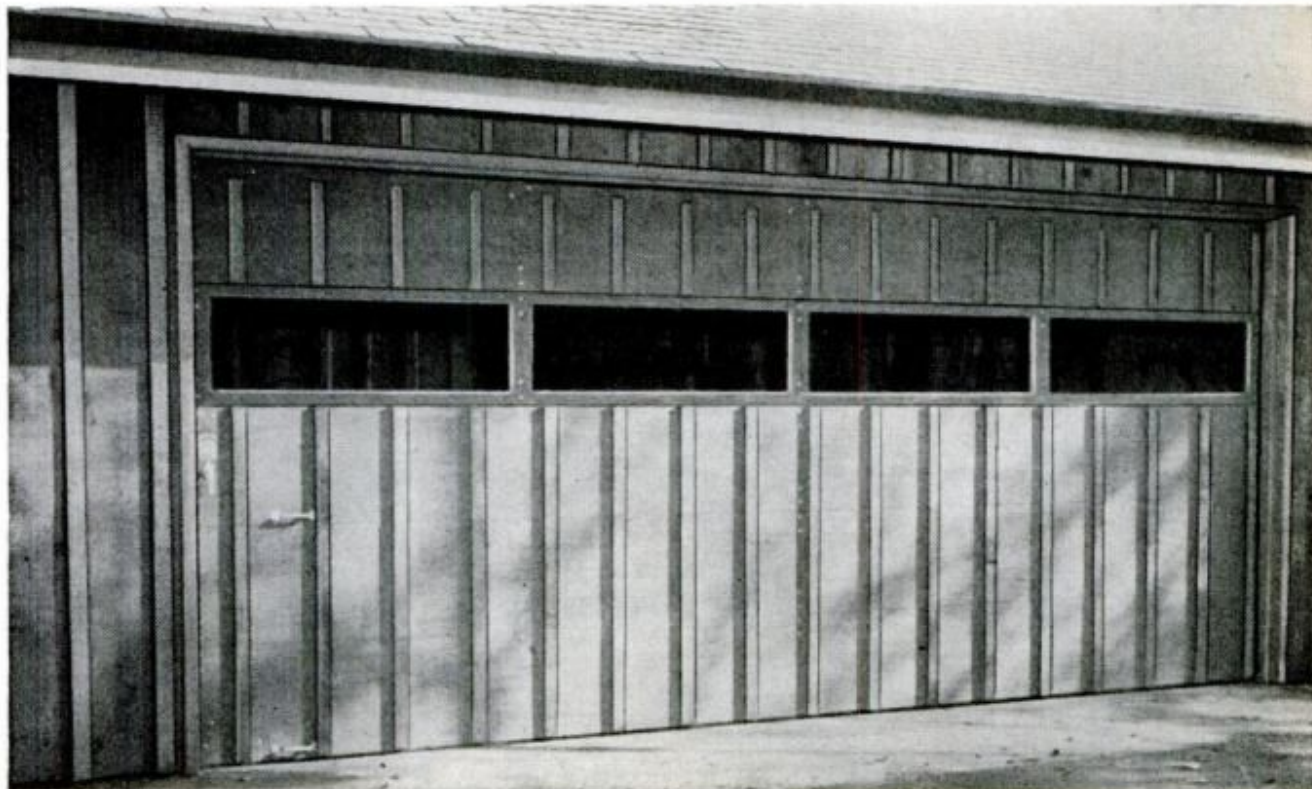


FINISH WORK goes on in all weather if you move your radial-arm saw inside after your wiring's in. Mine will stay here as the nucleus of my new shop



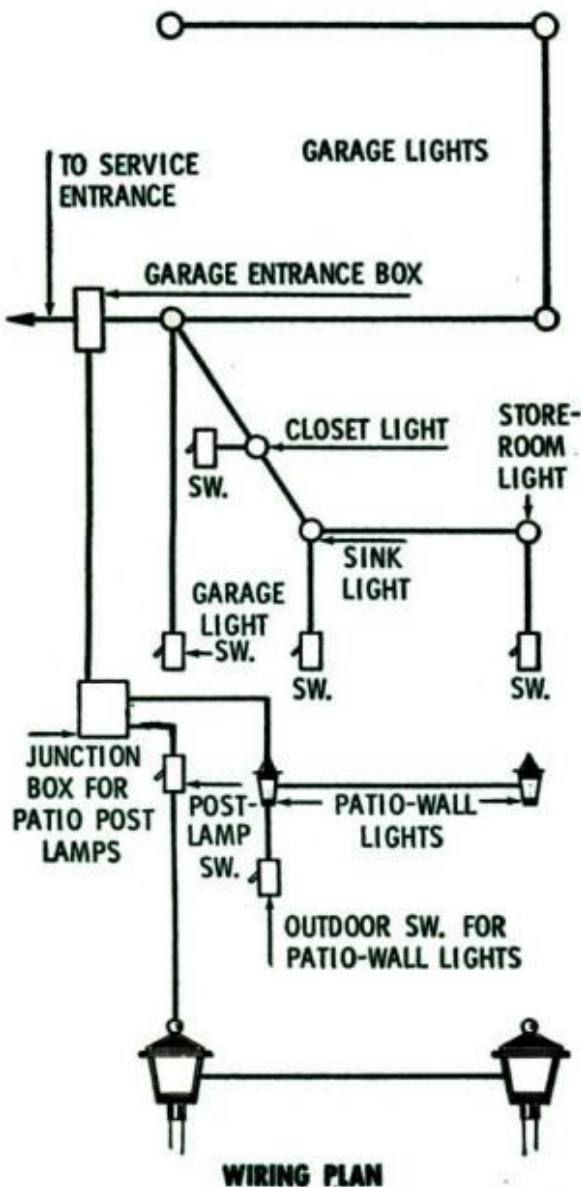
OPTIONAL DECK on top of ceiling joists greatly increases storage space. For access, leave opening between two joists, frame with 2x10s as shown above

ROLL-UP DOOR has five hinged panels, so each vertical batten had to be applied in short pieces to "break" at the joints. Door is commercial 7x16-footer





WIRING POST LAMPS is simple matter of twisting and taping leads from fixture and wires you previously ran up both posts; soldering is optional



one hand and the sound advice of local inspectors ringing in my ears. Even with these distractions, it only took me a week-end—and I got fairly elaborate—more so than my simplified diagram, below left, suggests. I included a 220-v. #10-wire circuit for a recessed wall heater, fused for 30 amps., plus a 220-v. crowfoot receptacle for my welder, fed by three #6 underground cables and fused for 40 amps.

Since my service entrance already had a 200-amp. box, I could add as many circuits as I chose. But it's a good idea to consult your local power company about your entrance facilities beforehand.

I'd ordered enough roofing shiplap to deck in an "attic" with the leftovers. This floor, nailed to the top edge of the joists and provided with a hatchway, gives me vast additional space for storage of seasonal or unneeded items. It also helps insulate the garage until I get around to installing real insulation this fall. Planning toward that, incidentally, I put fiberglass batts in all partition walls exposed to cold, before I paneled the inside.

But after weeks of work, my only thought by this time was putting that patio to use. Already, this summer, it's been the scene of many social gatherings—because once *PM* pictured it on the cover of the April issue, friends we'd not heard from for years began to turn up. They all want to be entertained on the famous patio. In fact we considered renting out our house for the summer, it was getting so little use. ★★★

ARCHITECT'S PLANS

If you find that an architect's working blueprint is required to secure a building permit, you can obtain a standard 17 x 23-in. plan (Scale: 1/4" = 1'0") by sending \$1 to *Popular Mechanics Magazine*, 575 Lexington Ave., NYC



Shelter Fly Rolls Out from Car-Top Rack

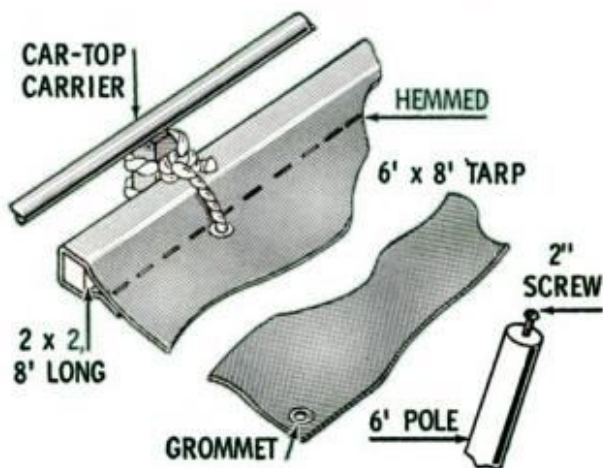
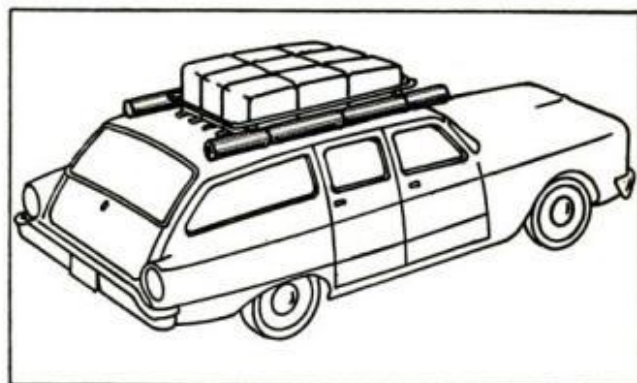


FROM extended auto camping trips to a quick roadside meal, you'll welcome the protection from sun and rain offered by this 6 x 8-ft. tarp mounted on the luggage rack of your car. For traveling, poles and stakes are simply rolled into the tarp which is then lashed to carrier.

To make it, hem the long edge of the tarp over an 8-ft. length of 2 x 2. Install three grommets along this edge to permit tying the pole to the rack. Use 6-ft. lengths of thinwall conduit for corner posts, plugging the upper ends and driving round-head wood screws part way in to engage grommets in the outer corners of the tarp.

Make one fly for each side of the car and you'll have almost 100 sq. ft. of shelter.—*Frank N. Stephany*

On pickup picnics, when you don't want to take along a big cooler, pack ice cubes in a laminated foil bag of the type provided by grocers when you buy ice cream. With paper cups and canned beverages, you can have cool drinks without having to carry anything home.—*Ken Murray*



Hypo Lube for Precision Gears

Placing a drop or two of oil exactly where you want it in a fishing reel or clock can be a messy, difficult job. The perfect tool for such lubrication tasks is a hypodermic needle, so the next time you see your family doctor, ask him to save a couple of syringes of the type designed to be used only once with medicine. Clean these out, fill them with thin oil and you're all set.—*Robert Hertzberg*



TV Cart Holds

THIS MONTH, everything moves outdoors—including your TV set! For the rest of the summer, you'll probably be watching the Dinner Movie out on the patio and the Late Late Show in the living room. And wherever you are, when you've had enough of Maria Montez, you'll want a selection of your favorite magazines at hand.

Even if your television never stirs from the house, you'll find it easier to position for reception and viewing, once it's on wheels. This cart looks best when the top and rack are a matching plywood, with veneer tape on the edges.

—Steve Ellingson



Magazines, Too

MATERIALS REQUIRED

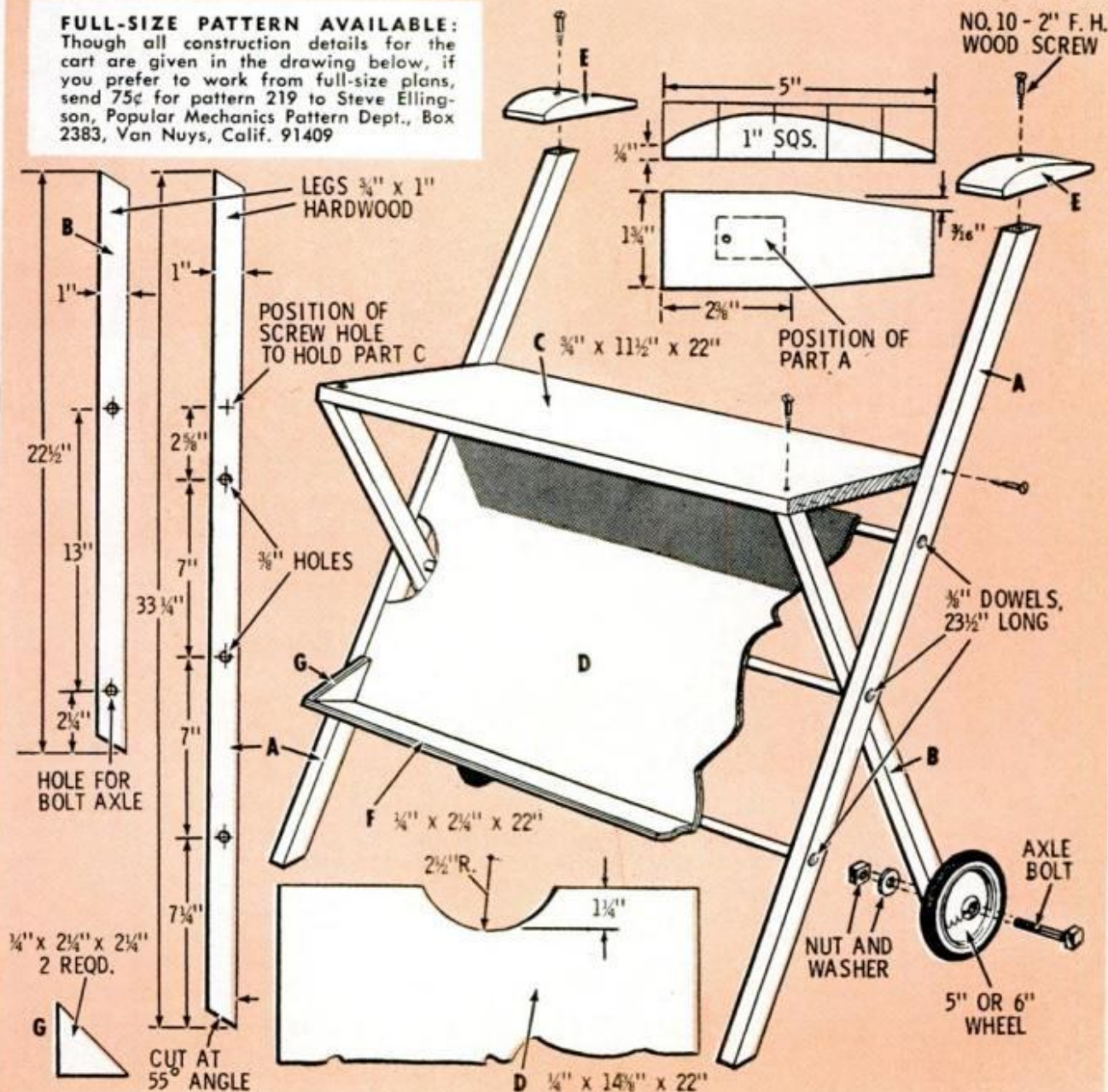
PCS.	DESCRIPTION	PARTS KEY
1	1x6 hardwood, 36" long, s4s	A, B, E
1	1x12 hardwood, 22" long, s4s or 3/4" hardwood plywood	C
1	1/4" hardwood plywood, 2 ft. sq. or 1/4" hardboard (pref. prefinished)	D, F, G
3	3/8" hardwood dowels, 24" long	
2	5" or 6" dia. wheels, wood or metal (pref. rubber-tired) with bolts, washers, nuts	
6	No. 10 x 2" FH wood screws	
	1/2" brads, glue, sandpaper, clear finish	
	If plywood is used: matching veneer tape	

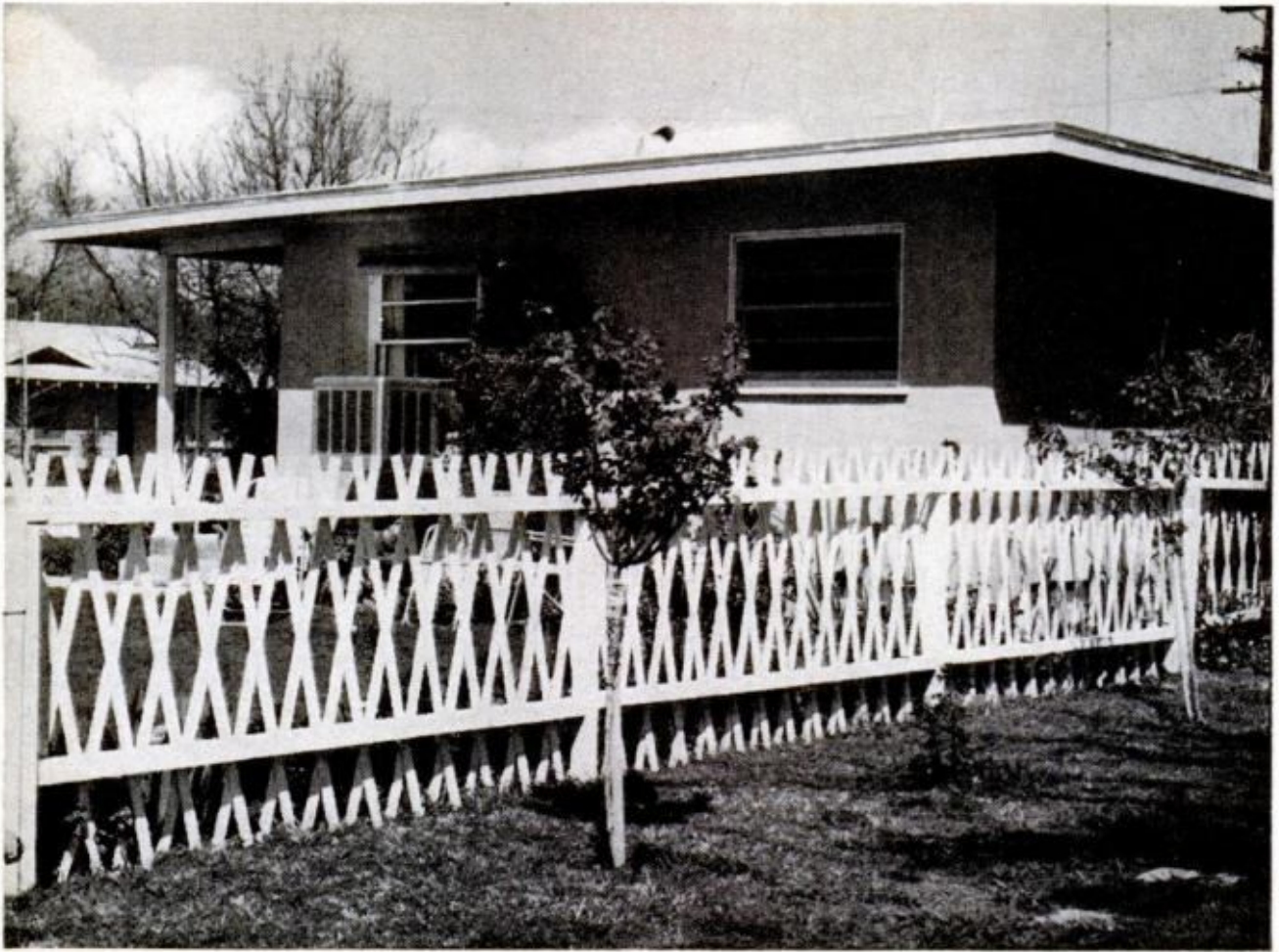


MAGAZINE RACK—four-piece assembly of panel D, ledge F and braces G—sets between handle-legs A and is fastened to dowels with glue and small brads before shelf C is secured with four countersunk screws

FULL-SIZE PATTERN AVAILABLE:

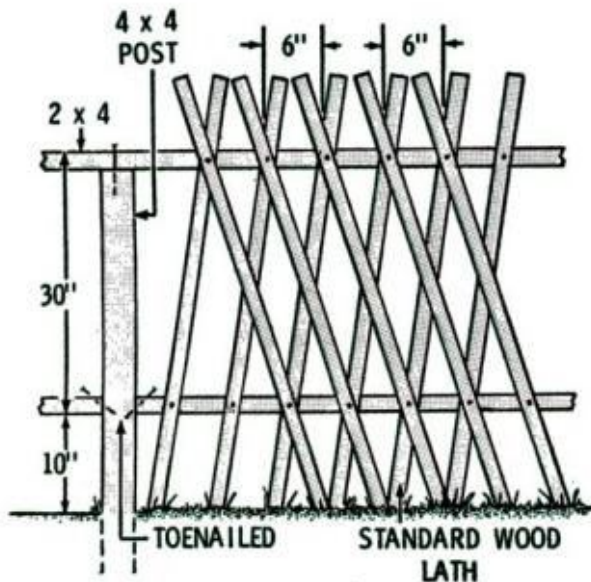
Though all construction details for the cart are given in the drawing below, if you prefer to work from full-size plans, send 75¢ for pattern 219 to Steve Ellingson, Popular Mechanics Pattern Dept., Box 2383, Van Nuys, Calif. 91409





A Fence to Suit Your Fancy

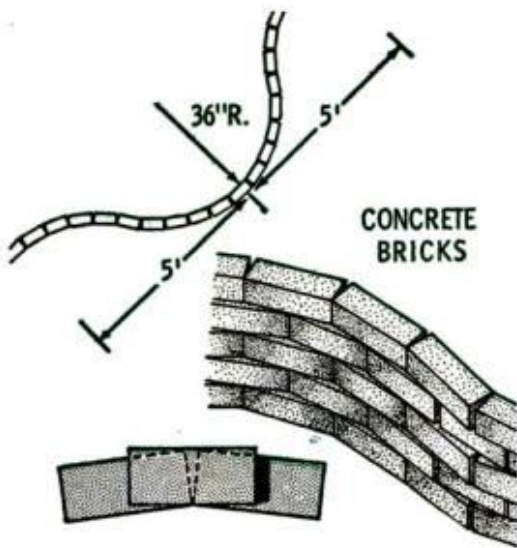
If you've been putting off putting up that much-needed property-line fence or privacy screen because hackneyed designs leave you cold, one of the 14 fences on these four pages should inspire you to action



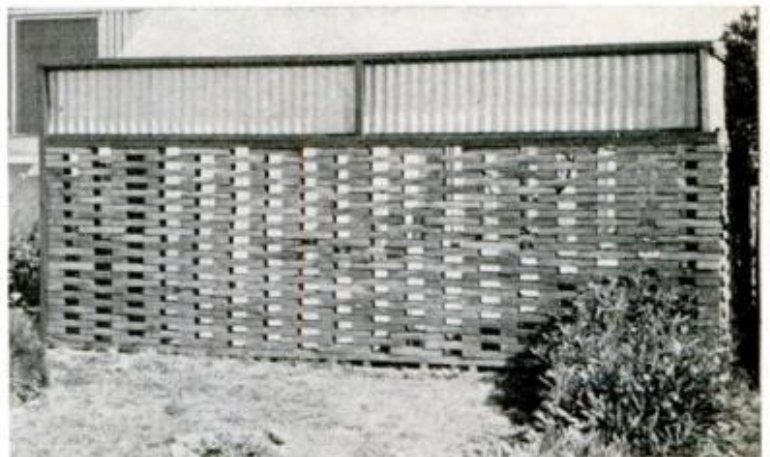
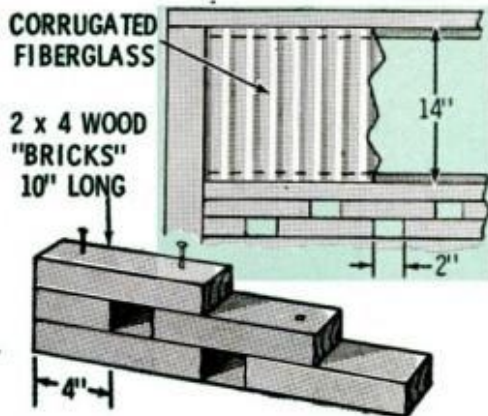
POET ROBERT FROST claimed "Good fences make good neighbors." But your fence needn't *look* just like your neighbors'. It should be designed to do the job *you* want—whether it's to protect and dress up your property, or to create a pocket of privacy for your family and guests. With today's great variety of materials to choose from, it's surprising that few homeowners venture beyond a handful of standard designs.

Here, then, are examples of the "personalized" flair you can achieve without any great jolt to your budget.

EVEN A WHITE PICKET fence takes on new personality if you use crisscrossed lath instead of conventional pointed stakes. It's less expensive, no harder to paint, and creates stronger pattern (photo above)

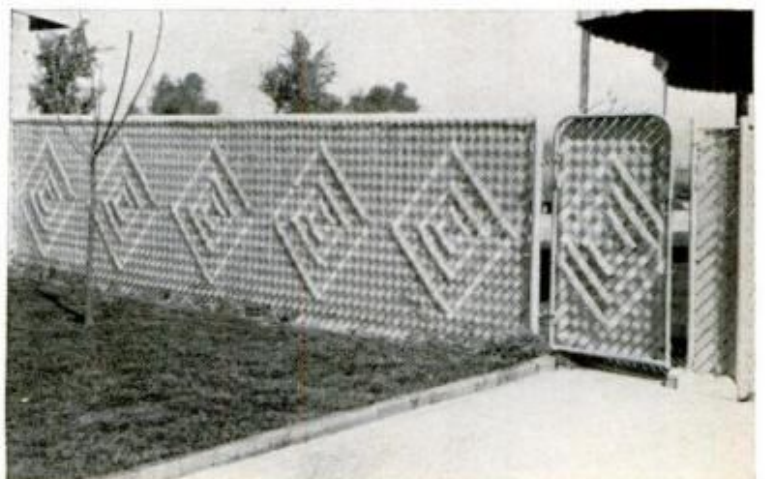


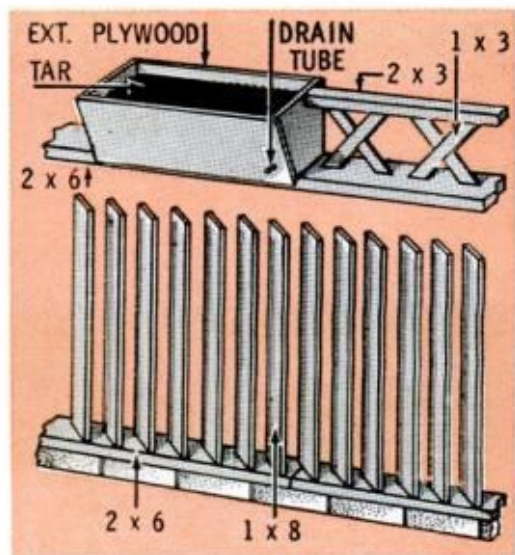
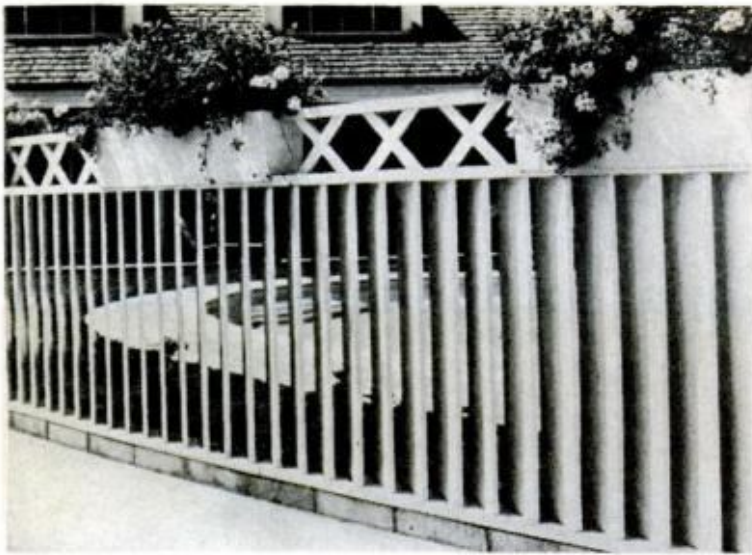
SERPENTINE BRICK WALL isn't as tricky as it looks, once you lay out the concrete footing on the radii shown. Passersby may laugh at your drunken trench, but once you've laid a course or two, with generous application of mortar to fill gaps between bricks, the wall begins to make sense. The curves reinforce the masonry, making it possible to erect only a single row. Thus you economize while creating a lively shadow texture



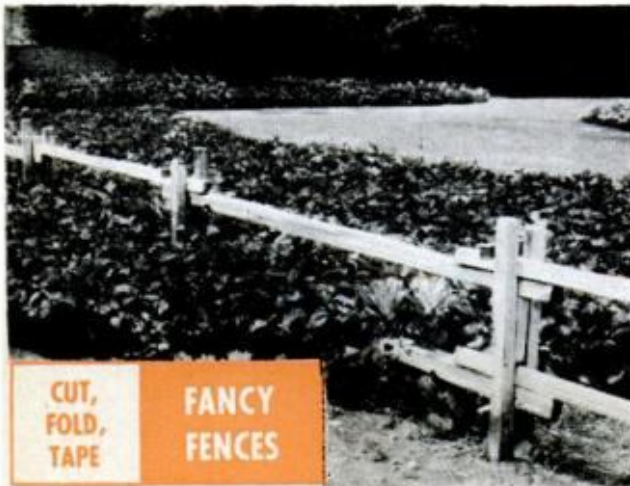
SCRAP 2x4s FROM A CONSTRUCTION JOB? Cut 'em into 10-in. blocks and start lapping and nailing with 8d or 10d nails—one per joint. It goes faster than you'd think, and gives you a fence that lets breezes pass. If you run short of 2x4s, cap the stack with a full-length plate and finish off to the height desired with framed corrugated panels. Every few courses of block should be toe-nailed into 4x4 posts at each end

BASKET-WEAVING PLASTIC STRIPS through a chain-link fence adds privacy to protection, and offers possibilities for bold decorative effects in contrasting colors. This homeowner used venetian blind materials, but 2-in. plastic webbing (made for lawn furniture) can be bought in large rolls, and many colors. Usually friction makes any fastening unnecessary, but you may have to anchor the top of each strip for a neat effect





BREEZE CONTROL FOR POOL OR PATIO is feature of louvered fence, which also gives "directional privacy". On-ground assembly is easy, with Ponderosa pine louvers laid one at a time between rails on pair of tapered blocks to establish uniform angle. Blocks are moved to next position after each louver is nailed through both rails. Base rail can rest on running brick foot, as shown, or be blocked up at intervals between posts

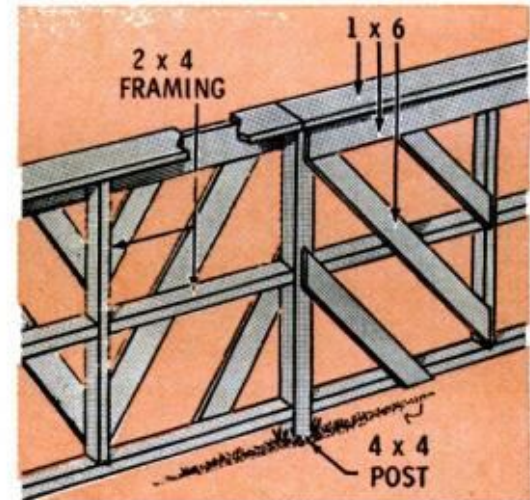


CUT, FOLD, TAPE
FANCY FENCES

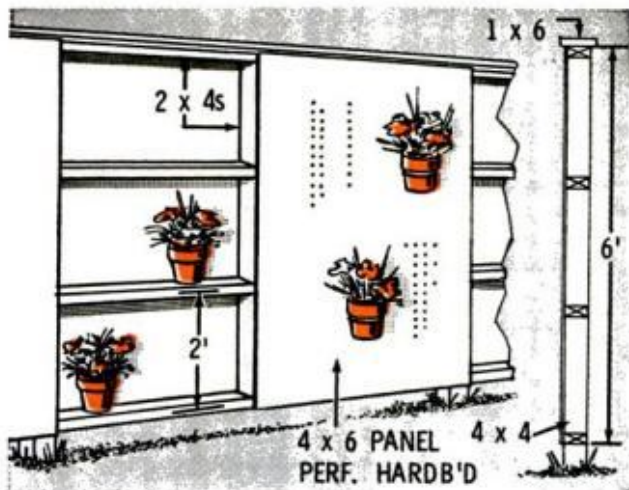


FAMILIAR MATERIALS may be most appropriate; such fences virtually design themselves. Split rail type is fine in spacious, informal setting with high ground-cover; redwood is best, but old telephone poles can be split, instead. Note double poles with spacer. Cast cement block in filigree pattern (right) is laid on poured footing, like solid units, creates sturdy architectural grille, fine planting background

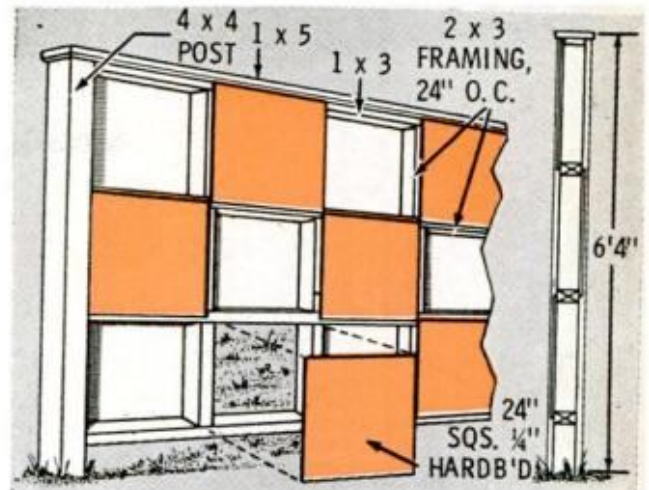
HERRINGBONE RAIL FENCE IS ATTRACTIVE from both sides and isn't hard to build once you've divided run into equal between-post units to determine pattern. Cut three Ponderosa pine rails to set at desired angle, use these as patterns for all others. Fence looks best "growing" out of border planting along broad flat yard but needn't be anchored to masonry piers, as here, if alternate verticals are sturdy 4x4 posts



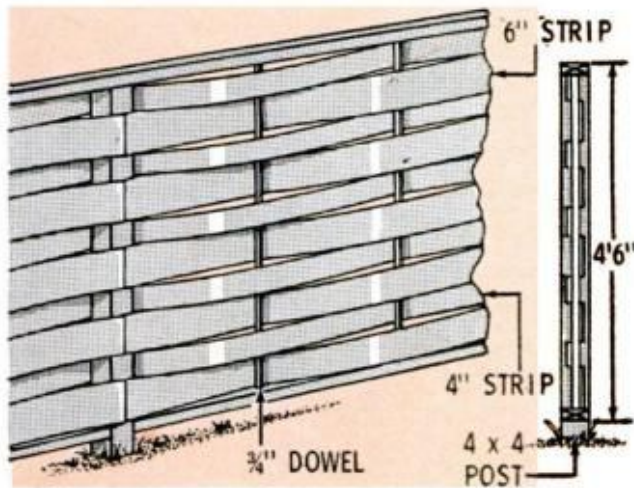
SIX MODERN FENCE DESIGNS FROM HARDBOARD



HANGING GARDEN is yours when you erect frame fence with alternate panels of heavy-duty Peg-Board and plain hardboard on opposite sides. Perforations let you spot hangers, exposed rails take smaller pots

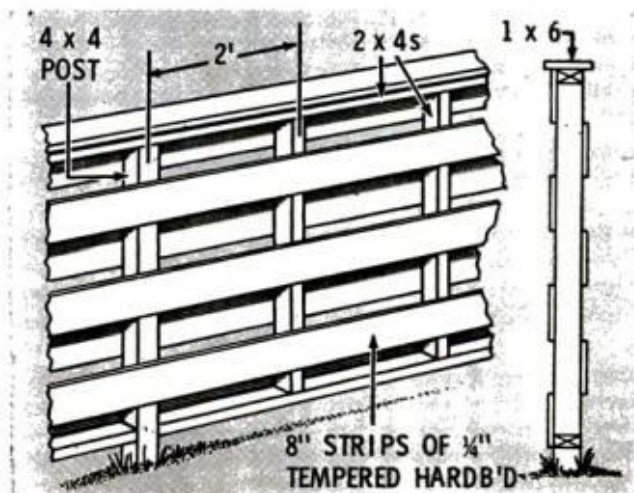


CHECKERBOARD fence plays off painted squares against "shadowbox" backs of panels on opposite side. By nailing 2-ft. squares on 2-ft.-on-center frame, you create rabbit effect that adds richness to design

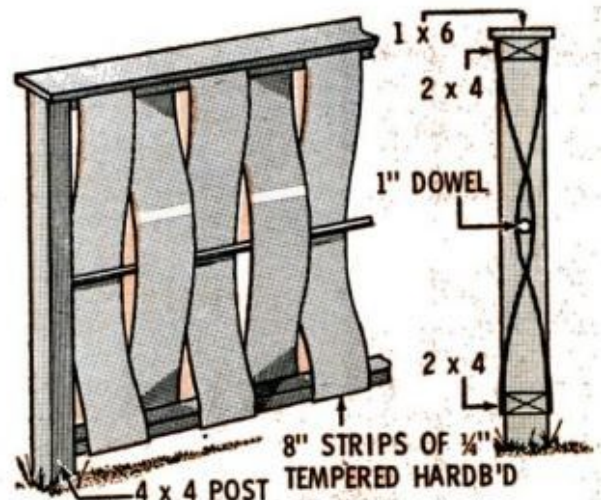


BASKETWEAVE is familiar design, but takes on added interest when alternate strips of hardboard are contrasting widths—and maybe two colors, as well. Dowels, too, can be painted to match or contrast

WINDBREAK lets breeze filter through without loss of privacy—great for pool or patio. Strong lines of hardboard strips (nailed on alternate sides of posts) particularly complement horizontal house sidings



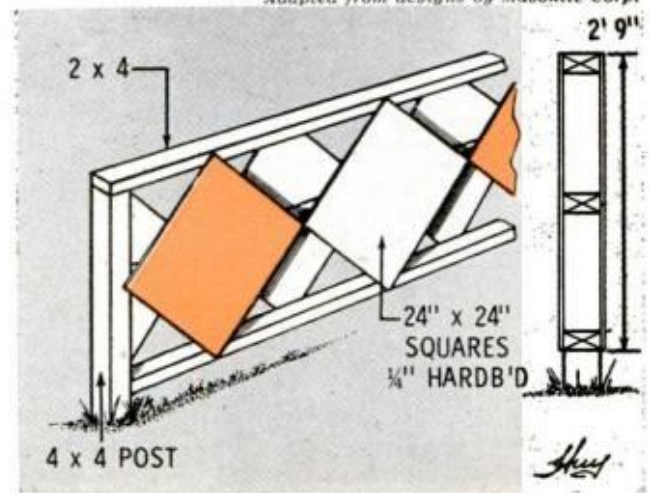
JULY 1965



VERTICAL WEAVE is novel variation, one of simplest fences to construct. Merely erect frame, nail dowel (or railing stock, for wider sections) between posts, and feed strips in place, nailing top and bottom edge

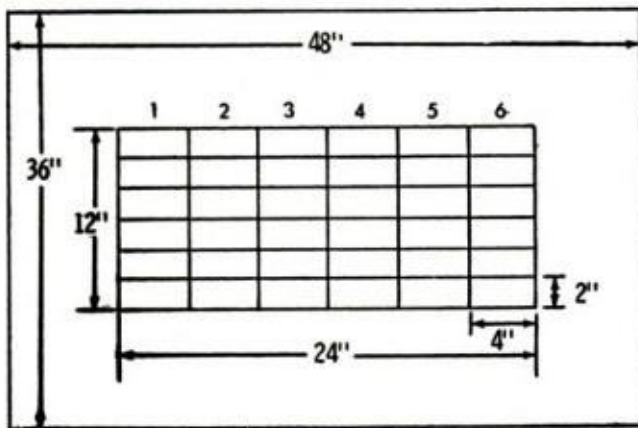
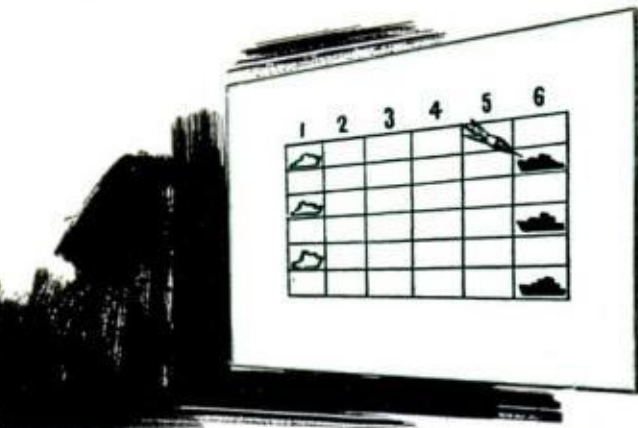
HARLEQUIN DIAMONDS make festive low fence for back yard or small patio. Alternate squares are contrasting colors—and backs of squares on opposite side are left natural brown, or painted still third color

Adapted from designs by Masonite Corp.



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Battleship Dartboard



HERE'S A GAME that combines the skill of darts with the thrill of a sea battle. The game starts with the green fleet lined up in section 1 and the black fleet in section 6. Each player throws six darts at the opposing fleet, then both enemies advance one section. Any ships hit by the darts are considered sunk and are removed from the board. The fleet with the most ships afloat

after withstanding six salvos of darts is the winner. The target board is made from a 3x4-ft. piece of $\frac{3}{4}$ -in. insulation board; the 2x4-in. sections are drawn with black crayon. If preferred, the lines may be made with narrow strips of tape. Black and green art construction paper is used for the ships, which are pinned in place.

—Frank N. Stephany

Tape Tips Off Traveler

When I'm traveling, I always seem to be in a hurry, and try to make each minute count. Yet every time I reached a destination, I used to waste several minutes in the terminal trying to identify "look-a-like" suitcases on baggage racks. I eliminated the problem by applying strips of brightly colored plastic tape to the top of each suitcase. Now there is no difficulty in spotting my luggage and there is less chance that someone else will grab it by mistake.

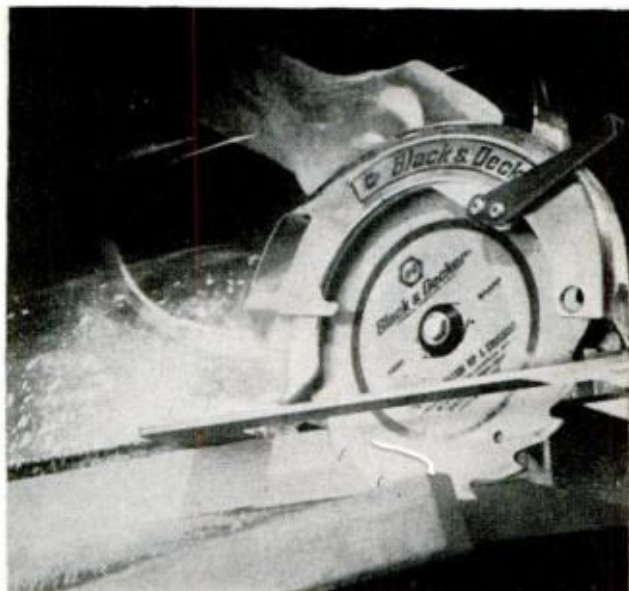
—Lawrence Spirer

In hot weather, evaporation quickly causes mortar to become unworkable. One solution is to add about two cubic feet of vermiculite plaster aggregate to each cubic yard of mortar. The ability of the aggregate to hold water keeps the mortar moist without frequent tempering and mixing.



Shopping for tools

Electric brakes are standard equipment on the new Super Sawcat portable circular saws. As soon as you release the trigger, the brake automatically stops the blade within seconds, says the manufacturer. Available in four models, ranging in size from 6½ to 9¼ in., and prices from \$86 to \$125. Handles are non-metallic, to reduce chances of shock. Manufactured by Black & Decker, Towson 4, Md.

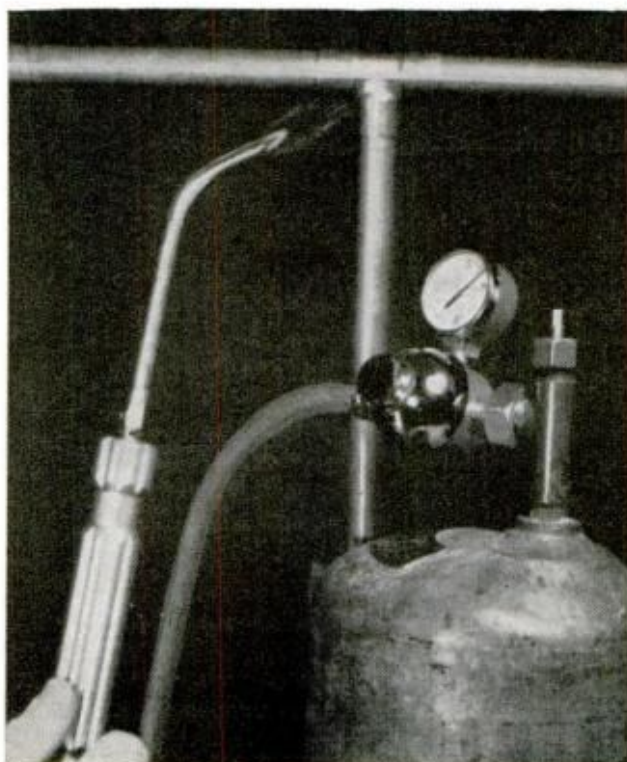
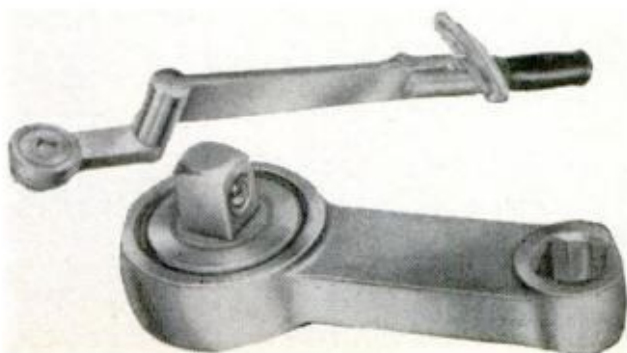


Quick-change riveter has a revolving turret-like head that lets it take three diameters of rivet— $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{3}{16}$ in. These rivets permit rapid fastening of sheet metal, plywood, fabrics and other thin materials. Comes with an assortment of rivets and sells for \$5.29. From Marson Corp., 130 Crescent Ave., Chelsea, Mass.

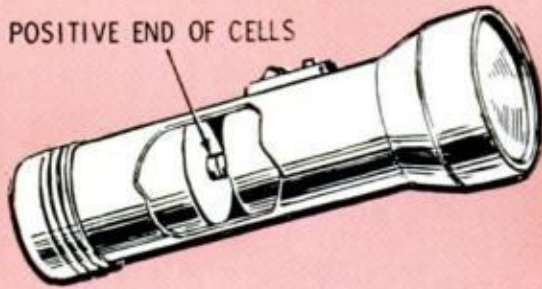


Economical torch kit is said to handle soldering, light brazing, heating or pipe bending jobs. Includes regulator, gauge, torch and hose. Needs only a tank of acetylene or other gas, as unit draws oxygen from the air. Priced at \$26.40. Keystone Cylinder Gas Corp., 46th & Westminster Ave., Philadelphia. Specify the type of gas you plan to use.

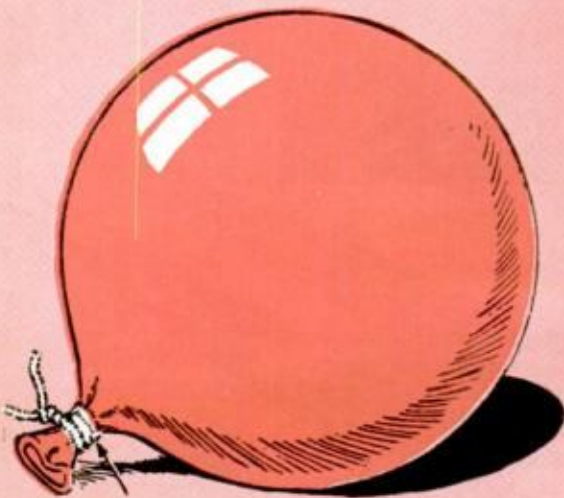
Ratcheting adapter (below), which fits almost any ½-in. square-drive torque wrench, simplifies the job of torquing in cramped areas, and permits the tool to operate like a ratcheting box wrench. Adapter is reversible, and has a 3-in. lever length. Overall length is 4⅜ in. Retail price is \$9.90. Manufactured by the Owatonna Tool Company, Owatonna, Minn.



POSITIVE END OF CELLS

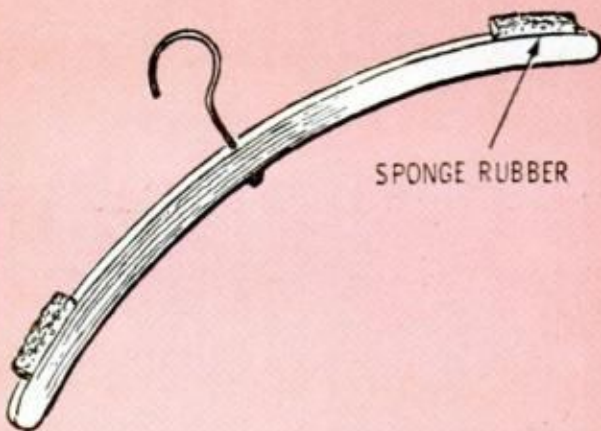


DRY CELLS in your two-cell flashlight wear out just standing around waiting to be used. However, you can reduce this idle drain by keeping one cell stored backwards in the case so that positive terminals touch. Simply remember to reverse it when you use the light



PIPE CLEANER

YOU'LL FIND it's a lot easier to tie off the neck of an inflated toy balloon when you use a pipe cleaner instead of string, and equally so when it comes to untying a tightly knotted string and you're short on finger nails

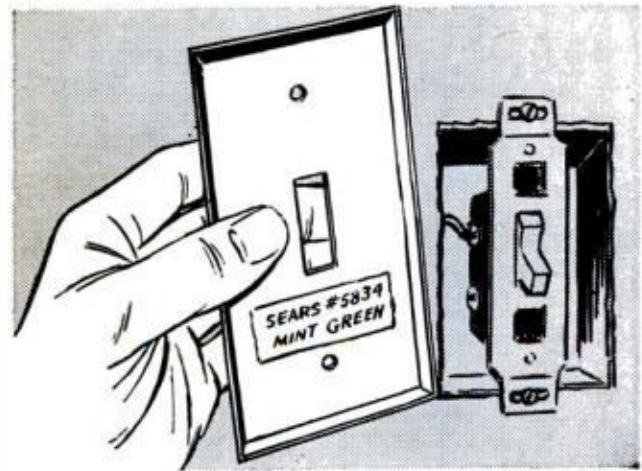


SPONGE RUBBER

SLIPPERY HANGERS can be converted to hold wide-necked dresses and slips by gluing a small piece of sponge rubber near each end. This will prevent the dress from sliding off every time the hanger is disturbed

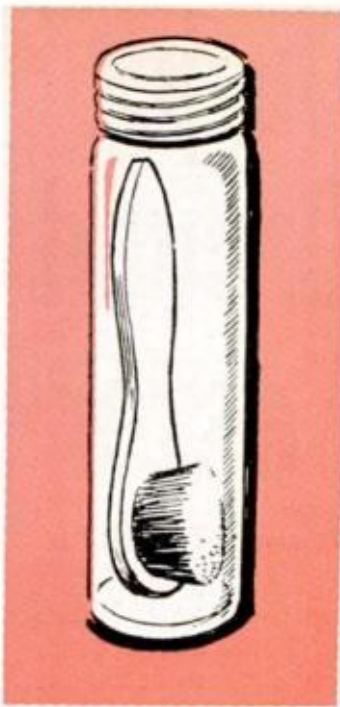
Solving Home Problems

KEEP A RECORD of the color used to paint a room and you'll know exactly what to buy for touch-up work. Just write the brand name and paint number on masking tape applied to back of a switch plate in room



CUT FLOWERS will stay fresh longer if a little table salt is added to the water in which they are placed. The sodium chloride will retard the growth of bacteria and thus slow down the process of wilting



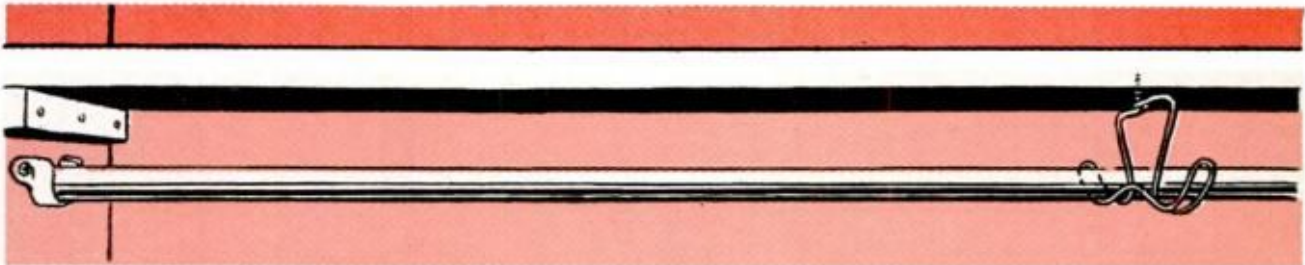


TO PREVENT shoe polish from hardening on your dauber brush, place it in a glass jar and screw the cap on tight. A little alcohol will soften any hardened polish already on the dauber brush



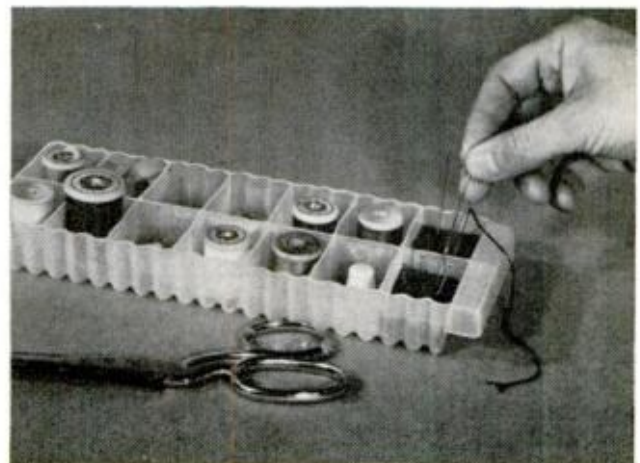
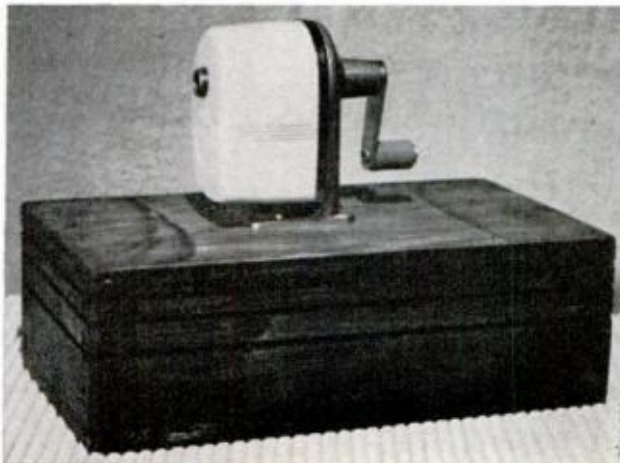
EXTRA SUPPORT for a long closet pole can be provided by driving a double clothes hook into a shelf above so that the pole rests in the rear hook. This stops the rod from bowing and gives you extra hook

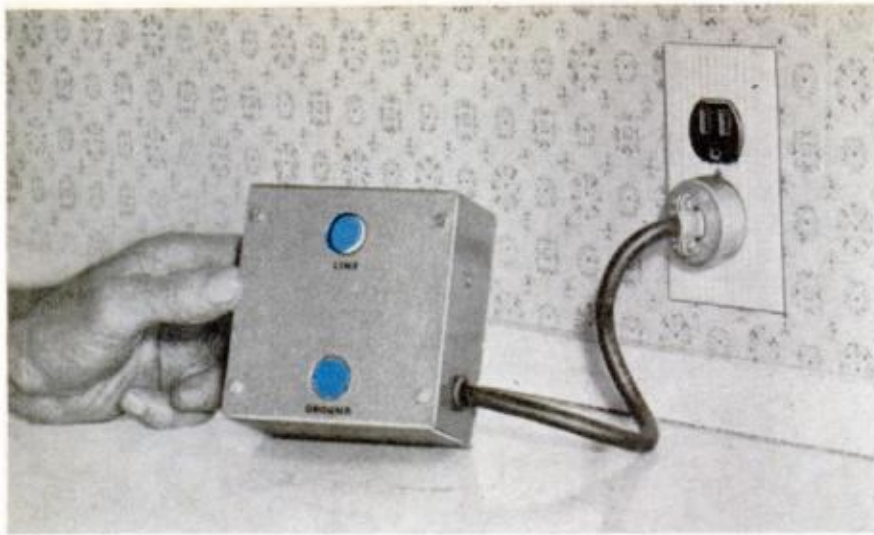
GANGED LEAF RAKES clear three times the area with each sweep. Bolt two extra rake heads to an aluminum crossbar fastened to a center rake and secure the two outer heads to it with a light chain



PENCIL SHARPENER designed for mounting on a wall can be made portable by securing it to a boxed-in brick. The brick makes it heavy enough to be stable, and you can make box as ornamental as you want

PLASTIC ICE-CUBE TRAYS make useful holders for sewing materials. The compartments provide separate storage for thread and bobbins, and foam plastic pressed into one compartment becomes a pin cushion





Outlet Ground Tester

By Harold P. Strand

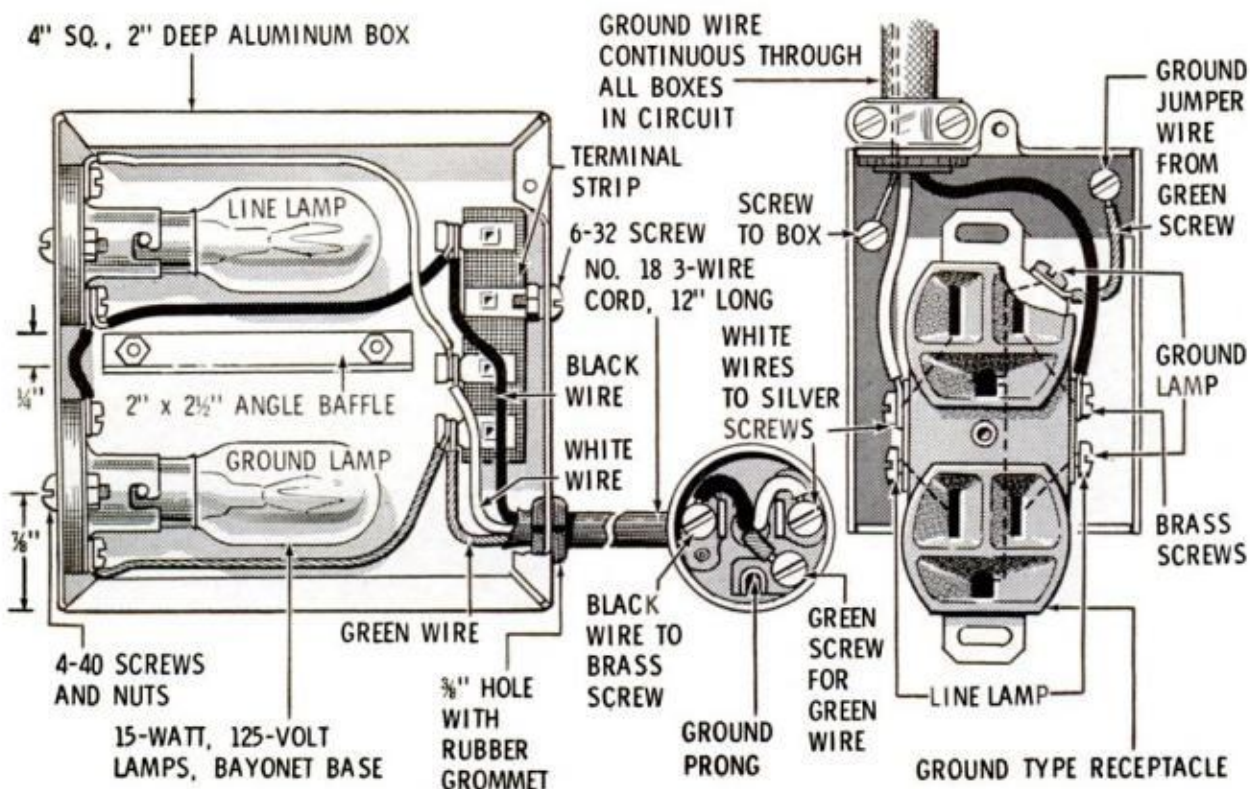
GROUNDED duplex receptacles (required by the National Electrical Code in all new wiring installations) are designed for plugs that have a third prong which makes contact with the metal outlet box. The shock protection is only as good as the ground for that box.

Boxes are grounded by means of a separate (bare) wire in Romex cable, or the metal armor of BX cable. But where the contact is poor, the ground may be faulty; or an unusable high-resistance ground circuit may be present. With this home-made tester, you can quickly check each outlet for proper ground. The tester is just two lamps in a utility box—one of them connected across the line as a standard of brightness. (Cement scraps of exposed film across the viewing holes, to cut glare.) The other lamp connects from

the live side of the line to ground. When you plug into an outlet, if *both* lamps burn brightly, you have a good ground. But if the second lamp won't light, there's *no* ground at the outlet, or the connections from line cable to receptacle are reversed.

Choose a rubber or insulated plug for the tester; you could get a shock holding the type with a grounded metal band. To use the tester with a two-prong outlet, first plug in a grounding adapter, anchoring its short lead under the plate screw.

The main ground for any system is likely to be a water pipe at the street side of the shutoff. A *dim* test lamp could mean that the grounding clamp is loose, here, or the pipe is corroded. Where ground is made by means of a *driven* rod or pipe, or a plate buried in the earth, a dim lamp may indicate the soil isn't moist enough.

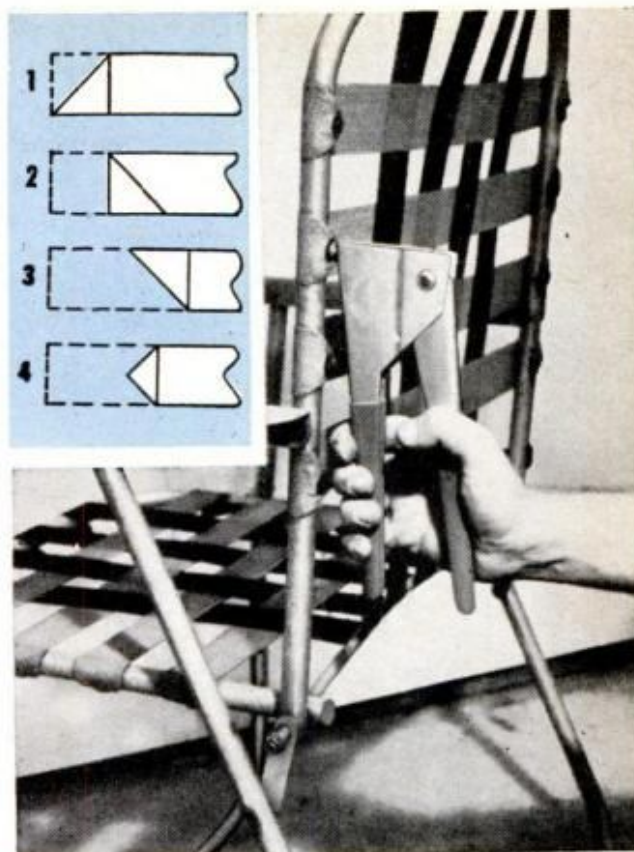


Replacing Plastic Webbing

IF THE WEBBING on your lawn chairs is torn or sagging, there's no need to go to the expense of buying new outdoor furniture. Hand riveters such as the "POP" RiveTool make it possible to install replacement webbing quickly and neatly.

First, remove the old webbing. This may have been secured with special fasteners which will have to be pried out. Next, try a rivet in one of the existing holes to test the fit. If the rivet has to be tapped in, the hole is the right size. If the rivet fits loosely, it will be necessary to drill new holes with a $\frac{1}{8}$ -in. or No. 30 drill bit.

Fold the end of the webbing as illustrated, punch a hole and insert the rivet. Don't forget to use a back-up plate (washer) under the head. After riveting one end, cut the other end of the webbing 3 in. longer than the distance to be covered and fold the end as before. Pull the webbing taut with pliers and adjust the fold so the holes in both the webbing and tubing line up, place a back up plate in the rivet, insert and pop it.



Is Your Back-Yard Barbecue Killing Your Trees?

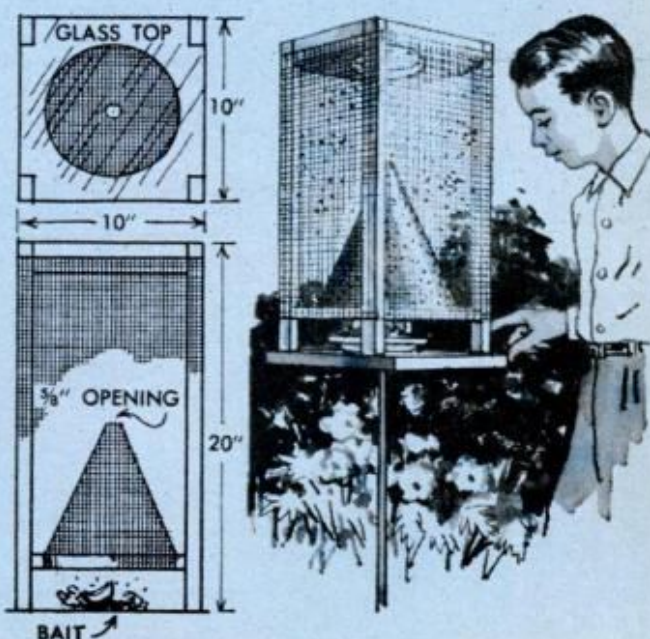
THOSE DELICIOUS STEAKS and hamburgers you grill outdoors may be giving your trees heartburn. According to the Davey Tree Expert Company, heat rising from a barbecue set directly under a tree many "burn" the leaves to a crisp. By the time the damage is noted it may be too late for a remedy. Trees can be injured in many other ways. For example, weed killer may

be absorbed by the leaves if you spray too close to the tree. Similarly, draining chlorinated swimming pool water into a stand of trees is almost sure to cause damage. If you want to hang a swing or hammock, avoid wrapping a wire around a branch as this injures the bark and invites decay. Less harm is done by screwing large screw hooks into the tree.

Tried and True Trap Draws Pesky Flies from Patio Cookouts

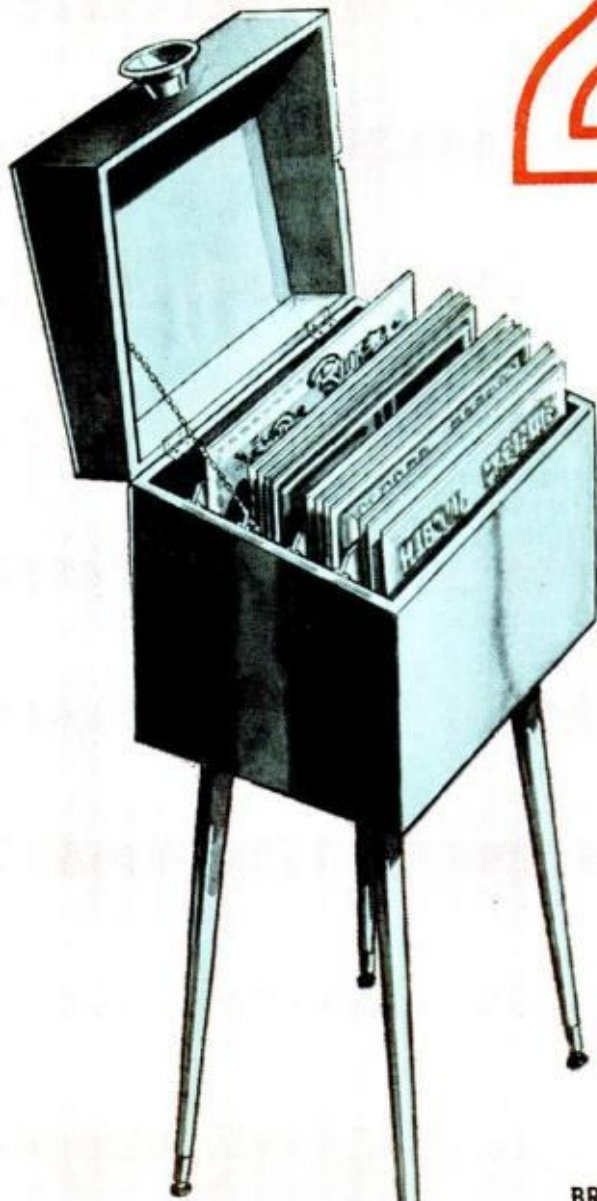
THE FLY CATCHER shown in the drawing is an old, time-tested design. In fact, I can remember seeing one many years ago in my great grandfather's backyard. The trap is constructed of 1 x 2s and screen wire. The top is covered with glass to create the illusion that the trap is open. A floor flange fastened with screws to the bottom of the trap permits attachment to a post of $\frac{3}{4}$ -in. pipe. The trap works on a simple principle. Flies are attracted to the bait (orange peels are ideal), after feeding they fly upward through the inverted cone of screen wire, and into the trap itself. Other than killing the trapped flies with a shot of fly spray, no attention is required except for an occasional renewal of the bait every couple of days.

—Harry F. Yates

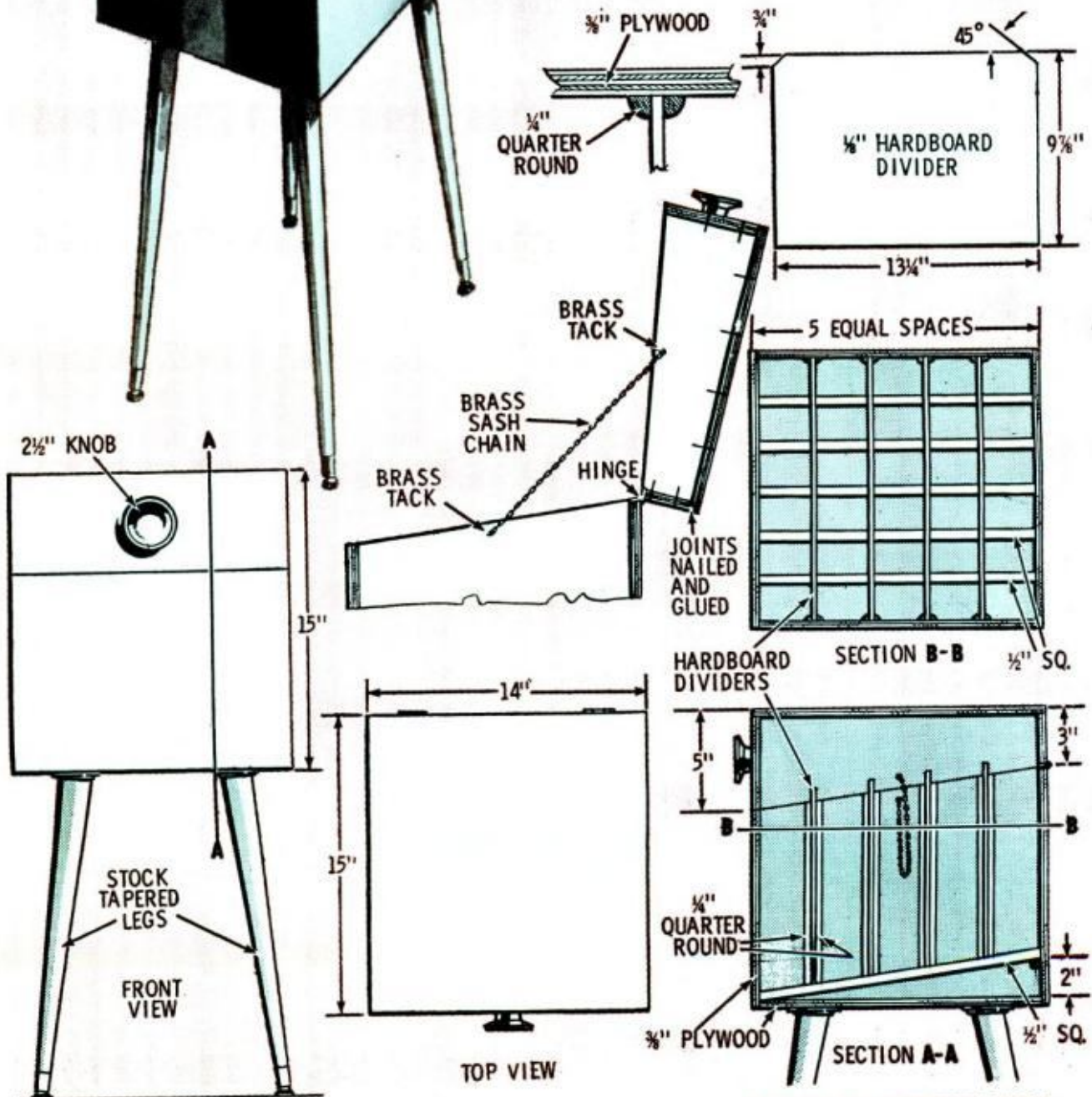


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Quick-Build

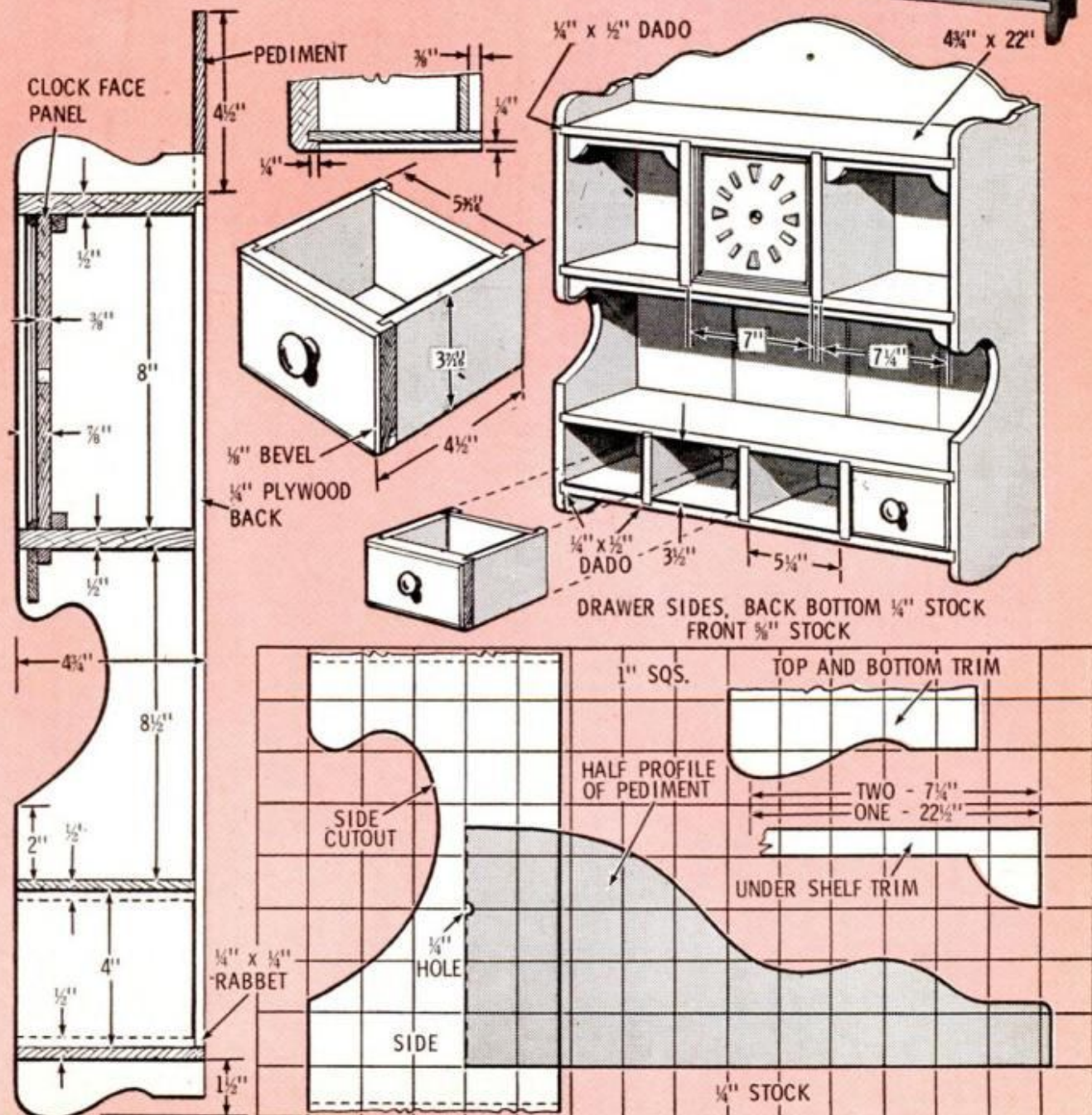


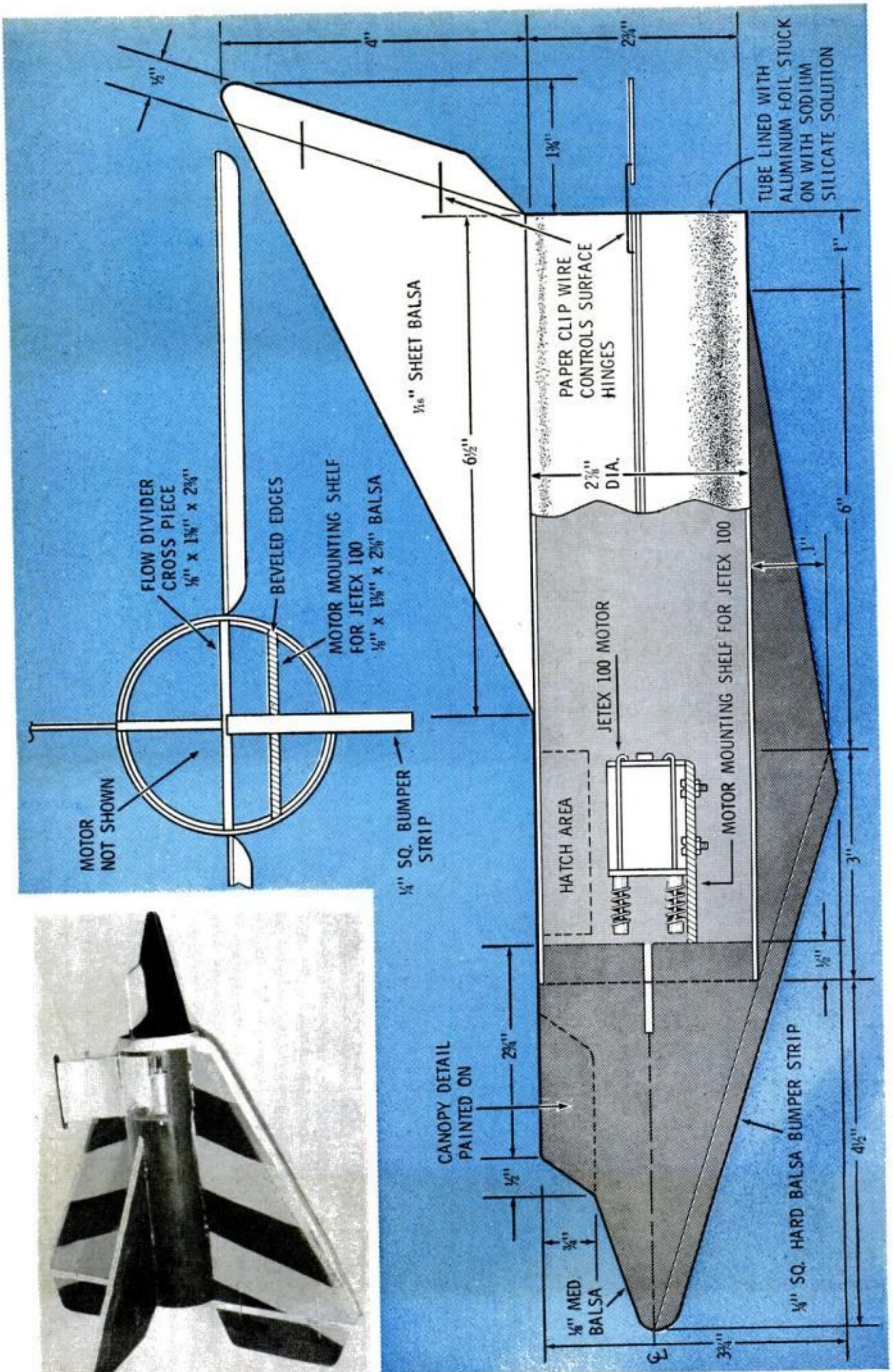
Bin Record Caddy. Accommodating as many as 85 LPs, this bin-type record cabinet with its separate compartments lets you riffle through your albums like you would in a record shop but keeps them separated by type—pop, classical, folk, or what have you. Closed, it'll pinch-hit as a stand for a portable record player, or you can simply park it alongside your hi-fi—perhaps with a figurine or other ornament cemented to the top to hold it in place when the cabinet is opened. Birch plywood, $\frac{3}{8}$ -in. thick is used to build the cabinet; the tapered legs are a standard commercial item.—*Burke E. Sugden*



Projects

Clock Spice Rack. This wall-mounted rack boasts a cordless electric clock movement powered by an ordinary flashlight battery. Since the clock isn't dependent upon a wall outlet, the rack may be placed anywhere, though it was designed for an Early American kitchen. The rack shown was built of white maple, but most any wood—including knotty pine—could be used. For the back panel, matching plywood, grooved to simulate planks, is best. Power tools will facilitate construction, but the rack can be quickly built with hand tools if you substitute butt joints for the dados. —C. L. Widdicombe







Build This Delta-Wing Jet

By Roy L. Clough, Jr.

LAUNCH the Delta Rocket from your hands and it glides straight out for a short distance. Then the nose tilts up and, gathering speed, the plane shoots skyward, trailing a cloud of blue smoke like a jet with the afterburner cooking. When provided with a 15-second fuel supply, the pilot model soared about 1500 ft. at an altitude of approximately 30 ft., then gently glided to earth.

The sharply swept-back delta wing, needle nose and rakish fin suggest its speed and power. The performance is equal to the promise. Construction is not difficult and the simple jet propulsion system is practically foolproof. Any one of a number of different size jet motors can be used—the experimentally minded may even try multi-motor arrangements since there's plenty of room for such an installation.

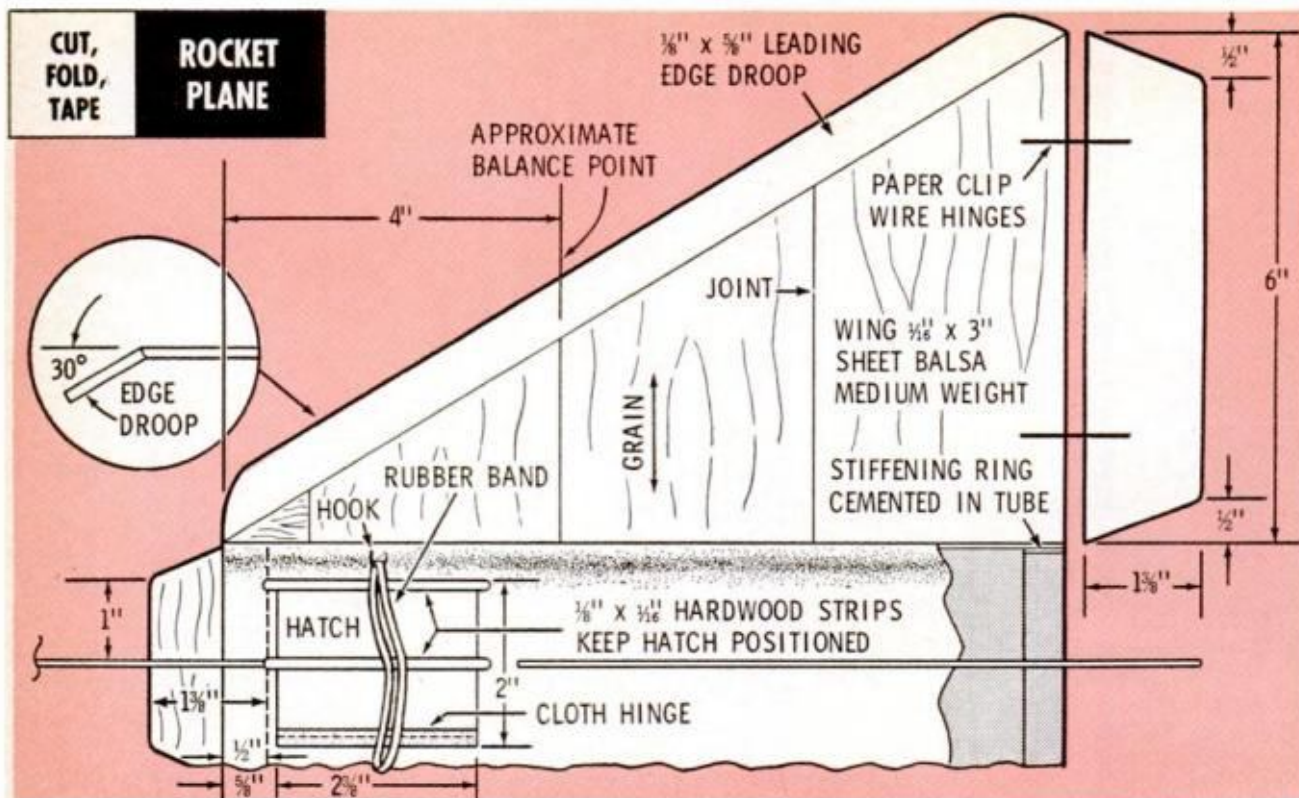
The original model flew well on a veteran Jetex 100 motor. Larger motors will provide even more spectacular performance and the model can be flown on a pair of 50's.

Although many model jet planes using this type of propulsion give a mild glider-type performance, this model behaves like

a real plane and moves along at scale speeds—with scale sound effects, as well!

The duct-mounted model rocket motor operates on the aspirator principle to gulp in large quantities of air for mixture with the hot exhaust gases, thus increasing the effective reaction mass of the ship. This sort of arrangement can increase the thrust of the basic rocket unit by as much as 25 percent.

Begin construction by finding a mailing tube about a foot long and 2 $\frac{3}{4}$ -in. diameter. The diameter is not critical; a variation of $\frac{1}{4}$ in. or so won't affect performance. Wrap a turn of wax paper around the tube and build up the fuselage out of $\frac{3}{32}$ x $\frac{3}{8}$ -in. strips edge-cemented around the tube. When the cement has dried, sand the edge round then slide the shell off the mailing-tube building form, cut out the hatch and hinge it as shown. The wings are built with a specially-drooped leading edge to provide better lift, greater stability and strength. A strip of $\frac{1}{16}$ -in. balsa is cemented down the sides of the fuselage to serve as a guide in positioning the wings. The fin is cemented directly to the top of the fuselage tube. The nose section is a



silhouette connected to the underside skid by a strip of $\frac{1}{4}$ -in.-sq. hardwood. It's important that the fins, wings and other projections be in accurate alignment. The model should be blocked up during assembly and plenty of time allowed for cements to dry.

The inside of the fuselage tube is lined with household aluminum foil stuck in place with sodium silicate solution (water glass). This fireproofs the model, though there is actually little danger from these motors.

Rocket motor installation is quite simple. A crosspiece of $\frac{1}{8}$ -in. balsa placed to center the jet orifice of the motor in the fuselage tube will do very well for Jetex 100, 150 or 200 series motors. If you use one of the larger Jetex engines which mount on a stud, the mounting stud may be built into the flow dividers in the nose or intake

end of the fuselage tube. It is essential that the jet efflux be centered in the tube and parallel to its walls.

The balance point shown on the plan is about right, although individual models may vary slightly and still perform well. Practice glides should be made with the engine installed, but empty of fuel. Don't try to get a maximum-float sort of glide, because you want the model to climb at a shallow angle at a high rate of speed—a much more efficient configuration for a jet plane than a steep angle at low speed.

There is only one precaution to be observed when flying the model under power and that is to be sure to hang onto it until the rocket motor has built up to full thrust. This may take as long as five seconds after igniting the wick. Then launch with a smooth even thrust. The model will do the rest. ★★★

Handles Built into Tool Shed Make Toting Easier



When constructing a small storage shed to hold lawn or garden equipment, keep in mind that a future move or changes in the landscape plan for your lot might make it necessary to move the shed to a new location. This task will be much easier to accomplish if the shed is equipped with carrying handles, so cut selected siding boards to protrude about 6 in. at the ends, as shown in the drawing, to form unobtrusive yet easy-to-grasp lifting handles projecting from each end. Such handles can be used to support shelves for potted plants to doll up the shed.—Mrs. G. Berg

Auto Clinic

Q I had a chattering clutch in my 1960 Rambler Super Six. Put in a new clutch plate, pressure plate, universal joint, and throw-out bearing. The chatter's out, except in reverse. Why?—R.S., Illinois

A As long as the clutch is set up properly, I'd check the engine mounts to see if they've worn loose or are broken. Such a condition can make a clutch seem to chatter.

Q When I hit a bump going about 50 mph, I get a shimmy in the front of my 1959 Rambler Super. I've got new tires on the car, all balanced, and a mechanic says everything's OK in the front. Why, then, the shimmy?—J.B., N.Y.

A This has happened with Ramblers of various years. As long as you're sure everything's tight and nothing's excessively worn in the front end, the trouble is probably lying with the original trunion bearing on the front knuckle support. It seems to break down after awhile. To offset it, Rambler's come out with a Teflon bearing kit that should be used as a replacement part. Its part No. is 3202283.

Q Recently a stone flipped by a car ahead cracked the tinted windshield of my 1960 Mercury. The crack's spreading and I've been told that drilling a small hole at the end of it will stop it and save me the cost of replacing the windshield. Is this true?—W.F.M., Mo.

A Before discussing this, please let me remind you that a crack in a windshield in most states is a violation of motor vehicle codes; if a cop spots it, you're likely to get a summons.

I've never heard of the method you suggest, and neither have the windshield experts we've talked to. To drill glass, you'd probably have to use a diamond-tipped drill and that could generate enough heat to completely shatter the windshield.

If you carry comprehensive auto insurance, check the policy to see if there's a glass damage provision.

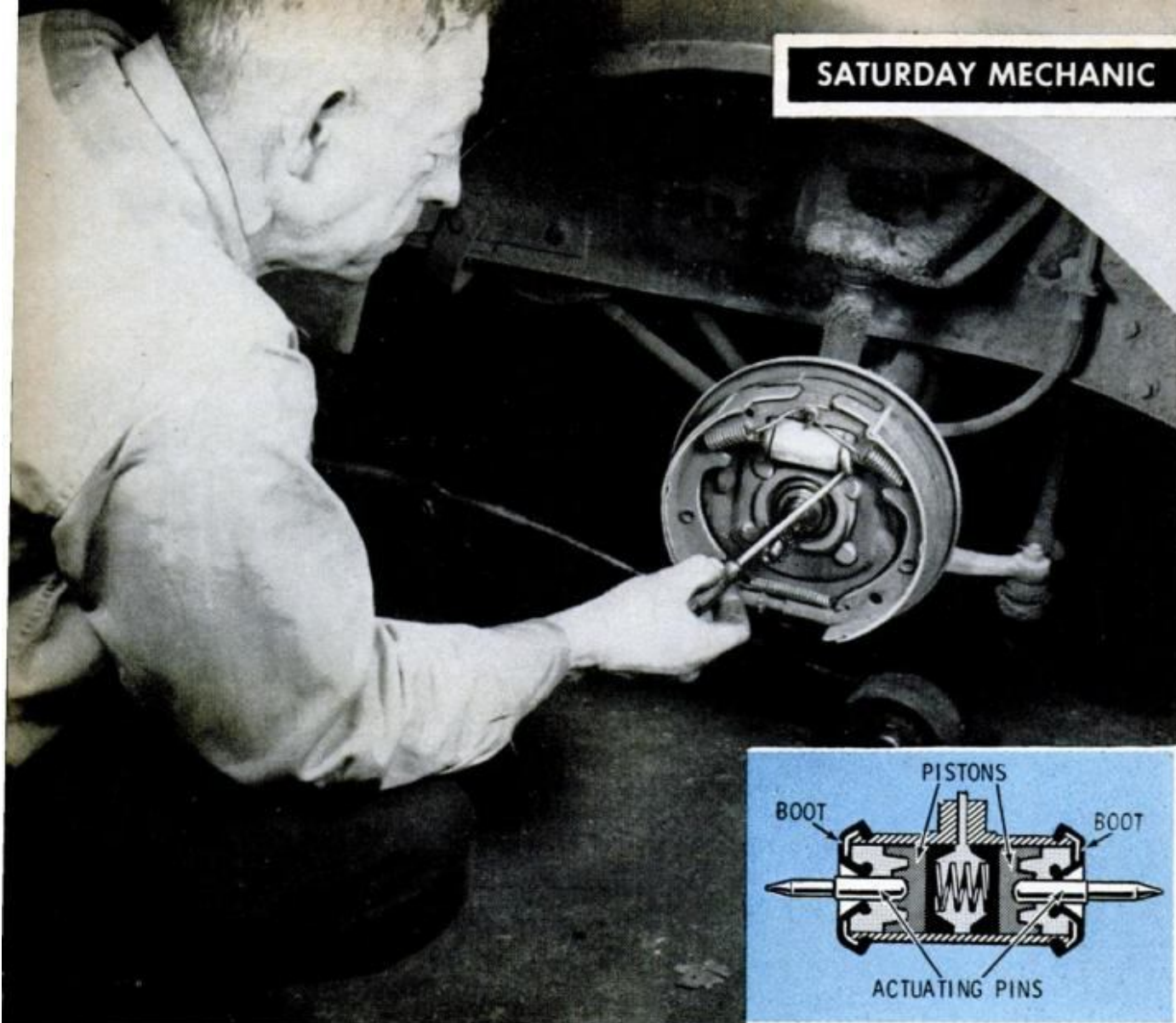
Q The automatic transmission of my 1964 Rambler Ambassador drips fluid, especially after a drive. We've tried a few things, but these don't seem to remedy the trouble. Can you help?—C.S., Calif.

A I'll try, but be aware that the leakage could be coming from a number of places including front and rear seals. Information we've received, though, indicates that there's been a little trouble with speedometer cables where the cable passes into the transmission. Apparently the seal between housing and cable is weak and fluid begins to drip. I suggest you check this and, if you find it to be so, have the cable assembly replaced with a new one to affect a tighter seal. If the cause isn't here, that transmission should be probed into carefully.

Monthly Service Tip

★ Radio noise in 1964 Thunderbirds, Fords, Fairlanes and Falcons might be due to an absence of a suppression choke at the constant voltage regulator. If the choke is installed, but a clicking sound like a turn signal flasher is heard in the radio, perhaps the choke is defective or even installed on the wrong terminal of the regulator. The regulator is found on the back of the instrument panel beneath the dash. When checking your installation, also make sure that a good solder connection exists on the choke.

EDITOR'S NOTE: When we began Auto Clinic we had no idea how popular it would be with our readers. Little did we think we'd be so swamped with letters that we'd have to set up a special system with additional help to handle the answers. But that's what has happened. Much as we would like to continue the clinic as a free service to our readers, we find we reluctantly must make a nominal charge to help cover the cost of diagnosing and handling your car problem—if we are to continue to answer all inquiries personally. Write Auto Clinic, Popular Mechanics Magazine, 575 Lexington Ave., New York, N.Y. 10022, enclosing a self-addressed envelope and 25 cents in coin



TO CHECK FOR LEAKS in a wheel cylinder, just break the rubber boot on each end with a screwdriver. A trickle of fluid indicates the pistons are letting fluid escape. The cylinder should be replaced or rebuilt

Give Your Brakes a Break

By Morton J. Schultz Part I

FACED WITH TWO FIGURES as different as male and female, I was in a quandary. One mechanic wanted \$10.95, the other \$60. Scanning the estimates didn't help much—"check linings, check springs, check wheel cylinders, drums . . ." On paper, at least, both brake jobs would be just about identical.

There was no doubt that my brakes needed work. My car was approaching that 25,000-mile point where experts feel some brake work is always needed, and it had developed a fading pedal. But who should I give the job to? One price seemed too low for quality, while the other, from a trusted mechanic, would hit my pocket-book quite hard.

Could I do the work myself? Well, parts of the job involve special equipment and

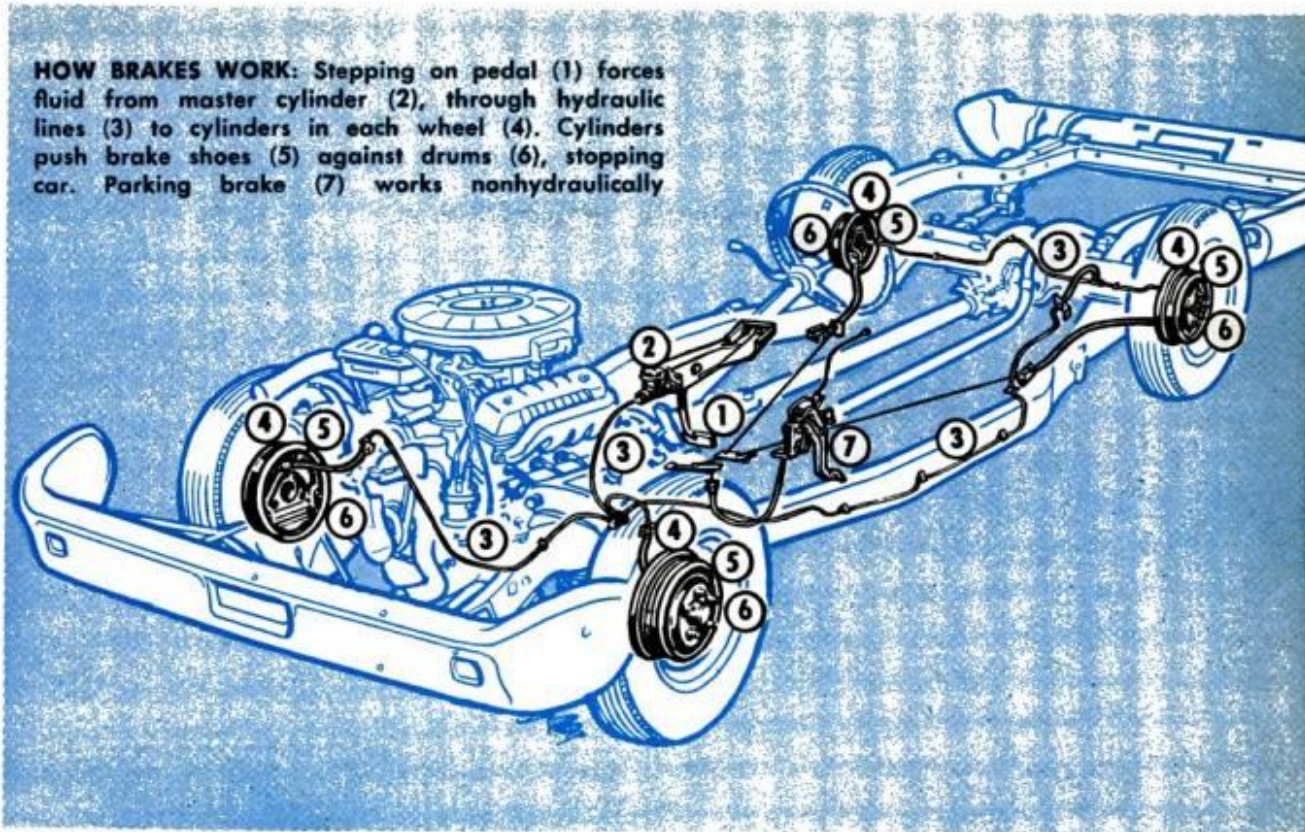
more know-how that most people realize. "Better leave them to a pro," I thought. "But master cylinders, wheel cylinders and the like are pretty simple. Why not tackle those myself?"

Result: By saving money on half the job, I could afford the best mechanic in town for the other, more critical half.

First step in a complete brake overhaul is an inspection of the master cylinder. This part is really an assembly consisting of two sections—a fluid reservoir and a cylinder, in which a piston slides. This piston is operated by a push rod connected to the brake pedal (drawing far right on opposite page).

Stepping on the brake pedal shoves the piston forward. The piston primary cup closes the compensating port, blocking the

HOW BRAKES WORK: Stepping on pedal (1) forces fluid from master cylinder (2), through hydraulic lines (3) to cylinders in each wheel (4). Cylinders push brake shoes (5) against drums (6), stopping car. Parking brake (7) works nonhydraulically



flow of fluid to the cylinder. Meanwhile, the piston shoves fluid through a check valve, through the cylinder outlet into the hydraulic lines, and to the wheel cylinders as pictured in the drawing above. The wheel cylinders, in turn, push the brake shoes against the moving drums, creating the friction which stops the wheels.

In other words, the force of the driver's foot is transmitted to the brake shoes by means of the incompressible fluid confined inside the brake system. The same principle is used in hydraulic presses and lifts. In cars equipped with power brakes, the operation remains essentially the same, except that the force of the driver's foot is augmented by a mechanical booster.

LEAKY SECONDARY CUP in the master cylinder will cause a dribble of fluid when you break the boot. You can test the cylinder while it's still in the car. We had to remove ours in order to photograph it



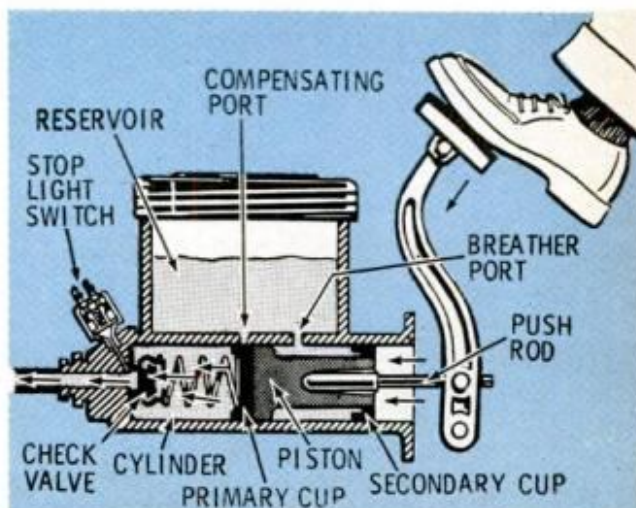
(See *Lifting the Lid on Power Brakes*, page 178, February '64 PM and page 174, March '64 PM.)

When you release pressure on the brake pedal, the piston return spring retracts the piston, re-opening the compensating port and relieving the pressure on the fluid, which flows back into the master cylinder and reservoir.

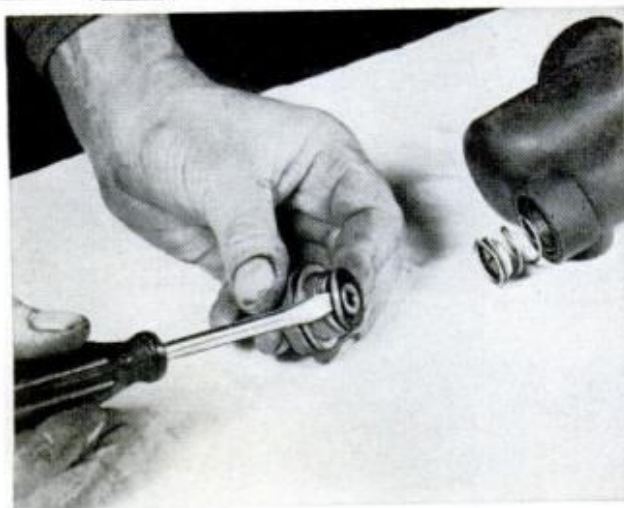
The most frequent causes of trouble in the master cylinder are the primary and secondary cups. Here's how to check them out for leaks:

Get in the car, apply *light* pressure to the pedal and maintain it for about a minute. If the pedal fades away slowly, the primary piston cup is probably shot, al-

OPERATION OF MASTER CYLINDER: Pressure on brake pedal moves piston forward. Primary cup shuts compensating port and fluid is pushed from the cylinder through check valve and into hydraulic lines



WHAT'S INSIDE A MASTER CYLINDER?



TO REVEAL THE GUTS of master cylinder assembly, first unscrew threaded cap on outlet end of housing, left. Then valve seat washer, against which the check valve rests, is easily pried off cap with knife or screwdriver. This part, and all other rubber parts, should be replaced when cylinder is rebuilt



WITH OUTLET CAP REMOVED, slide main spring out of cylinder. An important function of spring is to hold check valve firmly against the valve seat washer. Valve may be seen in end of the spring

SECONDARY CUP, in most cylinder designs, is an integral part of the piston. Its main purpose in life is to keep fluid from leaking past the end of the cylinder when pressure is applied to the brakes



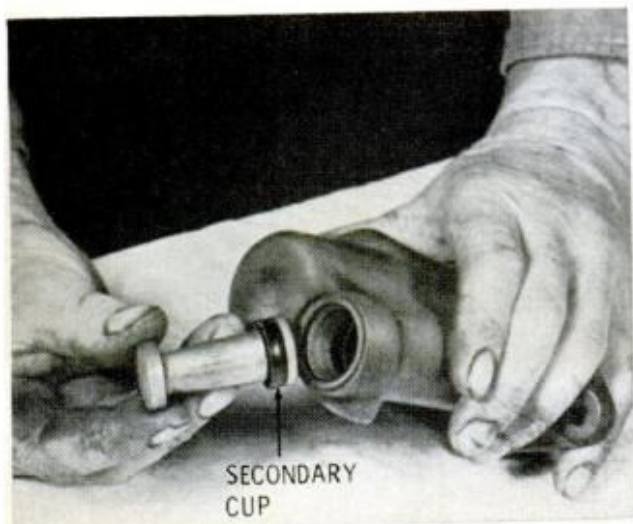
PRIMARY CUP, which is located at the end of the piston, is another part that must always be replaced during a rebuild job. The disc visible through opening in cylinder housing is the face of the piston

lowing the brake fluid to leak past it. Now, check the aft end of the cylinder—the end covered by the rubber boot through which the push rod goes. It is usually located on the driver's side of the fire wall, where the push rod enters the master cylinder. Break the boot away with a screwdriver. If fluid dribbles out of the boot, it means the secondary cup is shot. This, by the way, is a frequent cause of a low brake pedal.

Often, you can check for a leaking secondary cup by merely examining the engine side of the fire wall for a trickle of fluid running from the master cylinder and down the wall.

Rebuilding the Master Cylinder

If the master cylinder tests indicate internal damage, you can either replace



the entire assembly with a new or rebuilt one, or repair it yourself with the aid of a rebuild kit. This job proceeds as follows:

With the cylinder removed from the car, dump any remaining fluid. If the cylinder is the type that's fitted with a threaded cap, unscrew the outlet end of the cylinder. In other designs, the outlet end is sealed, so you'll have to work from the rubber-booted end, in which case the sequence of tear-down will be the opposite of that described here.

With the threaded outlet removed, check the end-nut rubber washer, which acts as the seat for the check valve. This washer seldom gets damaged, but if it is worn or distorted, replace it. Rebuild kits will generally include replacements for all rubber parts.

Now slide the main spring from its position. In the cylinder shown in the photos, the spring is attached to the check valve.

The main spring has two important functions. First, it holds the check valve against its seat when the brake pedal is applied, to maintain about a 7 to 12-lb. fluid pressure in the hydraulic lines. Then, when the brake is released, the spring forces the piston back, removing the primary cup from the compensating port.

With the spring removed, take out the primary cup and slide the piston from its place. The secondary cup is an integral part of the piston. The whole piston setup, cups and all, will be replaced with new parts from the rebuild kit.

Always Hone Bore

With all parts now removed from the cylinder, inspect the bore carefully. Whether rust or pockmarks are apparent or not, the cylinder should always be honed during a rebuild job. Lubricate the bore with denatured alcohol or brake fluid, and grind with a honing stone and electric drill as shown below until the cylinder

bore is as shiny as a gun barrel. Since it's easy to remove too much metal, check the piston-to-bore clearance with a feeler gauge after honing. If clearance exceeds .005 in., replace the entire master cylinder as it will no longer retain fluid effectively under normal use.

Now turn your attention to the compensating and breather ports. It's not likely that the breather port will ever clog, because of its size. However, if dirt lodges in the smaller compensating port, fluid will not be able to return to the reservoir and the brakes could lock. So, run a thin wire [through the compensating port \(see photo, page 160\), just to be safe.](#)

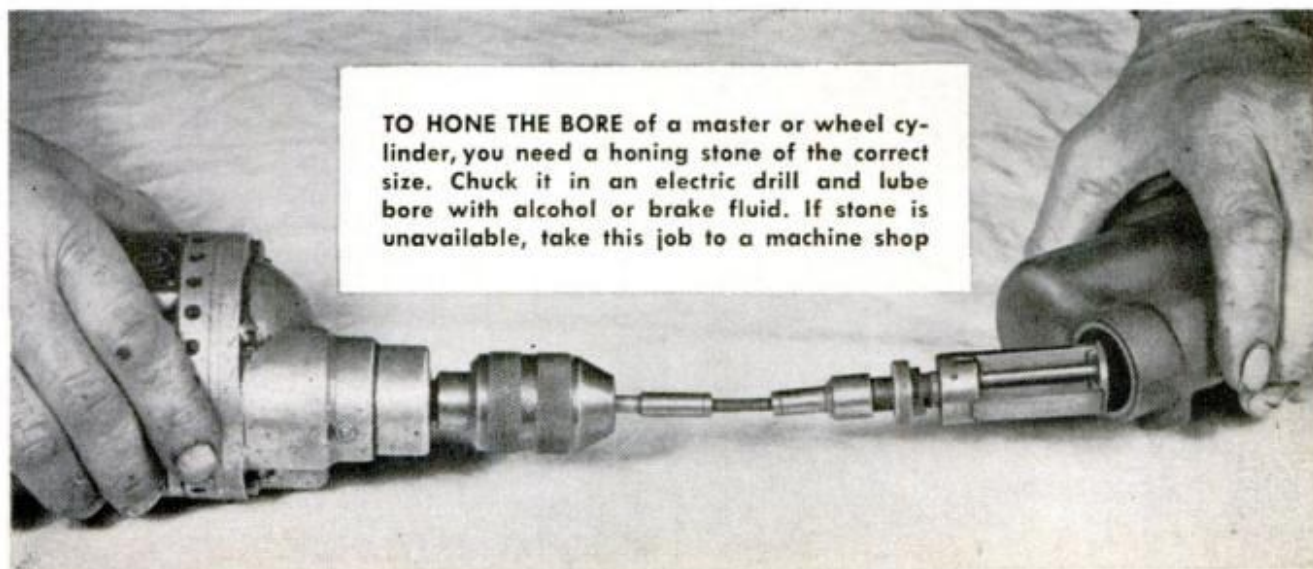
Next, reassemble the cylinder, by reversing the disassembly procedure already described. Clean out the vent in the reservoir cap hole with a wire, to prevent a vacuum from forming in the cylinder, which could lead to a dangerous spongy and/or low pedal. Then put the cylinder back into the car, hook up the push rod and fill the reservoir to within ½ in. of the top with fluid.

Trouble in the Lines

This brings us to an easy part of the job—checking the hydraulic lines. In most cases, damage to these lines will consist of either a leak, usually at a wheel cylinder, or a line crimp.

To find leaks, have someone apply firm pressure to the brake pedal as you examine the lines leading into each wheel cylinder. A trace of hydraulic fluid running down the inside of a tire is a sure sign of a leak at the wheel cylinder connection. Obviously, a leak elsewhere in a line will show as drops or traces of fluid on the surface of the line.

To find a line crimp, which causes a wheel to "slide," or keep spinning when the brakes are applied, just inspect each fluid line visually. If you should spot either





AFTER HONING, check the piston-to-bore clearance with a feeler gauge. A clearance of more than .005 in. means that the cylinder must be replaced

a fluid leak or a crimp, the line *must* be replaced.

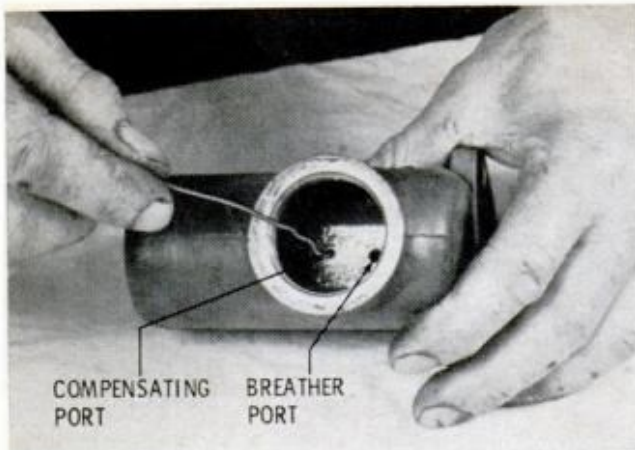
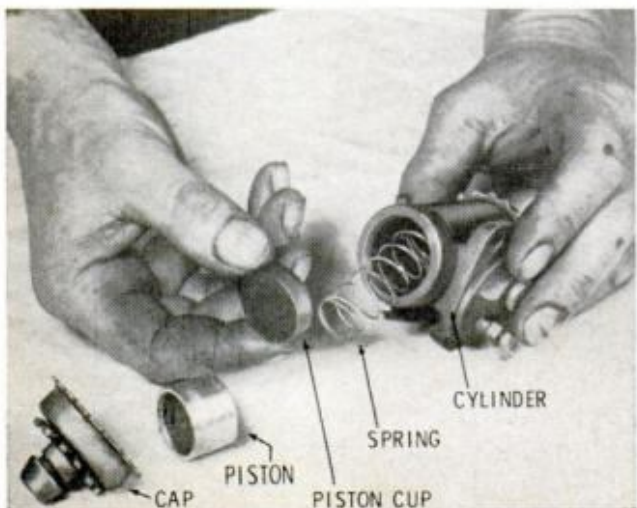
Finally, turn your attention to the last of the "fluid carriers"—the wheel cylinders. Each of these consists of eight parts: one cylinder, one spring, two caps, two pistons and two piston cups.

Two Wheel Cylinder Types

Usually, each side of the wheel cylinder operates one of the wheel's brake shoes. However, in some cars—including some Chrysler-built products—there are *two* so-called single-action wheel cylinders to a wheel. Each controls only one of the brake shoes. If, when testing, you find one of these cylinders must be replaced or rebuilt, replace or rebuild both, to equalize the pressure on the brake shoes.

As a wheel cylinder receives the force of hydraulic pressure, the pistons are pushed outward, moving in the cylinder bore. In some wheel cylinders (those equipped with rubber caps), the pistons will, in turn, activate the brake shoes by means of actuating pins. However, in cyl-

EACH HALF of a wheel cylinder contains parts shown in photo below. Cap at lower left pushes against brake shoe. In other types, pins do the pushing



TO BE ON THE SAFE SIDE, be sure to run a wire through compensating port to remove possible obstruction. Breather port is wider, seldom clogs

inders that have metal caps, the brake shoes are activated by the caps, which are connected directly to the shoes and are pushed outward by the pistons. When the brakes are released, the pressure is taken off the pistons, which then retract to their idle position.

The critical parts of a wheel cylinder, as with a master cylinder, are the piston cups. If these allow fluid to escape, you might experience a low brake pedal or a spongy, springy braking action.

To check a wheel cylinder, "break" each of its boots. If fluid is escaping, it will dribble out immediately.

Incidentally, any time you do a complete brake overhaul, you should either replace or rebuild all wheel cylinders, even if they show no sign of damage. There's little sense in renewing everything else only to have a cylinder fail shortly afterward.

If you decide to rebuild, the procedure is similar to that already described for the master cylinder. Again, you'll want a rebuild kit. And, after disassembling the cylinder (see photo, below), hone the bore and be sure the piston-to-cylinder wall clearance is .005 in. or less.

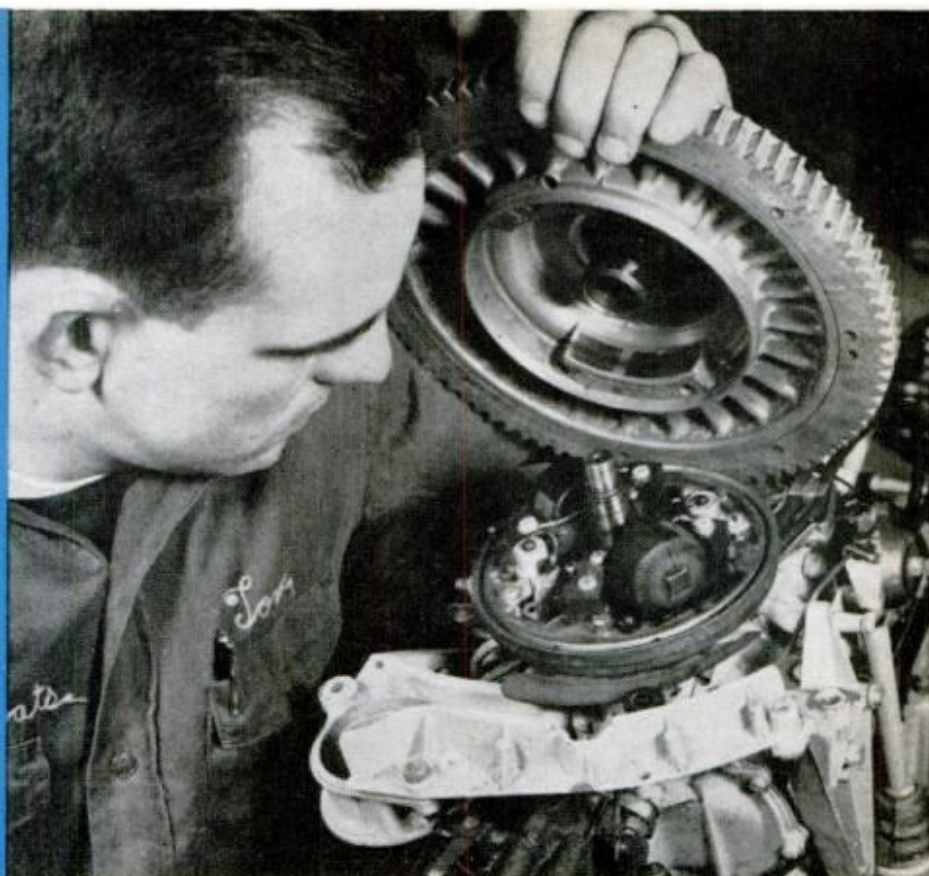
An Ounce of Prevention

There's one more point to keep in mind when installing new parts from a rebuild kit in either a master or a wheel cylinder. Since you never know whether the parts are clean, wash each one in alcohol or a non-oil-base cleaning fluid before installation. Dirt on any part can score a cylinder wall. Also, soak the rubber parts in clean brake fluid. If installed dry, they may score and start to leak the first time you run the car.

So much for the do-it-yourself phase of brake overhaul. Next month, we'll discuss such parts as linings, drums, springs and seals, all of which require careful, highly skilled attention. ★★★

Meet Mag

By Henry B.
Notrom



To keep your outboard running silky smooth, get acquainted with the hot little number that puts the spark in your sparkplugs

TELL AN OUTBOARD OWNER that he can do his own ignition troubleshooting, and he'll look at you as if you'd suggested that he fly shotgun on a Gemini. It's the one part of the engine that causes the staunchest do-it-yourselfer to cringe.

And yet the most common ignition troubles—sparkplug failure and breaker point breakdown—can usually be handled by the owner himself, if he knows something about the system.

Most small and medium-size outboard engines contain a miniature generating plant called a magneto. Basically, it's nothing more than a magnet that emits a magnetic force, as all magnets do. But this force isn't even strong enough to tickle a baby, let alone ignite fuel. So it's got to be stepped up into something "hot."

This is accomplished by embedding the magnet in the flywheel. As the flywheel rotates on the crankshaft, the magnet passes over a core laminated from sheets of soft metal. Now, instead of traveling through the air from one pole of the magnet to the other, the force passes into the laminations, since they offer less resistance than the air.

The laminations, in turn, are hooked into the coil, which is really two coils, one inside the other. The inner (primary) coil

has a comparatively few turns of heavy wire. The outer (secondary) coil has a great many more turns of fine wire. As long as the primary circuit is unbroken, the relatively powerless magnetic force flows through and out the circuit. But when this circuit is broken, the force col-

HERE'S THE BABY that can pinpoint almost any mag problem, but you can do a lot of work without one





SIMPLE TEST to determine whether you have a mag problem involves pulling plug wire to check spark



PLUG BOOTS should be checked for cracks since these mean that the plug isn't getting proper protection

lapses abruptly across the secondary circuit. This induces a current in the secondary coil of a much higher voltage because of the many more turns of finer wire.

Interruption of the magnetic force at the right time is handled by a set of spring-loaded breaker points which are connected into the primary circuit. When the magnetic force in the primary reaches its peak, a cam on the crankshaft forces the points apart, collapsing the magnetic field and producing the current in the secondary—current that's powerful enough to break down the air resistance of the sparkplug and allow a strong spark to jump the gap.

The remaining part in the magneto setup—the condenser—comes into action when the points open to absorb surges of current which otherwise would arc across the open points and ruin them.

Now, suppose the engine's hard to start or doesn't start at all. It could be a fouled-up mag, but it could also be a fuel problem or other internal troubles. To rule out the magneto, remove a sparkplug wire and hold its terminal $\frac{3}{16}$ in. away from a ground, such as a bolt on the powerhead. (Be sure to hold the wire by the boot or insulation. The surge can't kill you if you grab it in the wrong spot, but it will be more than a little stimulating.) Crank the engine and look for a spark to jump the gap between terminal and ground. In bright light you may not see a spark, but you should hear a sharp crackle. No spark or crackle? You've got a magneto problem.

Mag troubles can also cause an engine to

miss and lose pep at higher speeds. So, with the engine running this time, remove the lead wire, hold its terminal $\frac{3}{16}$ in. away from the plug terminal and rev the engine for an instant. Snap, crackle or spark? You're okay.

Be careful in doing this test. It puts a terrific strain on the coil and could ruin a perfectly good one if you overdo it. Hold that lead no further away from the plug than $\frac{3}{16}$ in. and make the trial only for an instant. If there's no spark right away, there won't be one later.

Suppose you get spark or crackle. Does this mean the *entire* ignition system's in good shape? Not by a long shot.

It means the mag's okay, but don't overlook that one part of an ignition system which most people take for granted and which, without doubt, causes the most trouble—the sparkplugs.

Every outboard manufacturer stresses that burned, fouled or damaged plugs be replaced with the same type as originally installed in the motor—unless the engine is operated under abnormal conditions.

There's one sure way of telling whether frequent plug troubles are being caused by use of the wrong plugs. Examine the porcelain after the plugs have been in use for some time. Porcelain that's become coffee-colored or dark brown indicates the plug's the right one for operating conditions. If the porcelain retains its natural white color or has formed flakey blisters, it means the plug's too hot. If it's turned black or has an oily coating on the firing

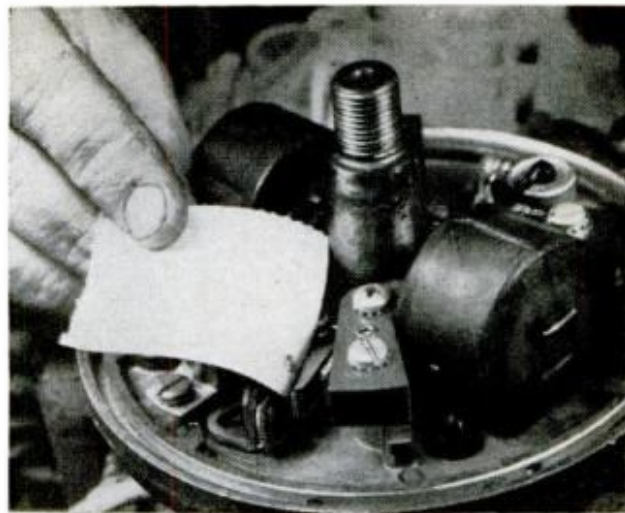
end, the plug's too cold for conditions.

To avoid ruining plugs, analyze the conditions under which your engine will be operated. For example, sustained idling periods, much stop and start, and light load operation mean combustion chamber temperatures will be relatively low. To get full combustion, you may need the hotter spark provided by a plug hotter than that recommended.

On the other hand, an engine that's going to be pushed at high speed for long periods will probably require a colder plug, since chamber temperatures are going to get mighty hot. This type remains cool long enough to avoid engine pre-ignition and plug electrode corrosion. One sure tip-off that a colder plug is called for shows up when you're operating at high speed—the engine suddenly slows down, then picks up speed again, and keeps repeating this erratic operation.

So-called sparkplug problems seldom result from *faulty* plugs. Instead, the trouble usually stems from plugs that aren't installed properly, plugs of the incorrect heat range, or an engine that needs overhaul or adjustment. By the way, outboard plugs should be protected against moisture, and the thing that does this is the rubber sparkplug boot. Once it dries out and begins to crack, get rid of it.

Modern outboard magneto ignitions come in two general types. One, used primarily on small motors, has the magnet embedded in the flywheel. The flywheel sits on top of the stator assembly, which



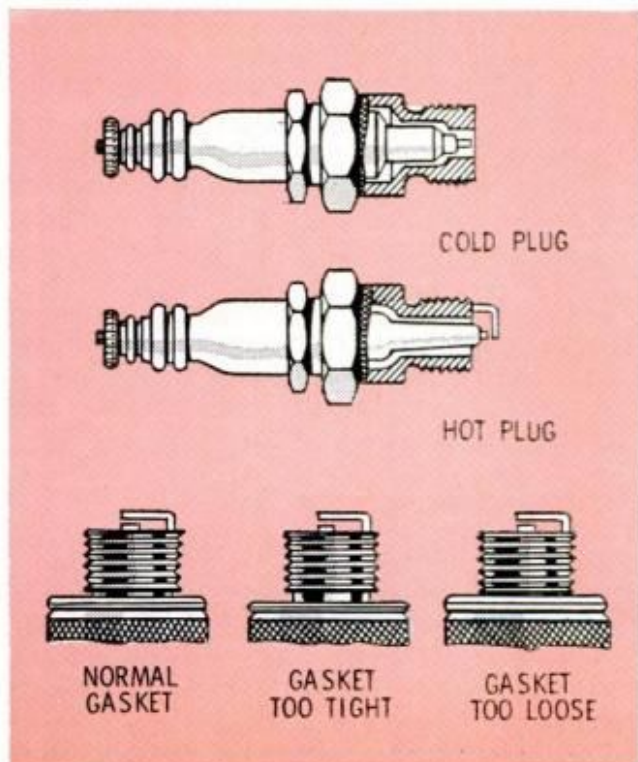
DIRT CAN CAUSE a surprising amount of trouble with points, so clean them well if you don't replace them

contains the ignition parts. Since this kind is the most common, we'll concentrate on it here. (By the way, it's the only one you should even think of tinkering with unless you have special tools. Even then, you'll need a flywheel puller to get at the stator.)

The other kind, used primarily on bigger engines, is a distributor type in which the flywheel and magneto stator are divorced. The magnet and all other ignition parts are contained in a sealed case. A drive belt connects the flywheel to the shaft. As the flywheel turns, it drives the belt which drives the shaft. The magnet's tied into the shaft, so it turns, too. Everything else operates pretty much the same as discussed earlier.

PLUGS SHOULD BE of the proper heat range, with gaskets compressed only enough to provide a tight seal

CHECK THE MAGNET for streaks which indicate that the core laminations are probably out of alignment

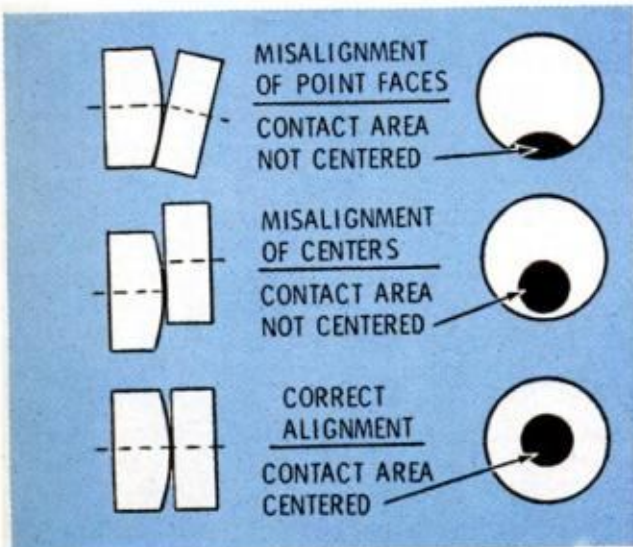




AFTER REMOVING the retainers, pull out the movable point and the spring which holds the points closed



FIXED POINT can be unscrewed if you find that it needs replacing. This one looks like it's still okay



BE METICULOUS as a jeweler when setting point gap. Adjust until you feel a slight drag on the gauge



The one thing that characterizes the distributor-type setup is the need for pin-point timing. You simply can't set breaker point gap on this ignition setup, as you can on the other type, and hope to get away with it. You need a certain amount of dwell, depending on your engine's specifications, which dictates how long the points will remain open. You determine this dwell with a meter.

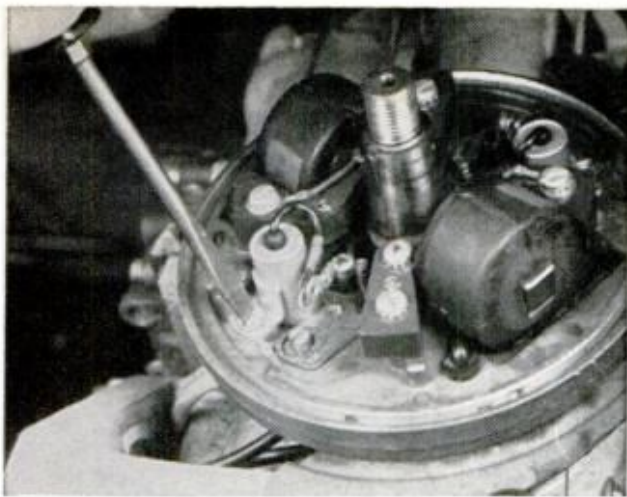
No matter what type of setup you have, the only way of telling for sure what part of the mag's upsetting the works is with a magneto tester—an all-purpose gadget that tests everything from coil windings to condenser and sells for about \$100. Should you get one? That's up to you, but you can have a shop do lots of magneto work for that kind of money.

The magneto tester shown on page 161 does all of the following jobs:

- tests the general condition of the coils under both high and low speeds.
- tests the coil's secondary for high resistance, open or shorted windings and dampness (continuity).
- tests the coil's primary for open or shorted windings.
- checks out the insulation throughout the whole system.
- tests for high resistance between breaker points, connections in the primary circuit and high-tension leads.
- tests the wiring itself for breaks and current leaks.
- checks the condenser for leakage, shorts and capacity.
- sets engine timing.

But even without this versatile package you can do a major portion of your ignition troubleshooting. Start by removing the flywheel and checking the magnet. If it's hitting the core laminations, you'll see a tell-tale black streak.

In many engines, you can set the lami-



CONDENSER is held in place by two screws—one for the pigtail and the other to hold condenser on its seat

nations yourself. Loosen up the screws—there are usually three—and back off the core until its edge is aligned with the edge of the boss on its seat.

Now check the points. Take a piece of clean cardboard and run it lightly between them to remove dirt. If points are pitted or worn, they should be replaced. The moveable point is removed by prying out two spring-type retainers—one on top and one on the side of the point—that keep it from floating. (Don't lose these. You'll want to use them again if your new set doesn't have them in the package.) The fixed point is then removed by unscrewing it.

To align points, bend or twist the *fixed point only*. It's best to use a regular point alignment tool—you can buy one for about \$1. If you don't have a timing instrument, gapping is the one way of insuring the engine's properly timed. Use a feeler gauge, and consult a mechanic at a local outboard shop for the proper gap.

In the absence of a magneto tester, always replace the condenser when you replace the points. To remove it, simply remove the retaining screw.

In engines equipped with electric starting, the one indication which characterizes a bad starter—no start—can be caused by any of a number of other things. Nine times out of ten you'll find that the first thing to go bad in outboard starters is the armature—it gets burned. However, the brushes, commutator, solenoid or field circuit could also be at fault.

Want to save yourself some money if you suspect a weak starter? Unbolt it and take it to an auto repair shop. The man there will put the starter on a growler, which'll pinpoint the exact trouble area. You can then buy the one component you need to get cutting across your favorite water—without the delay and expense of leaving your outboard at a shop. ★★★

JULY 1965

Outboard Clinic

Q Gas isn't coming to the carburetor of my 5-hp fishing motor as it should. Blowing into the tank helps some, but it's not a good solution on the water. Can you help?—Z.T., Illinois

A I have a hunch there's a hole in the diaphragm of your fuel pump that's destroying pump vacuum. By blowing into the tank, you're creating the vacuum the pump should be providing. Replace with a new diaphragm and see.

Q A complete tuneup of my 9.5 Evinrude, including carburetor cleaning and adjustment, plugs, points and the whole bit, has failed to stop a rough idle condition. What do you think that I'm overlooking?—L.E.E., Texas

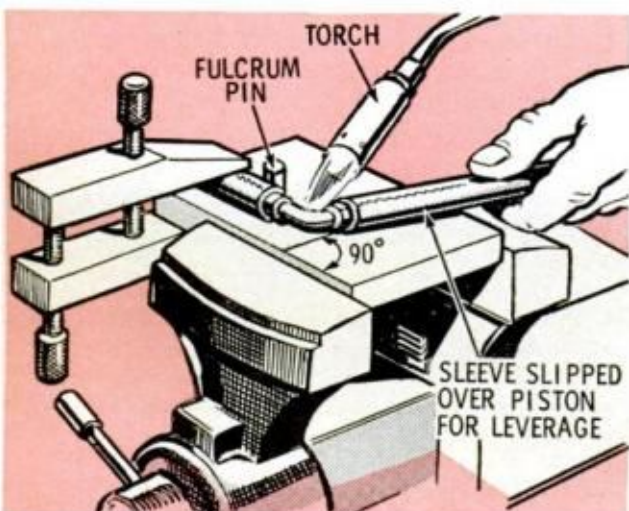
A In searching for frequently overlooked causes to this trouble, you'd best consider these three: (1) Your fuel-oil ratio may be wrong. Too many of us give never mind to it—yet it's mighty important and can lead to all sorts of woes. In your case, I'd say you have too much oil in the mixture; (2) A plugged air-vent hole in your fuel-tank cap could be causing reduced vacuum at idle and a gas-starvation situation. Just to make sure, clean it out; (3) You could be using the wrong heat range sparkplugs for conditions. Under the circumstances, you may be letting the engine idle for prolonged periods. So, you should consider switching to a hotter plug. See this month's service feature for full details on choosing the correct plug for your operating conditions. This might be the key to solving your problem.

As a service to the readers of **POPULAR MECHANICS** in solving problems relating to their outboard engines, you are invited to submit your questions to this column. All questions will be answered, either in the column or by mail. Address Outboard Clinic, Popular Mechanics Magazine, 575 Lexington Avenue, New York, New York 10022 and enclose a 5-cent stamp.

You Can Make This Incredible Elbow Engine



By Jeremy Harris
and Willard Slay



AFTER TURNING DOWN center to create piston pairs, bend elbows by clamping to plate-and-pin jig. Apply torch while pulling longer sleeve to the 90° mark

WITH AN ENGINE as novel as this, you don't ask "What's it for?"—it's for murmuring "Wow!" over when you hook it up to an air or steam line. It's worth a "wow," too: it's a six-cylinder engine that has only five moving parts!

The pistons are paired into three elbows that bridge two cylinder barrels. In order to *move* when they're activated, the pistons have to *turn* both barrels; thus back-and-forth motion is converted into rotary motion—without gears. Switch the pressure line (steam, compressed air or gas) to the exhaust port and the whole thing spins in reverse. Either way, there's more elbow action than you'd get from a line of señoritas in a maraca contest.

Valving is accomplished without adding a moving part. There are two crescent-

shaped slots in the plates that the cylinder blocks ride against. These slots are spaced so that pistons on an upstroke lie over one of them, while pistons on a downstroke lie over the other. Both ends of each piston pair are "fired" simultaneously, so the power-pulse pattern is like a three-cylinder engine. The action is based on a type of constant-velocity joint known as "Hobson's coupling." But the way the pistons dance is what engineers call "simple harmonic motion."

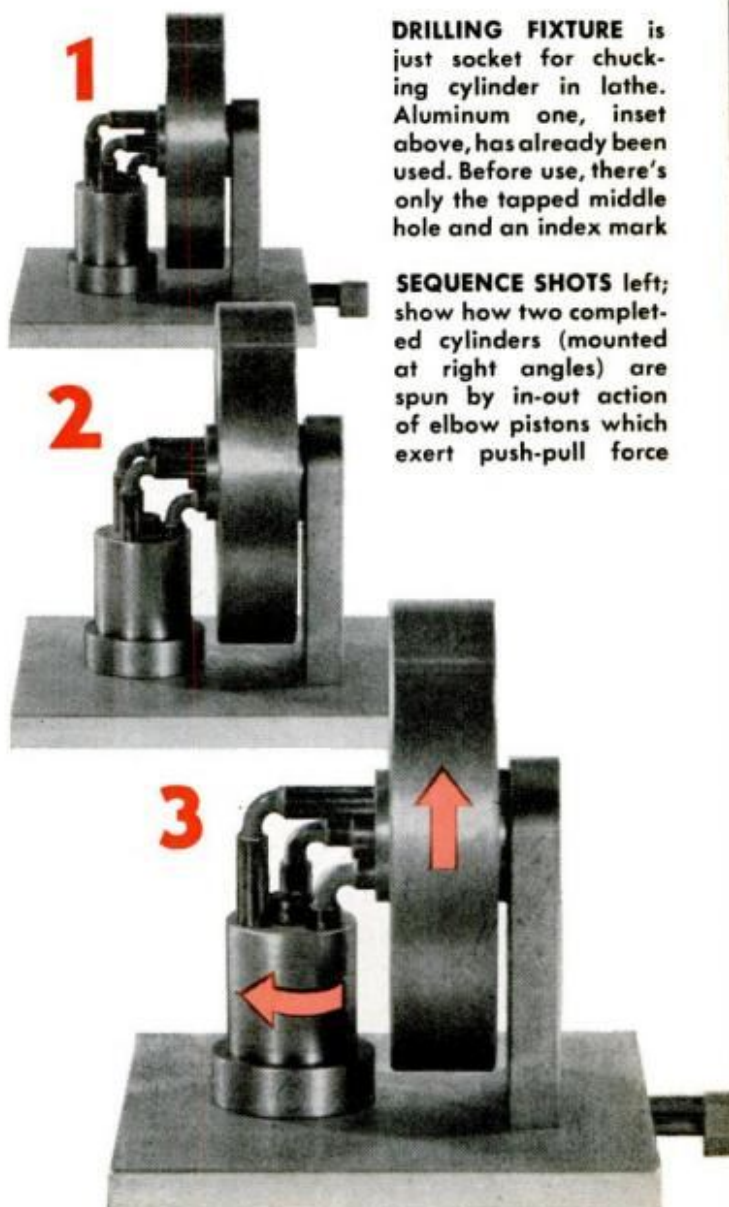
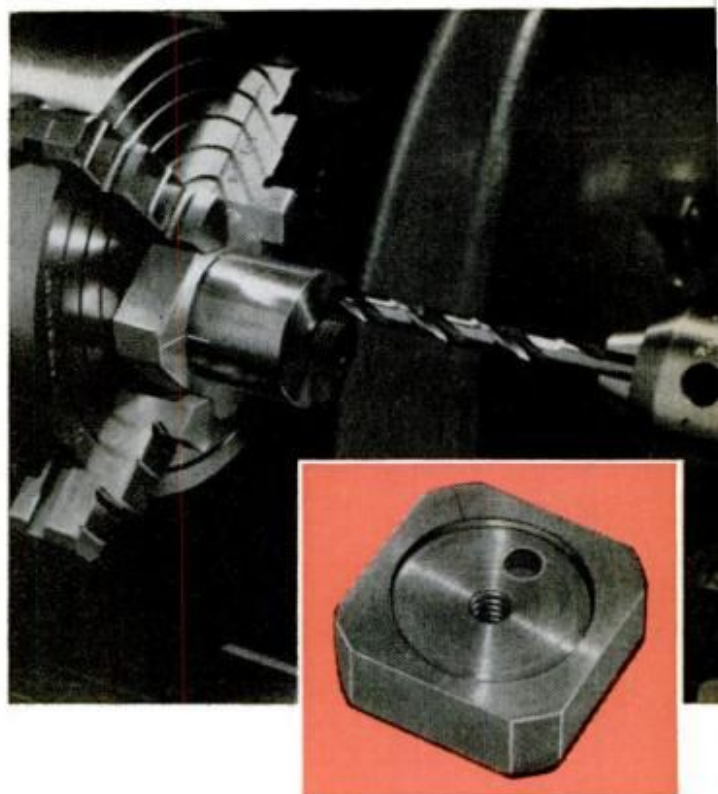
Although a milling attachment is useful for cutting these valve crescents, you can make the entire engine on a lathe alone, working from the full-size plans on pages 120 and 121. For those valve ports, for example, you'd just drill a series of overlapping holes along a scribed arc, using a bottoming drill. (The exact shape and depth of the ports isn't critical, as long as the cylinder barrel covers and seals them.)

Use bronze bar stock for the cylinders. Square both ends of each barrel accurately and finish-turn the outside diameter. Make two identical blanks, and postpone turning down a shoulder on one until later. Drill and ream a 1/4-in. center hole in each barrel; then (with use of an indexing head if possible) scribe three axial lines 120° apart on the side of each barrel, running about 1/4 in. up from one face.

You'll need the simple fixture shown at upper right to help space the cylinder bores. Chuck up a piece of plate or bar stock which has a face area larger than the cylinder barrels. Machine a 1/16-in.-deep recess to nest—snugly—the base of the barrel. Next, drill and tap a center hole for a 1/4-28 bolt. In the recess, make a centerpunch mark on a 3/16-in. radius and scribe a single radial line at any one of the corners, as shown in the inset.

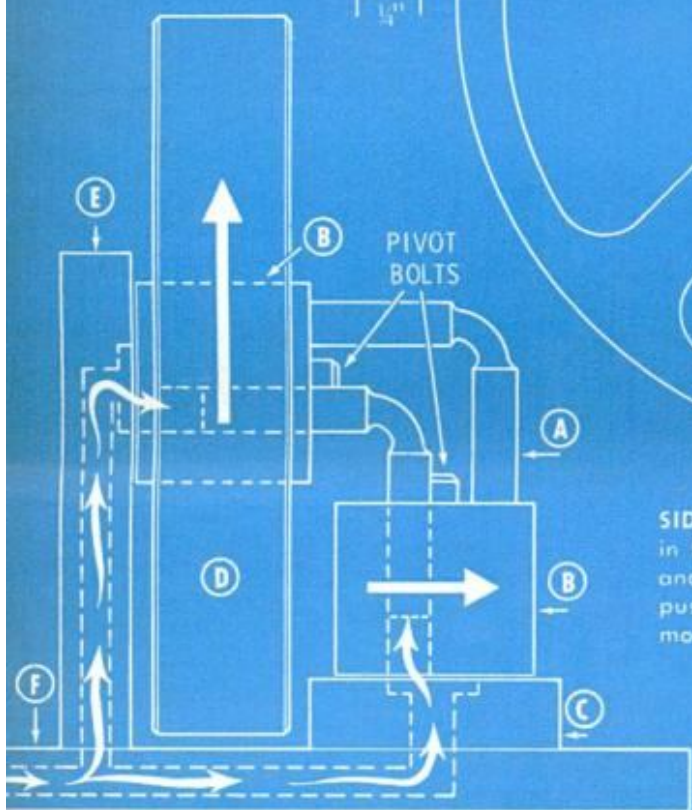
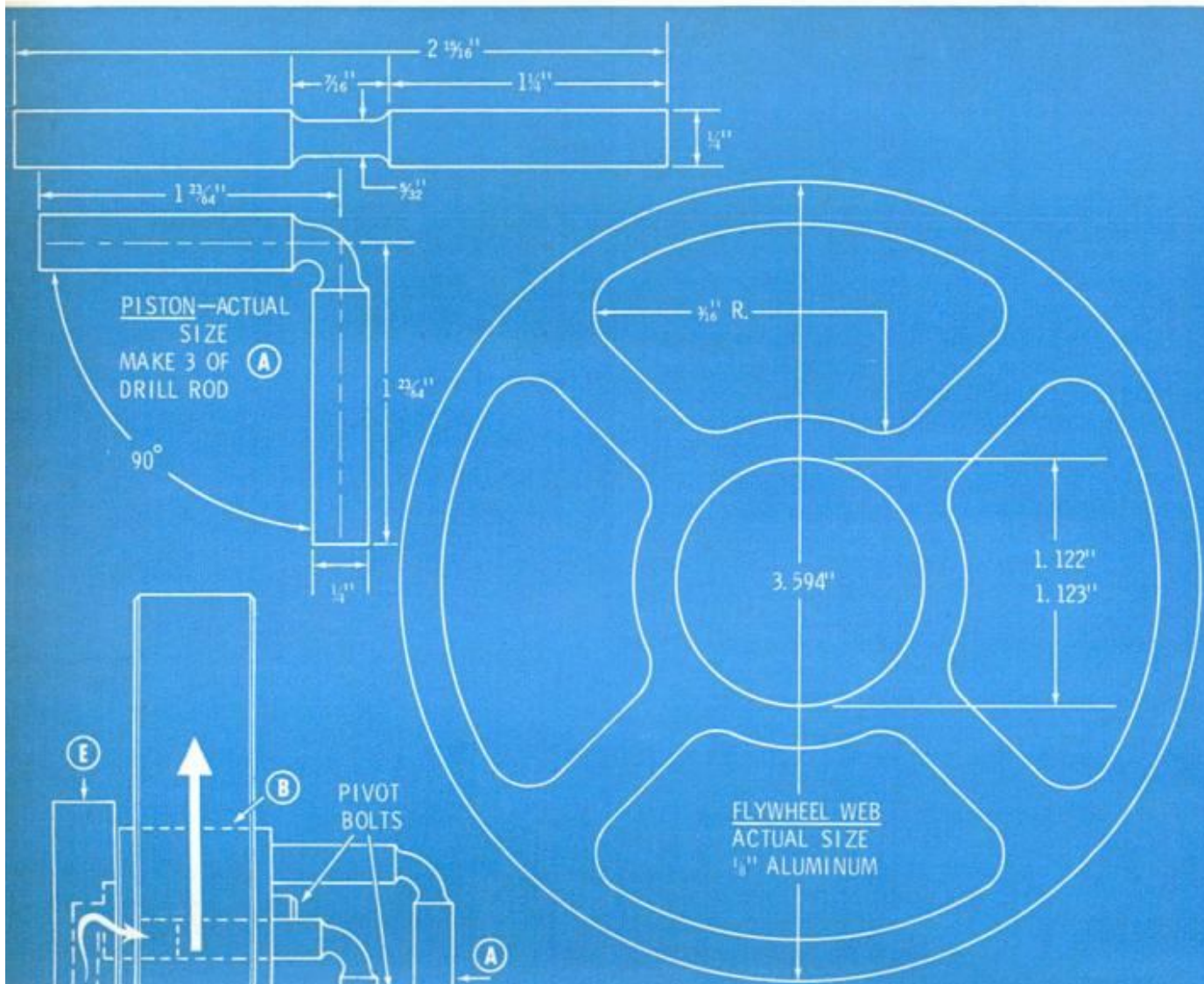
Mount this fixture in the lathe so the punch mark is centered; check the recessed face for true running, then use a 1/4-28 Allen-head bolt to clamp one of the barrel blanks to the fixture, making sure it turns freely but snugly in the recess. Rotate the barrel until one of its index marks is in exact alignment with the radial mark on the fixture, then tighten the bolt and drill the first hole, using a center drill to start. If equipment is available for boring the last few thousandths on the diameter of the cylinder holes, this will give maximum straightness and smoothness. At any rate, work to a close slip fit with the 1/4-in. stock used for the pistons. When the first hole is completed, simply loosen the clamping bolt and rotate to the next scribed line on the cylinder. Make the second cylinder barrel the same way, then turn down its o.d., as seen on the next page

(Please turn to page 182)

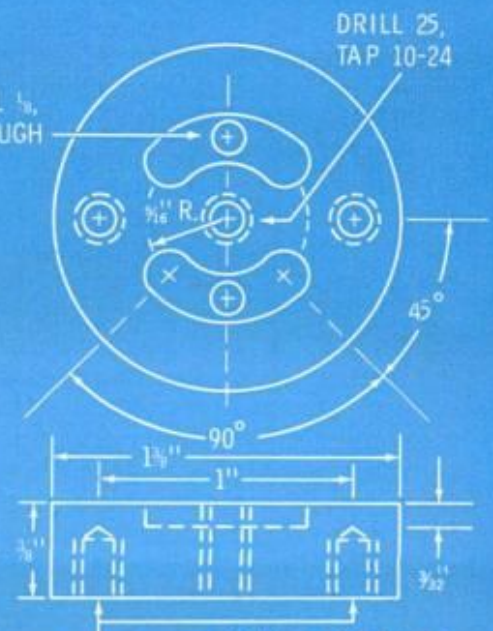
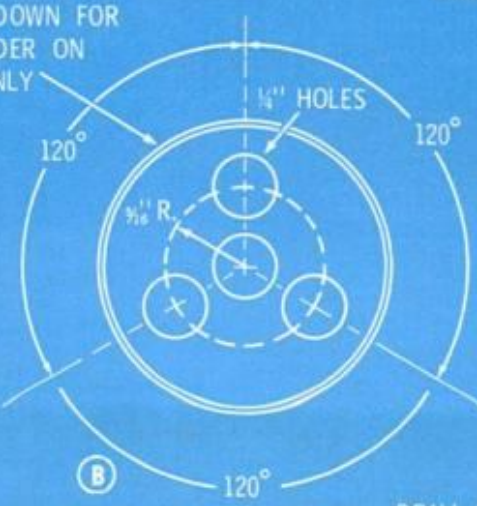
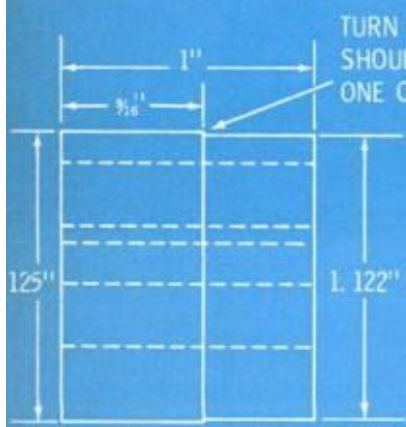


DRILLING FIXTURE is just socket for chucking cylinder in lathe. Aluminum one, inset above, has already been used. Before use, there's only the tapped middle hole and an index mark

SEQUENCE SHOTS left; show how two completed cylinders (mounted at right angles) are spun by in-out action of elbow pistons which exert push-pull force



SIDE ELEVATION at left is key to assembly of parts shown in full-size plans. Arrows trace path of steam through base and post to valve parts. Both ends of elbow piston are pushed at once; cylinders spin so flow is cut off and holes move on over exhaust parts for elbow piston's return stroke

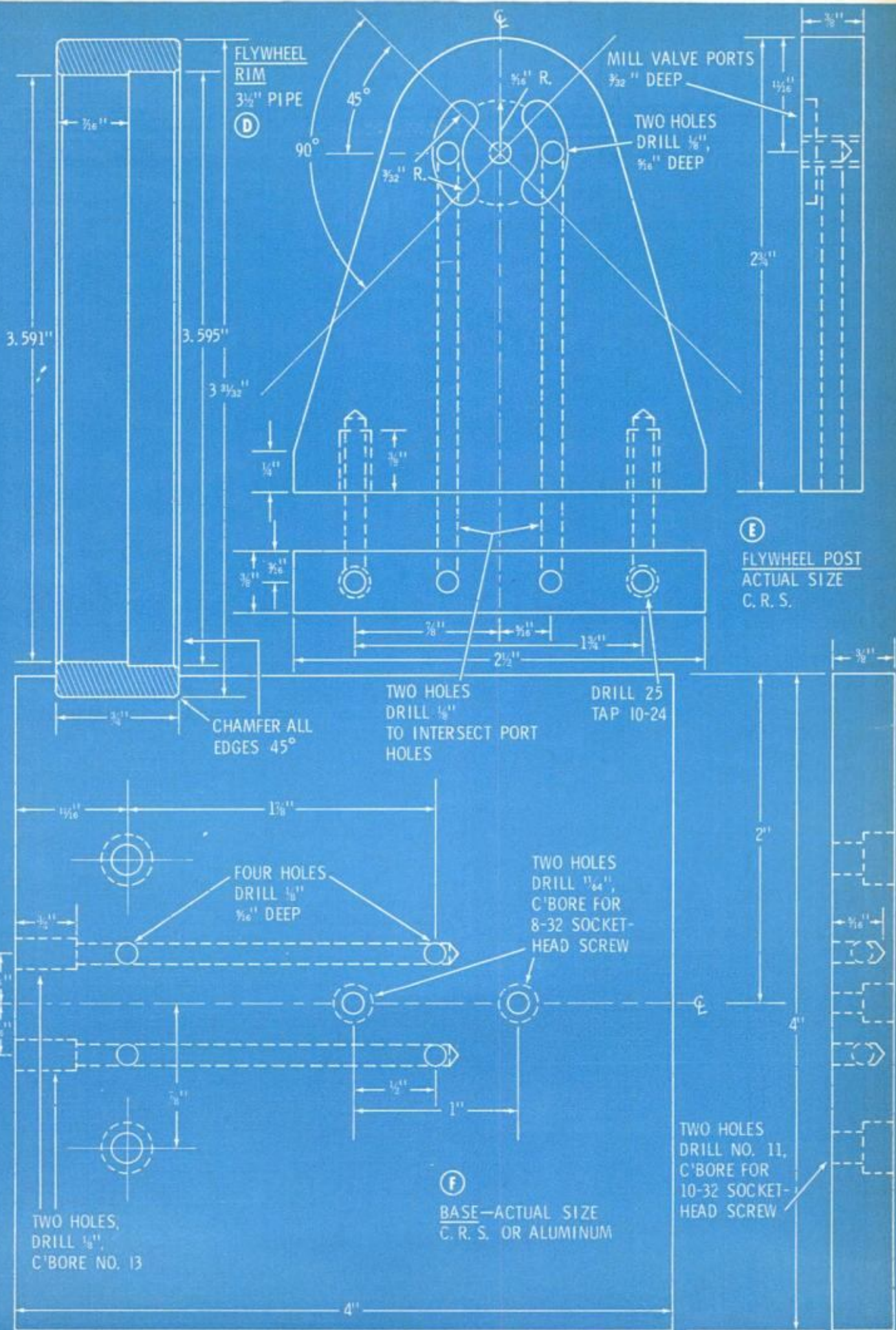


CUT, FOLD, TAPE

ELBOW ENGINE

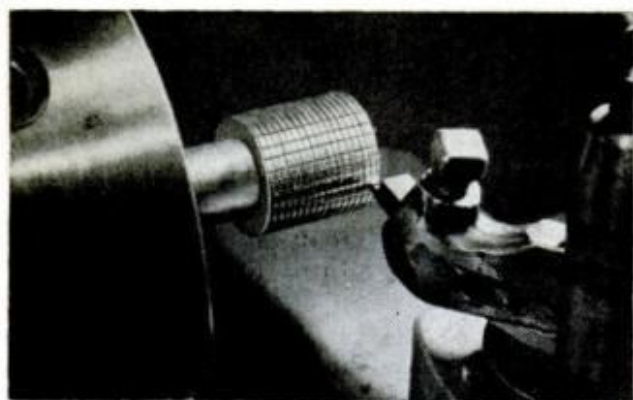
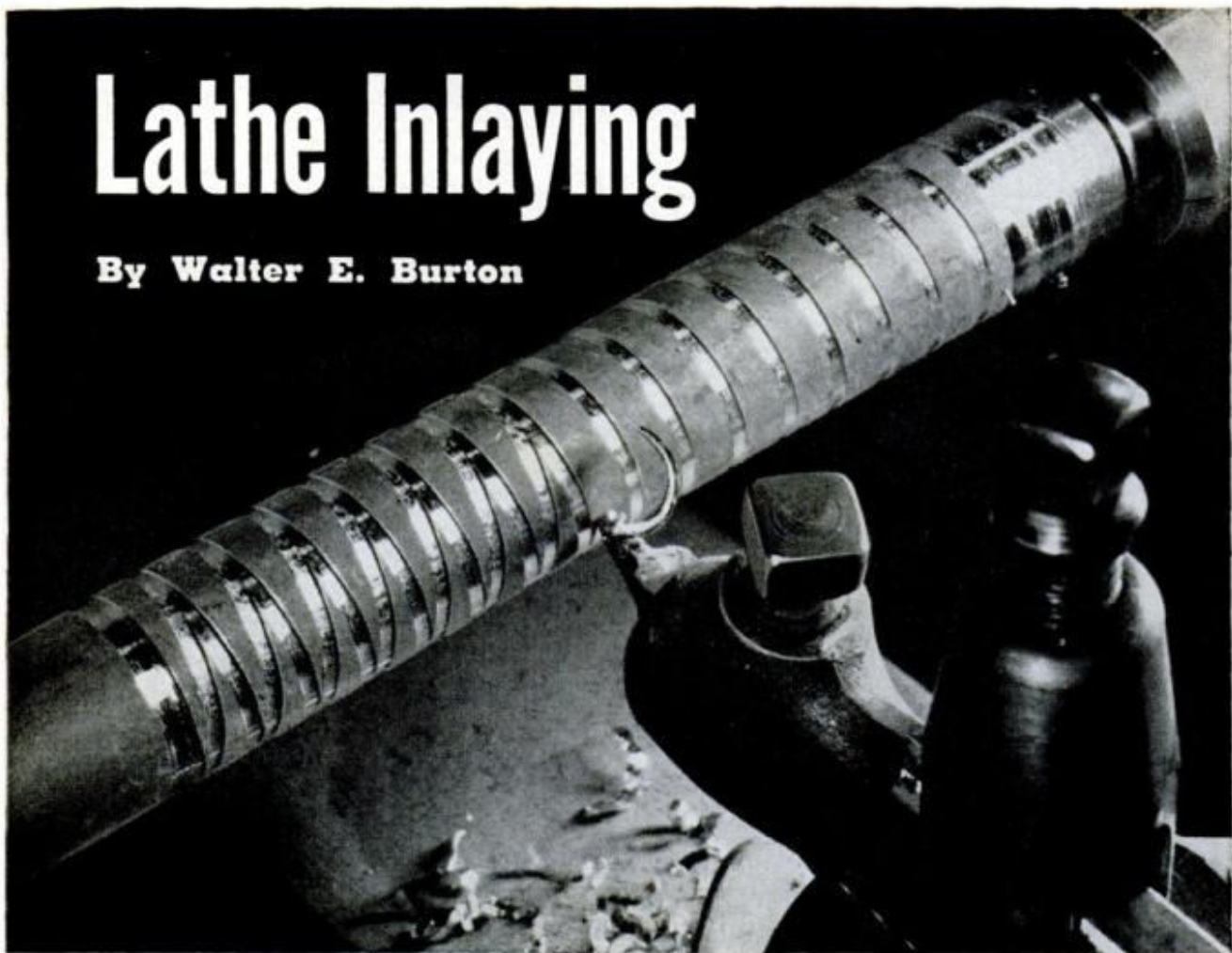
(B) **CYLINDER**
MAKE 2 OF BRONZE

(C) **VALVE PORT BLOCK**
COLD-ROLLED STEEL



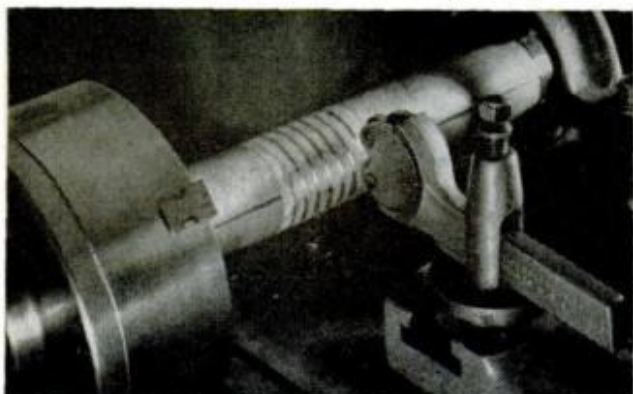
Lathe Inlaying

By Walter E. Burton



DECORATIVE SUBSTITUTE for knurling is a combination of threading and grooving. Checkered design achieved resembles the pattern found on gun stocks

BY OPERATING the lathe as for coarse threading and using a knurler in place of a tool bit, an ornamental spiral pattern can easily be produced

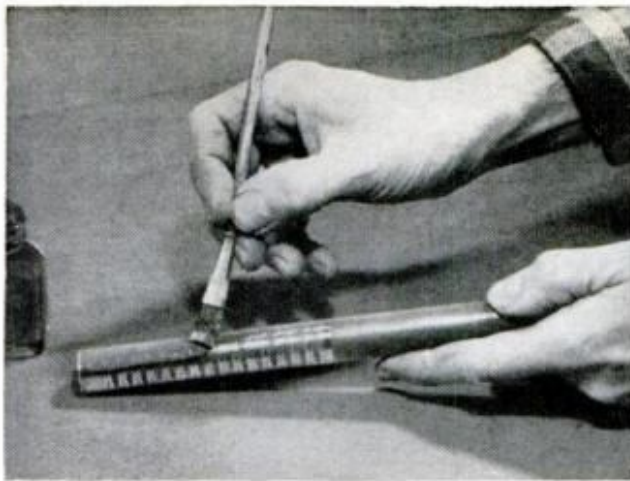


CANDLESTICKS, lamp bases, salt and pepper shakers, cabinet hardware—these are but a few of the metal or plastic projects you can dress up with color “inlays” created on your metal lathe. Actually, the designs are *incised*, using a variety of machining techniques and cutters. The *inlay* effect is achieved by coating the worked area with enamel or lacquer, letting it dry, then polishing this coat off the surface, leaving the grooves filled with color.

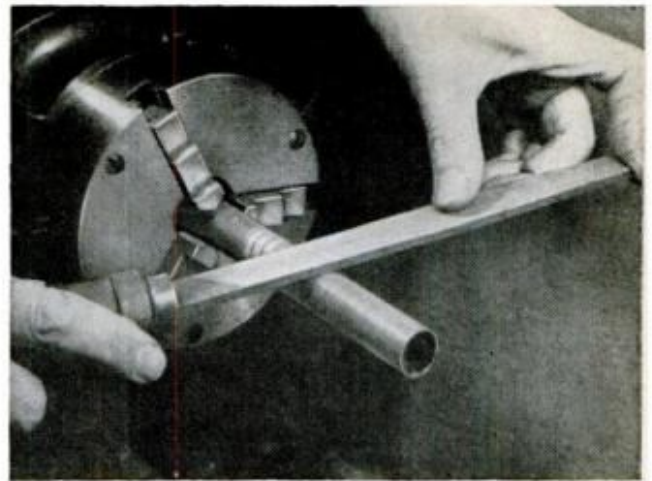
Such “in depth” designs are not only more handsome but far more durable than decorations painted on the surface of non-porous materials. And on such items as knobs and handles, they improve the grip, like knurling.

The project shown in the large photo above is a good example of the effects that can be achieved by machining. Here, a square-nosed cutoff tool is being used to chase grooves in 0.003-in. bites, and the right- and left-spiraling grooves cross to form a basket-weave pattern. Variations on this pattern could be achieved by cutting grooves of different widths, changing the spacing between grooves or substituting a round-nose tool for the cutoff tool. Another possibility is to knurl a spiral impression, as shown left center.

Some patterns are decorative enough in themselves, without the addition of color.



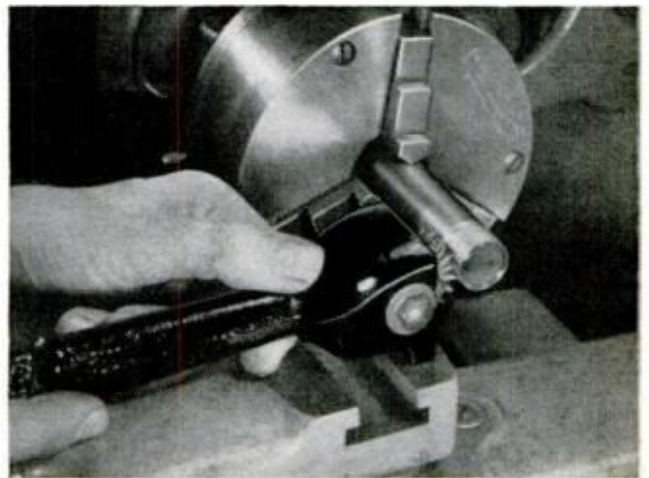
TO MAKE DESIGNS stand out sharply, first remove all burrs and polish the metal, then apply a uniform coat of lacquer or enamel to the turned area



REMOVING COLOR from the high places requires the use of a fine flat file or abrasive cloth with the work rotating at slow or moderate speed in lathe

The checkered design, left, was produced by setting the lathe for a coarse thread and cutting a spiral about one third the depth of a standard thread with a threading tool. Longitudinal grooves were cut by rotating the tool 90 degrees in the holder and moving the lathe carriage back and forth like a shaper ram.

The coloring operation is shown in the photos above. Flow the color on generously enough to fill all the depressions without any skips. For crisp edges, and easy removal of the dried coating from the surface, you must knock off all burrs and polish the metal before painting. Then, to strip the surface back to bare metal, work it with a fine file. After final polishing, coat with a clear finish. ★★ ★



FINE-TEXTURED surface can be indented in brass, aluminum or other soft materials with a grinding-wheel dresser from which round washers have been removed

NEXT MONTH IN SHOP AND CRAFTS

- ★ **ALL ABOARD FOR FUN.** A backyard railroad that's sure to delight any budding Casey Jones in your family, this kid-size replica of an old-time locomotive runs on wood rails and is driven by king-size solenoids powered by auto batteries. Built of plywood and lumber, it chugs along at 5 mph and is bound to make your backyard the most popular place in the neighborhood. Complete build-it-yourself plans and photographs, next issue.
- ★ **MULTICHORD STEEL GUITAR.** Only \$18 worth of materials and a couple of weekends of spare time work are required to build this fine musical instrument. Mounted on legs, it uses just one bank of 12 strings so that all damping can be performed in the classic fashion—with the edge of the hand. Next month's PM shows you all the construction details, plus how to rig your "Hawaiian" guitar for use with an amplifier. Be sure you don't miss it
- ★ **PEDAL-POWER FUN BOAT.** Start with an old bicycle frame and a couple of wooden pontoons, then add a pair of paddle wheels and an outboard motor board and you'll have some idea of the fun potential of this one-man bike boat. When you want to pedal, tilt the motor and go to it. When you're tired, lift the paddle wheels and drop the motor. It's all in August
- ★ **IS THAT A LOAD-BEARING WALL?** All the partitions in your house look alike, but when you want to remove one to enlarge a room, you'd better know whether that wall is helping to hold your house up. The August PM tells you how to determine what's what before you start to take out a wall, so if you're thinking of remodeling, watch for next month's issue

The Truth About Tube

Used properly, that drugstore check can get your TV working again for the price of one tube. Here's how to cut service calls

By Larry Steckler

THE MAN WAS MAD. There was no doubt about that. You would be, too, if you had just bought \$14.35 worth of new tubes at the drugstore, installed them in your TV set—and still the blamed thing wouldn't work.

I waited until his sputtering subsided and then offered to help him find the trouble. He welcomed the idea. So we checked

all his new tubes on my Heathkit mutual-conductance tube tester. One, a 10DE7 (vertical oscillator-output), was defective. A good replacement cured the set.

That experience set me to wondering how many other people had had the same problem. Just how good are the replacement tubes you buy, how accurate are the drugstore testing machines, and what could and should the average Joe do about testing tubes on his home electronic equipment?

Before I found the answers, I had tested 105 radio, TV and hi-fi tubes on home, store and laboratory-type testers, as well as in working electronic circuits. The results were fascinating.

I used as my good-bad standard the

DOUBLE CHECK ALL CONTROL SETTINGS before depressing the test button, when checking tubes at the do-it-yourself tester. One wrong dial setting can make the machine goof by calling a good tube bad or a bad tube good



Testing



operation of the tubes in actual circuits. If a circuit worked with the test tube, the tube was called "good." If the circuit did not work, the tube was called "bad."

Several types of testers were used. First, I tried a *continuity* tester which tells you only whether a tube's filament is good or bad; that is, if the tube is burned out and will not light. Next, I used an *emission* tester, the type found in drugstores and used by many TV repairmen. It rates a tube according to the electron flow between the two main elements of a tube. It also reveals shorted and gassy tubes. Finally, I used a lab-type *mutual conductance* tester. This unit checks tubes under simulated operating conditions with all sections of the tube under test con-

LABEL EACH TUBE and its socket with the tube type number to be certain that each one is returned to the same socket from which it was removed for test

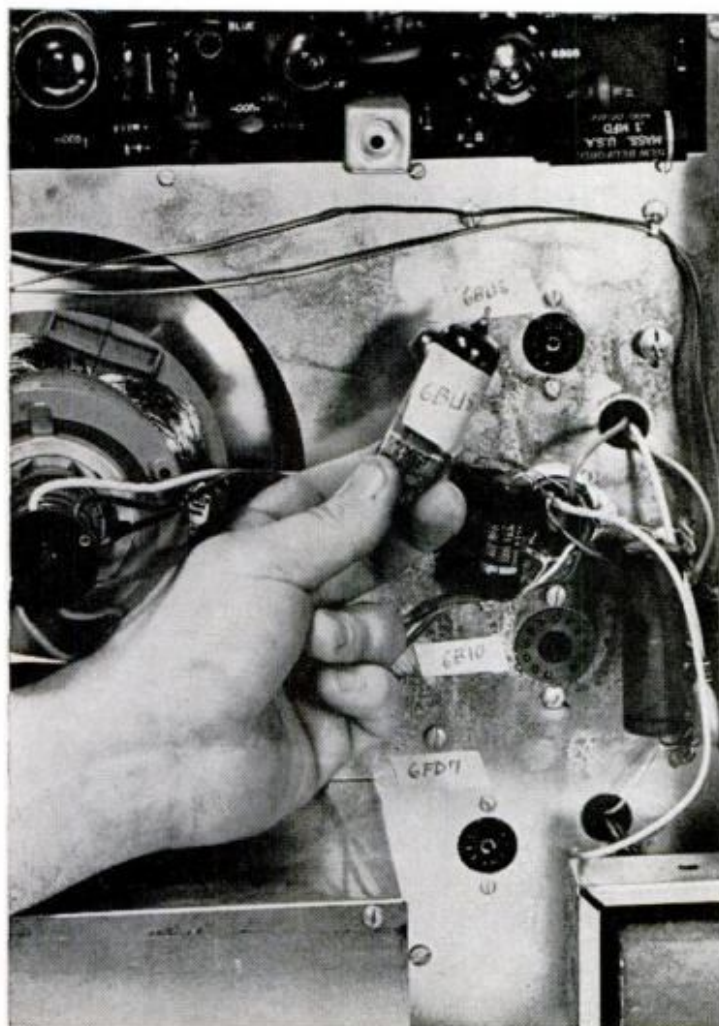
nected and loaded much as they would be in an actual electronic circuit.

The continuity tester—that's the sample, bargain-basement-type tester—found five bad tubes. All the tubes it called bad were bad; they did not work in an actual circuit. It did not locate any shorted or weak tubes, but it did provide a quick and easy test for the dead ones.

The drugstore emission tester and the repairman's emission tester gave identical results. They picked out the same five dead tubes plus two shorted and three gassy ones. They also listed six other tubes as "weak" and four others as "bad." One of the "bad" tubes and three of the "weak" ones were still in working order.

The mutual conductance tester did the

CONTINUITY TESTER makes quick work of identifying a burnt-out tube. In many TV and radio sets, when a single tube fails, the good ones won't light either





MUTUAL CONDUCTANCE TESTER is tops in accuracy but the proper setting of its many controls is a task for a technician experienced with its operation

best job of all. It found the five dead tubes, confirmed the two shorted and three gassy ones. And it also picked out one additional gassy tube the emission testers missed. It listed eleven "bad" tubes.

Now let's look at tube testing procedures. The most important single point is to make sure the set is off and the line cord disconnected when tubes are removed. Next, remember that if a tube has a metal cap, you must ground this cap before removing the tube to bleed off any residual electricity. Do this by touching a screwdriver from the cap to some metal part of the chassis.

Tag Tubes to Avoid Damage

Another important point is to be sure you get the tubes back into the same sockets they came from. Get them mixed and you can cause a lot of damage under the chassis—costly damage. Switch two tubes of the same type (you may have two of the same type number in entirely different circuits of the set) and a tube which worked in one socket might not work in the other.

There are several ways to tag tubes for identification—grease pencil, paper tags or numbers. The best method we found is to mark the tube number on the chassis by the socket and on a label taped to the tube. In the situation where two tubes bear the same identifying number, say two 6SN7s, add a roman numeral I to one pair of marks and a roman II after the other.

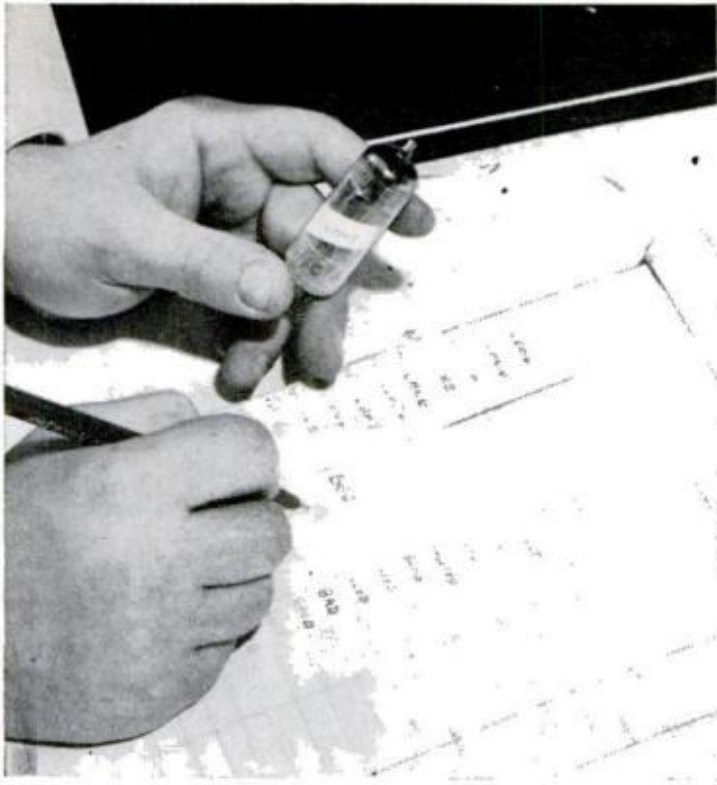


AFTER WARM-UP in tester, tapping tube lightly with pencil or short length of dowel may reveal an internal short. Otherwise, tube might test as good

Which tester should you rely on? Well, if you have a lot of vacuum tube equipment around the house, it may pay for you to get a tube tester of your own. The continuity tester becomes worthwhile if you have only one TV set. Prices range from about \$2.50 to \$15. If you have two TV sets, a vacuum tube hi-fi or stereo set and a couple of radios, you probably have 40 or 50 tubes in action in your home and I'd suggest picking up an inexpensive emission tester. They sell for about \$20 to \$45, and enable you to do your "drug-store testing" at home.

To use a continuity tester, just unplug the inoperative set and remove the back cover. Remove one tube at a time and plug it into the tester. If a tube tests "good," put it back in the same socket. Put a "bad" one aside, mark the empty socket with the tube type number and go on testing until you've tried every tube in the set. When you're finished checking, buy the proper replacements, have them tested at the time and put the set together. The chances are that it will now be back in business. One hedge is called for: If any new tube also burns out in a short time, there is serious trouble in the set. You'll have to call for skilled assistance.

If you don't find any bad tubes with the continuity tester or if you don't have one, take your tubes to a drugstore tester or a TV service shop; both have testers of about the same quality. A few technicians use the more accurate mutual con-



DETAILED RECORD-KEEPING is desirable when you have a large number of tubes. Enter each test reading of every tube for later study and comparison

ductance unit, but these are \$300-and-up instruments that must be operated by the repairman as the controls are much more complex than those on the emission unit.

The drugstore tester is easy to use and will tell you quite accurately which tubes are definitely burnt out. It will also pinpoint shorted or gassy tubes. Its "good-weak-bad" scale will give a quality reading on the rest. Any tubes that test low down on the "bad" scale must be replaced. But hold off on those in the upper portion of the "bad" scale and on all of those in the "weak" section. Quite often they will still work, so don't replace them until after you have replaced all the really bad tubes (burnt out, shorted, gassy and low-scale) and find the set still doesn't work. Our tests found seven borderline tubes.

Check Replacements on the Spot

Be sure to test any tubes you buy before leaving the store. This double checks the tester and the new tubes. If a tube fails to light and the new one also doesn't light, try wiggling it around in the tester socket. If you then find signs of life, the socket is worn. Try another tester in another store. Also be sure to use a tester that has a control marked "line adjust" or "meter set" atop the panel. Testers with either of these controls are almost impossible to rig to indicate more bad tubes than actually are in your set.

My expensive mutual conductance lab tester gave about the same results as the

drugstore testers but was much more accurate in picking out the bad marginal tubes, because it includes a "life" test. It did tip me off to some additional tubes that weren't going to last much longer. And the ideal procedure—if your budget permits it—is to replace a suspect tube with one you know to be good, which is just what your repairman does.

Paste that "known-to-be-good" comment in your hat, please. We made a check of tubes right off the shelf in one dealer's salesroom and found 5 bad ones in a lot of 200 that we checked.

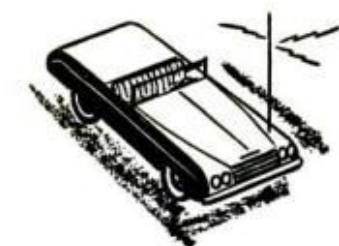
After all testing is done and all bad tubes have been replaced, you will occasionally find that the set still doesn't work. About 15 sets out of 100 that don't work have circuit rather than tube troubles, and may need a repairman's expert touch. But at least when he tells you that the set has to go to the shop, you'll know that it's not just a bum tube—the trip is, in fact, really necessary. ★★★

"MAYBE" READING is cue for further check. Cover tube with empty frozen juice can and retest. This raises operating temperature, may show up faults



For Your Car, Boat, Home...

Two-Way Radio



Low-cost set has high-price features: squelch, noise limiting, front-panel channel changing

By Larry Steckler



TWO-WAY CITIZENS BAND RADIOS are about the handiest pieces of electronic equipment you may ever use. You can install these sets in your car, aboard your boat or right in your kitchen. Use the one in the car to call your wife from the train station and tell her you're on the way home; put supper on. From the boat, you might call the dock and tell the attendant to get some ice ready; you've made a good catch.

One of the best sets for all of these purposes is the Knight-kit model C-540. It's a do-it-yourself kit you can assemble in a couple of evenings and it works off the batteries in your car or boat as well as the 110-volt line in your home. Price is only \$49.95 and you get features normally found only in the more expensive sets. There's a squelch control that eliminates background noise between transmissions, and an automatic noise limiter to reduce ignition static when in your car or boat. Select any of the 23 channels by simply plugging a crystal into the front panel socket.

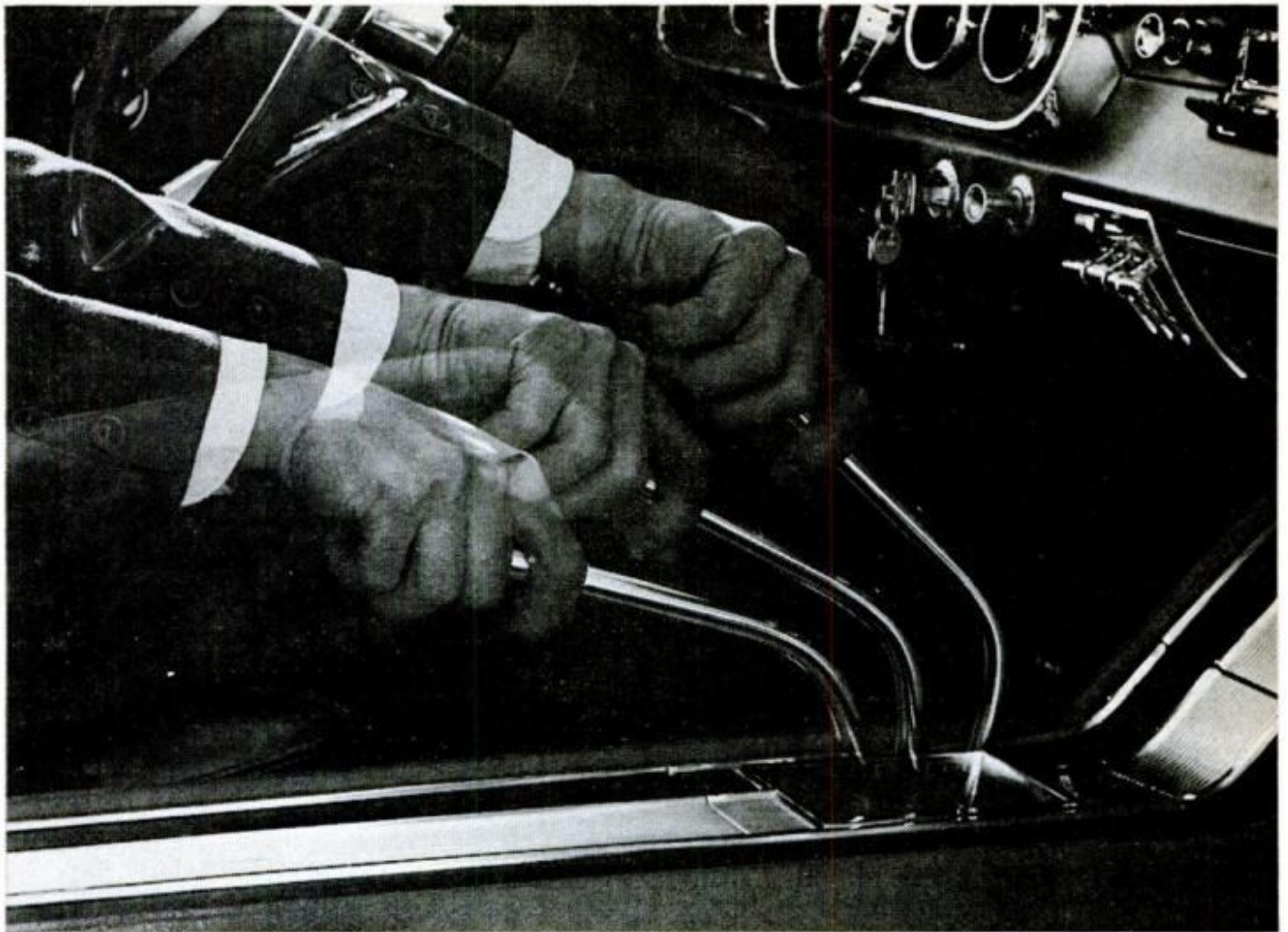
I tried this unit and found it easy to use and a pleasure to operate. When operated as a base station at home, even my wife had no trouble getting the hang of it.



KITCHEN TABLE is convenient spot to locate a CB radio. All you need is hookup to a.c. power and antenna. Detail above shows how transmitting crystal plugs into front-panel socket; letting you switch channels quickly



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Here are quality features you won't find in other manual transmissions. Shot-peened, helically cut gears for improved ruggedness and durability. Antifriction bearings. Precision cast-iron case construction. Extra quality at no extra cost from Ford Motor Company.

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RIDE WALT DISNEY'S MAGIC SKYWAY AT THE FORD MOTOR COMPANY PAVILION, NEW YORK WORLD'S FAIR

JULY 1965

177

Outside Loops

(Continued from page 99)

the European idea of proper aerial ballet being one performed at a near constant speed, with more grace than flamboyance. Russian and Czech planes are highly adaptable to this style, having excellent climbing ability and extremely stable inverted characteristics. American competitors, seasoned as they are in the airshow world, would like to include more abrupt and flashy snap maneuvers, at which our few good, if old, planes outshine most European craft.

Few Versatile Planes Here

A most severe handicap for U.S. aerobats has been the lack of versatile planes. In the Iron Curtain countries, aerobatics has been largely subsidized for its prestige value. The Russian team was flown intact to Spain in large transports parked ostentatiously on the field throughout the contest. Competitors, many of them drawn from the military services, are given planes, fuel, practice time and encouragement to compete.

However, the pilots' interest goes deeper than mere propaganda. Czechs in particular have developed excellent aerobatic routines and planes, the best of them being the Zlin series of trainers. A low-winged monoplane, the Z-226 Akrobat Special, is considered the most outstanding craft flying today, and many of the highly rated maneuvers seem to have been drawn around its flight capabilities and structural strength. Even the Spanish winner of the 1964 world competition used this plane.

Soviet pilots now depend on the Yak-18P, a 300-hp radial-engined, low-winged monoplane with an amazing ability to fly through vertical maneuvers, upright or inverted, with an imperceptible change in speed. Its big variable-pitch prop lends climbing ability, also helps retard the plane's speed in a steep dive.

This stability has been sought in the United States by retaining the biplane configuration in most aerobatic craft. Belgians and French pilots do the same with their use of the Stampe SV-4, a wood-and-fabric biplane built in the 1930s. Our own Great Lakes trainer, built in 1932, is still considered by many as the best American production aerobatic plane. A variation has been constructed by top American show pilot Hal Krier. His KrierKraft combines the better characteristics of the Great Lakes and the German Buecker World War II training planes. One of the latter, the Buecker Jungmeister, is used by the dean of U.S. aerobatic pilots, Bevo Howard, for exhibitions.

Most U.S. show aerobats have depended on the old Stearman primary trainer, first designed by Boeing and now usually fitted with an oversize 450-hp Pratt and Whitney engine for noise effect and climbing power. Even this powerplant is insufficient to haul this heavy plane around repeated outside figures. Both Stearman and Great Lakes trainers are unsuitable for the almost casual whip stalls (called tail slides in Europe) that are regularly performed in top competition.

U.S. production light planes are fairly hopeless in aerobatic performance, maneuverability and strength. Built mostly for straight-and-level business use, they are often stressed for no more than two inverted G forces. Competitive aerobatics often faces twice these forces. Modifications, however, can transform some of these planes into surprising aerobatic performers. Duane Cole's famous bird is a standard 1939 Taylorcraft, with several feet taken off the wings, its internal structure strengthened, and a 100-hp Continental engine added.

The newer, faster monoplanes are too clean in design. Like the thrilling but limited military jets, they have good climb characteristics but once pointed downward their speed builds rapidly to a point at which inverted maneuvers become impossible and recovery itself is rather questionable.

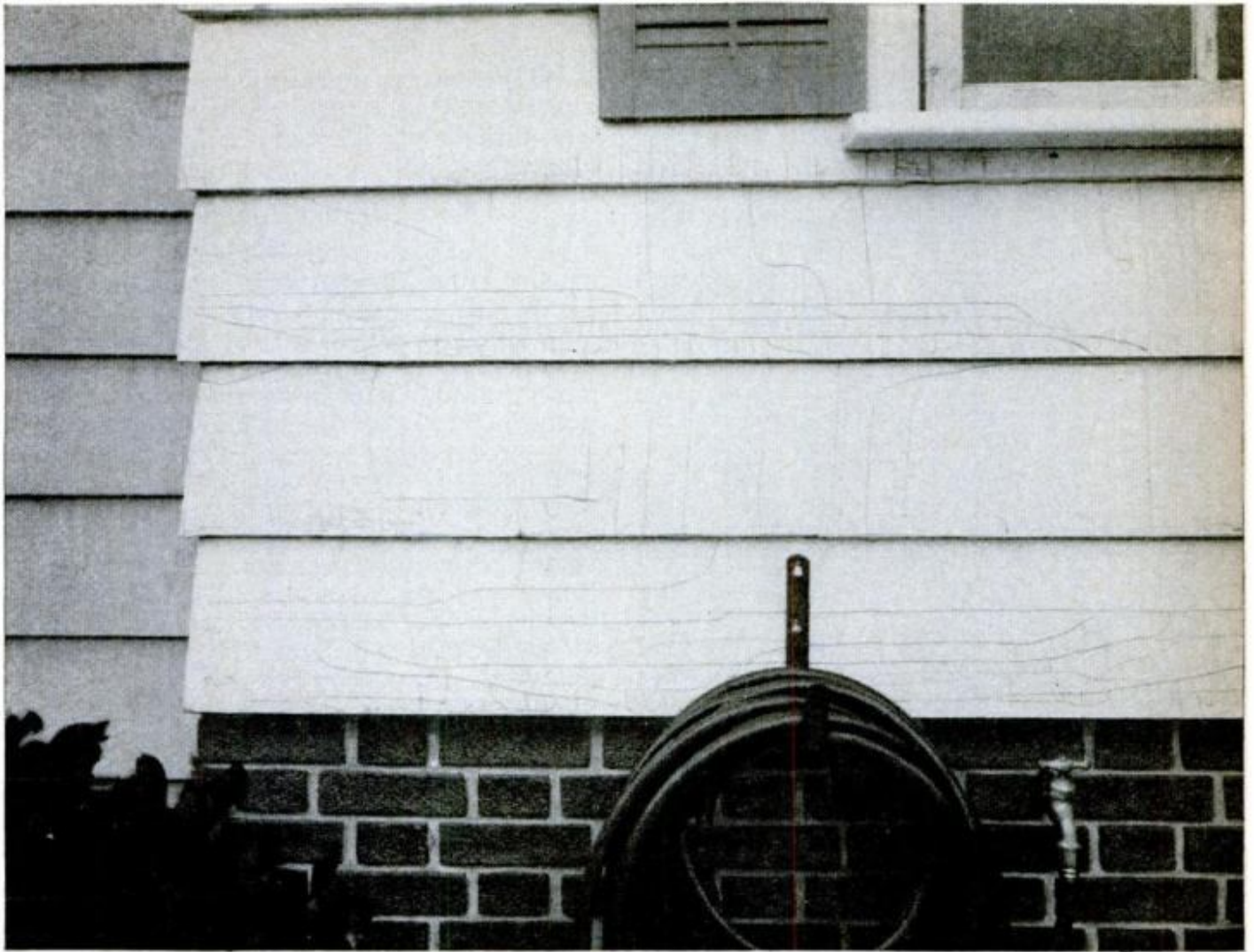
Home-Built Do Well

Many plans are now available for builders who want to construct their own fully aerobatic sport craft. Some are far stronger than factory-made planes, their craftsmen usually adding oversize tubing or other beef to already heavy designs. One of the best known is the Pitts Special, an early model of which was flown by Betty Skelton to win the U.S. women's aerobatic championship a decade ago. The Pitts easily withstands whip stalls and end-over-end tumbling. As the sport takes hold here, better aerobatic planes will undoubtedly be built. Most of these designs will be fashioned in the workshops of expert amateurs.

By now it would seem that every craft being used in this strenuous sport would be thoroughly tested and known. Still errors do creep in, and G-forces have a way of getting out of hand in tight maneuvers. These forces are often higher than those experienced by test pilots wringing out new jets. A G-meter carried in show pilot Don Pittman's Pitts registered seven positive and five negative Gs after one recent routine exhibition.

Even tested and trustworthy equipment

(Please turn to page 180)



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Du Pont LUCITE® House Paint is *flexible*. It expands or contracts *with* the surface it covers. Painting with Du Pont LUCITE House Paint means great protection against cracking.

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Outside Loops

(Continued from page 178)

sometimes gives way under such stress. During the past year young Rolly Cole was killed and Lindsay Parsons injured when their planes shed engines.

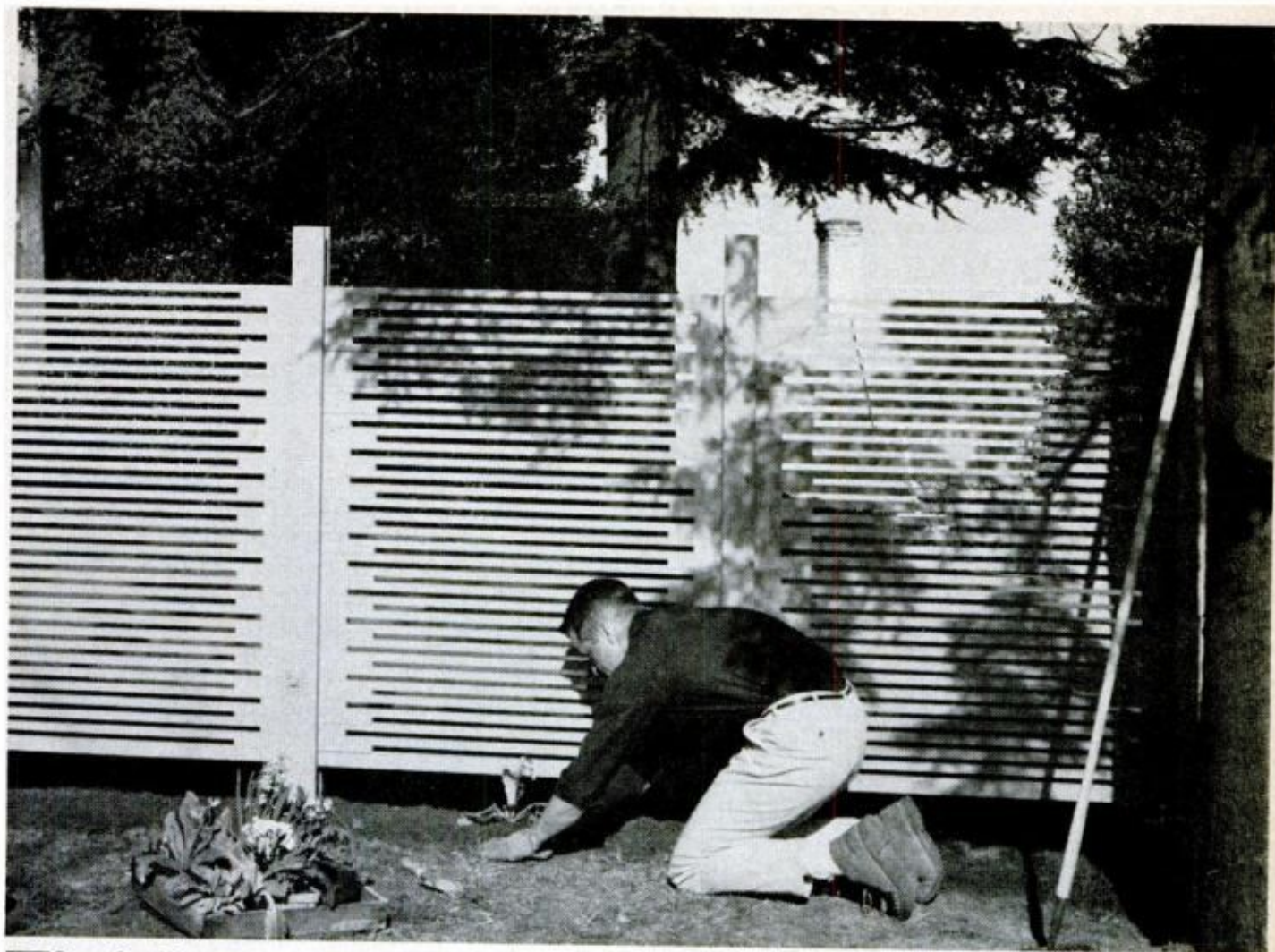
Low-Altitude Contests

Most real hazards in aerobatics are found in any other rough sport: carelessness, inexperience, overestimating one's own ability. One other factor, however, is unique and disconcerting; the earth is deceptive and it is occasionally bewitchingly difficult to judge one's altitude from the terrain's appearance. Flat, colorless or monotone country can fool a veteran pilot into believing he is hundreds of feet above his actual altitude, necessitating hasty recovery from some maneuvers. Limits set for international contests are usually about 3500 and 300 feet. Violation of either means a loss in points; going below an altitude of 150 feet means disqualification.

In air shows, an aerobat scores with his audience by courting the ground. In competitive aerobatics, pilots are constantly fighting a clock and must perform long series of figures without pause or climbing for additional altitude. No hedging or cheating is possible; precision is the goal rather than applause. As audiences gain an understanding of the rules, they invariably find the show routines to be dull in comparison.

Despite handicaps, U.S. sports pilots now show intense interest in competition. Top pilots are sought out for tips and instruction. Shows and contests are improving in caliber and attendance; fly-ins by state and national organizations bring thousands of pilots together. The National Aeronautics Assn., Experimental Aircraft Assn. and others have sponsored demonstrations. A National Aerobatics Assn. has even been organized. Some contestants at the National Championship Air Races have flown across the country to compete in aircraft they knew were hopelessly out-classed, yet the aerobatic experience gained there was worth it. Such meets as this, scheduled again this year, will fill the recent gap in competition for U.S. pilots.

This will be necessary—in 1966 the world competition will be held in Russia, and the contest is bound to be vigorous. With our slow start it may take longer than this to form a championship team. But who knows? The efforts of a dedicated few are paying off now as their point is made clear to public and pilot alike: Aerobatics is not only an excellent show, but a better sport. ★★



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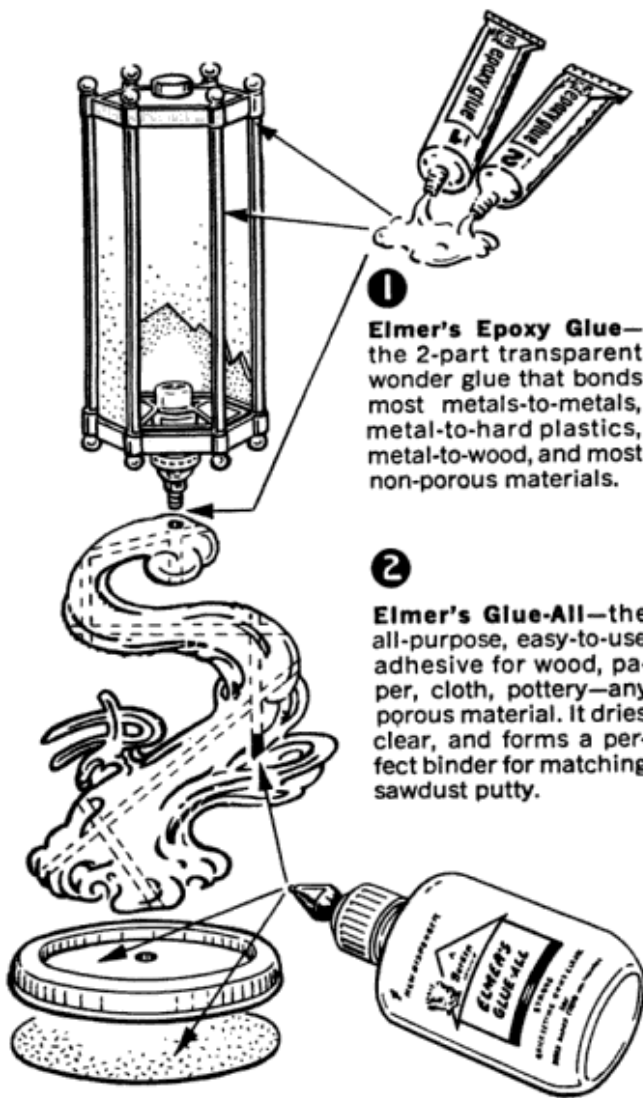
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Here's a job that requires two kinds of glue. Making this attractive driftwood lamp is quick and easy when you use *both* Elmer's Epoxy Glue and Elmer's Glue-All. To make the shade (metal-to-metal, metal-to-plastic and metal-to-wood), take a few square feet of hard plastic, six shortened curtain rods, a bit of channel brass, and use Elmer's Epoxy Glue. For the base assembly (wood-to-wood and wood-to-felt), use Elmer's Glue-All. Then plug the holes for the lamp cord with a putty made of sawdust and Elmer's Glue-All. That's all! For additional crafts tips, send for FREE copies of "Elmer's Wood-Gluing Handbook" and "Working With Elmer's Epoxy". Write: The Borden Chemical Co., 350 Madison Avenue, N.Y., N.Y. 10017. (Available in Canada).



Elbow Engine

(Continued from page 167)

in the drawing, to provide a press fit in the flywheel web.

The piston elbows are made from 1/4-in. drill rod. This material is recommended because of its accurately ground finish and predictable diameter. Three pieces are cut to length, faced and necked down in the center to form the elbow of the 90-deg. bend. Keep that section cherry red while bending, and hold the sleeve you've slipped over the unclamped end firmly against the face of the jig to prevent misalignment by twisting.

There are several ways to make a flywheel, but the two-piece construction shown is probably easiest. The rim is 3 1/2-in. steel pipe, with its i.d. reduced enough to form a press-fit shoulder for the aluminum web. The inside bore of the web, on the other hand, provides a press fit for the o.d. of the cylinder barrel. Once this three-part assembly is complete, test it for squareness. If it wobbles, lightly tap the web and rim until the unit runs true.

Make the base from 3/8-in. plate. Besides the tapped holes for attaching the port block and flywheel support, the base contains drilled passages for intake and exhaust of both cylinder barrels. These passages are identical 1/8-in. holes which run straight in from the back edge. Four short vertical holes intersect them, and mate with passages in the port block and flywheel support. Use thin paper gaskets under these parts to avoid leakage.

When assembling the engine, switch the pistons and bores in various combinations to find the best free-running arrangement. The engine should turn smoothly, with very little drag, once the pivot screws are tightened. End play of the barrels should be reduced until they just turn freely; this play can be adjusted either by shimming under the screw heads, or by machining the screw shoulders. Don't be discouraged if a little tuning is needed to make the parts move freely. The action of the mechanism is inherently very smooth, so it's worth some extra time to take full advantage of this characteristic.

Either of the two ports may be used as the intake. Press lengths of 3/16-in. o.d. tubing into the counterbored ports, for attaching the pressure line of your choice. The right load for your engine must be determined by experiment. The model shown runs best when compressed air is regulated to between 20 and 40 p.s.i., and the pistons are kept lubricated with SAE No. 10 motor oil. This, of course, kicks up an oil spray, so do your engine-tending in your shop and in old clothes. ★★



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What's more, you'll like the way an M-50 takes to the road. How it cruises at a comfortable 40 mph. And

puts nearly 300 miles between filling stations. In addition, low-cost insurance is readily available. Stop in soon, check out an M-50 at your nearby Harley-Davidson dealer. Run it through its paces. Take a friend along. Discover exciting new worlds of adventure — together.

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plus low delivery charge

HARLEY-DAVIDSON

Supermarket in the Woods

(Continued from page 110)

be snapped off, the outside leaves peeled away, leaving a tender white stalk from six inches to a foot long that can be sliced into a salad, sautéed with meat or boiled like green beans. But they are best when boiled lightly and then creamed like asparagus.

The common picture of the cattail is that of the brown, fuzzy bloom at the top of the stalk. In early summer, when the plant is still green there is a pencil-like spike about six inches long above the bloom. These can be snapped off, boiled and nibbled like corn-on-the-cob. Served hot with butter and salt they're delicious.

A little later in the summer a bright yellow pollen appears on these bloom spikes in amazing quantities. It is as fine as cake flour. You gather it by simply bending the head over a container and rubbing it off, each plant yielding about a tablespoonful. Mixed with regular flour, the pollen adds a unique taste and golden color to muffins, and when made into a batter with egg, milk, salt and a little sugar, it makes beautiful golden flapjacks.

The ropelike root stems that criss-cross just under the surface of every cattail marsh have a snow-white core that can be made into flour. Peel the root and crush the white core in the hands, then wash it in cold water to separate the starchy flour from the fibers. Let the water stand a few minutes and the flour will settle to the bottom. Carefully pour off the water and the wet flour can immediately be made into muffins, biscuits or pancakes that are comparable in taste to those made with wheat flour.

On the outer end of each submerged cattail root is a fat little sprout that will be next year's plant. Cut these off, wash and peel them. You can fry them or boil them, but with a little butter added they're a delectable vegetable.

Substitute for Spinach

Milkweed grows in old fields and along roadsides. If you break the stalk it will ooze a milky substance, so it is easy to identify. The very young sprouts can be prepared like asparagus and the leafy tops make an excellent substitute spinach. During the month of May the clusters of green buds can be boiled and served with butter for a broccoli-like vegetable. The young seed pods, gathered in July and August, when they are still firm and tender, can be cooked like okra.

All milkweed products, sprouts, buds, leaves or pods, have a bitter taste in the raw state, and to make them palatable

they must be cooked in three waters. Cover them with boiling water, bring the water to a brisk boil for a few minutes, then remove from the heat and drain. Repeat this three times, then they'll be ready to cook until tender.

Poke is one of the best known of the wild vegetables. It was transported to Europe by explorers who learned of it from the American Indian, and in the South you will often find it being sold in the markets. A rank-growing herb that reaches a height of six to eight feet, it has a thick, green stalk and leaves shaped like the head of a lance. It grows from Maine to Florida and west to the Great Plains.

The time for eating poke is in the spring when the young, tender sprouts are pushing through the soil. Pick them when they're small. Wash and trim, leaving the unrolled clustered leaves at the top. Boil for ten minutes in plenty of water, then throw this water away. Then cook them with just a little water, salt and a lot of butter, margarine or bacon drippings. Simmer slowly for a half hour and serve.

We already mentioned dandelion greens, but the tiny white flower buds found in the very heart of the young plant are many times better than the leaves. They're tedious to gather, but worth it. When boiled just a few minutes in salted water and served with butter they make an epicurean dish.

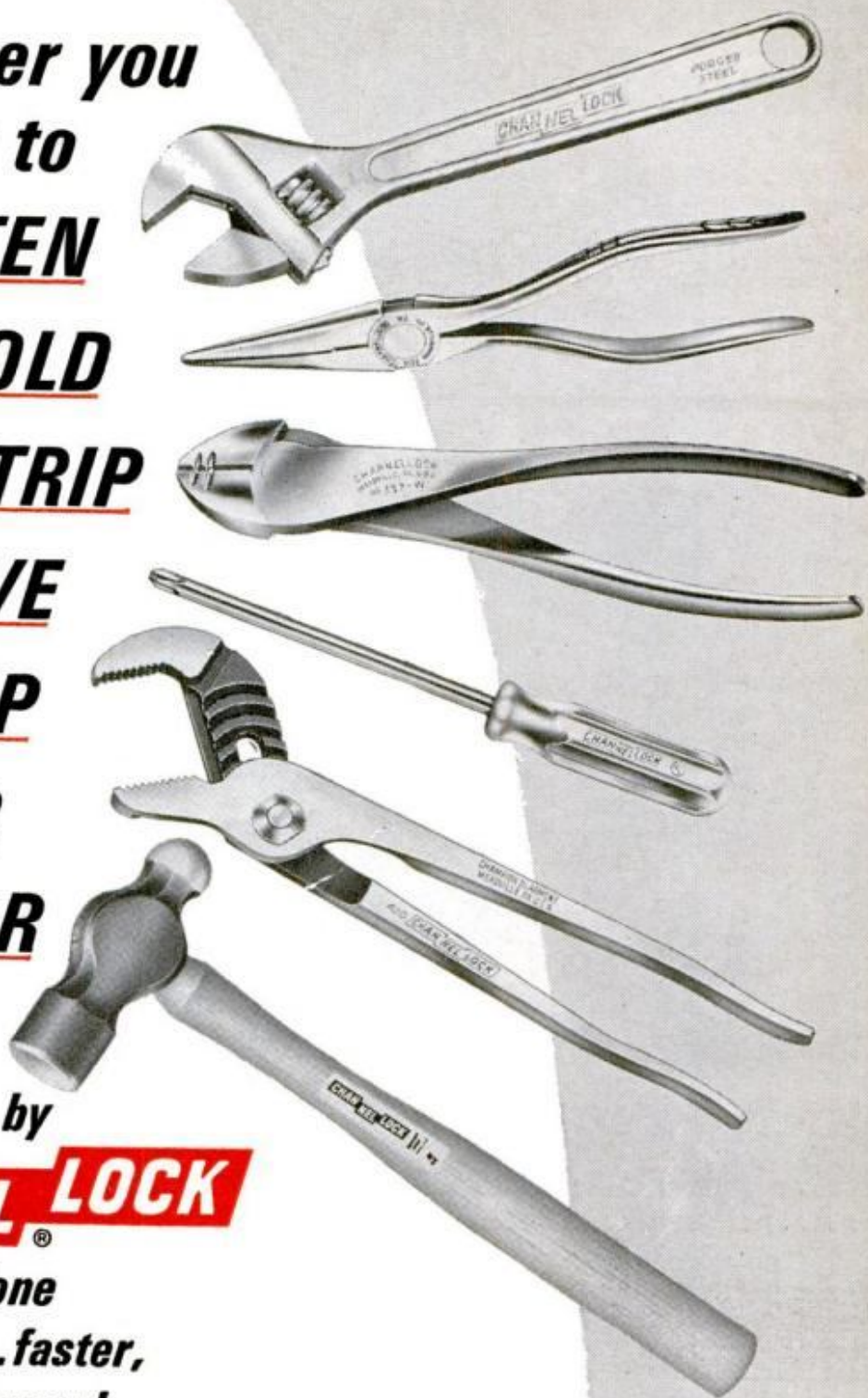
Frog's legs cost a small fortune in a restaurant, but they're free and plentiful for the forager. Hunt them at night with a flashlight and a sharp stick. When the hind legs are removed, just slit the skin with a razor blade and peel it away. Dip them in an egg batter, fry them to a golden brown, and they taste like very delicate chicken.

From the middle of March to the middle of June is the best time for crayfish or crawdads. Watch the bottom of wide, shallow streams and you'll see them moving about. You can net them, spear them or get them with your hands. You only eat the tails and they are prepared just like shrimp.

Freshwater mussels are found everywhere. Cut the mussel loose from the shell and chop it up for a chowder, or just dip the whole thing in a batter and fry it. This is good eating, but if there is any danger of the stream being polluted make sure they are well-cooked.

Every acre of the outdoors is like a heavily laden buffet. When I see acorns, for instance, my mouth waters for acorn grits and acorn muffins. A wild persimmon tree is filling for a chiffon pie. I could go on and on. But you try it. Soon as the tent is pitched start the kids foraging. It's fun and delicious. ★★★

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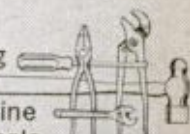
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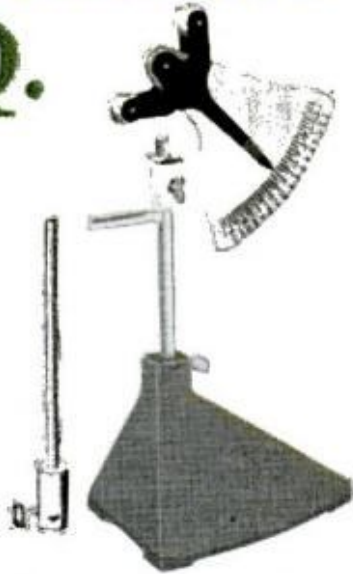
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Short Course in Long Ladders

(Continued from page 186)

dangerous. But is lightness that important? After all, a woman used to handling, say, an 18-pound turkey could easily manage a ladder of the same weight. Yet a good aluminum or magnesium stepladder weighs in at about 12 pounds. (Actually, the best ladder for a woman is a 24 or 27-inch step stool.)

A metal stepladder's rear rails may be angle or channel (preferably channel), provided they are hefty enough. Some ladders have criss-crossed bracing on the back. Others have rugged cross rails that you could stand on in a pinch. The best models have both.

When sizing up a stepladder, open it up and pull down on the pail shelf. The A.S.A. says this should be sturdy enough for a 50-pound load. Also, check for good locking devices to hold the ladder spread out for stability, and for wide steps (at least 3 inches), preferably with grooves or rubber treads.

Look at the profile of the ladder. Unless it was specifically made for close-in work, it should splay about 5½ inches for each foot of height. Add to this the front-to-back width of the top, and you see that a 6-foot ladder should spread to about 36 inches at the floor. The amount of splay is proportionally greater for very short ladders, to assure stability.

Now take a head-on look. The ladder should be at least a foot wide at the top, and each side should spread at the rate of an inch per foot. Thus, a 6-footer will spread to around 24 inches at the base. Again, the degree of splay is greater for short ladders.

Special-Purpose Styles

Finally, a word about a few special-purpose stepladders. At least one—the platform type—is often more comfortable than the standard variety. It has a platform near the top for you to stand on. Such ladders are classified by height. A "No. 8," for example, will be around 8 feet high, with the platform about 6 feet from the ground when in use.

The double-front, or trestle, ladder has two fronts instead of a front and back, permitting two people to stand on it simultaneously. Such models are usually strong and stable, and prove handy for such jobs as applying gypsumboard to a ceiling.

Then there's the shelf ladder, which is a stepladder without a back. In use, it is placed against the wall like an extension ladder. Both the shelf and double-front types are usually made only in commercial grades. ★★★

f.p.s.

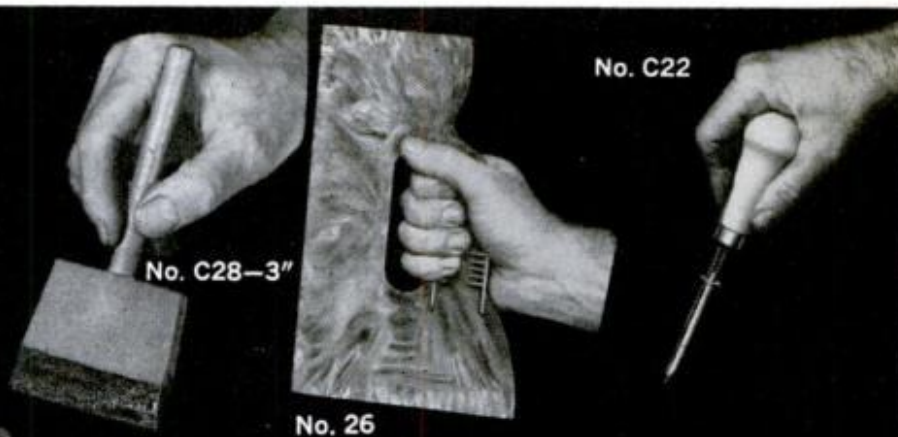
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HYDE TOOLS

Step Right Up, Folks

(Continued from page 105)

odd-numbered holes. Whether the flattie presses the button or not depends, of course, on what number you play.

"Either way, you can only win if the operator wants you to," Witsman explains. "And believe me, if you do win you can be sure he's just building you up for a big loss later on."

Traps in Games of 'Skill'

Even carnival goers who do not suspect a gaff sometimes pass by these gadgets because they seem to be strictly games of chance. But the same people often fall victim to the games of "skill," mistakenly believing that only a good aim and a steady hand are needed to win at these set-ups.

Residents of San Antonio, Tex.; Sydney, Australia, and other cities were lured by a miniature version of the familiar ring-the-gong-with-the-sledgehammer device that appeals to the muscle men among us. On this model, you send the "rabbit" flying up by slamming your fist down on a padded springboard at the base of the 22-inch tower.

On the scampering rabbit's back side, buried in the innards of the striker so you can't see them, are protruding metal ratchets which snag on catches along the sides of the track, causing the rabbit to stop at one of the numbers painted on the front of the machine. You usually bet on whether it will catch and stop at a number more than or less than 17.

You may assume that the strength with which you strike the board makes a difference. Actually, the control lies with a little wooden knob which the carnival gypster must turn to release the rabbit. Unknown to you, turning the knob causes the hidden ratchets to extend or retract in certain given combinations, so that they miss some catches. Thus the position to which the operator surreptitiously twists the knob determines whether the rabbit halts at a low number, a high one, or runs fairly.

Tricky Bowling Game

Among the other "skill" items the raiders seized at the game factory was a bowling alley device which requires the player to topple three cone-shaped pins with a hardwood ball. Narrow leather thongs run from the bottom of the pins to rods beneath the boxlike alley so that the fallen cones can be pulled upright again by the operator, who simply moves a lever on the side.

The pins are set in a two-one triangular

pattern, and the operator has no trouble knocking them down when he demonstrates the game. Yet you'll find it impossible.

As the flattie raises the lever to pull up the pins, according to the sheriff's men, he tugs it outward slightly. This causes the ropes on the right front pin to shift infinitesimally toward the edge of the alley. And this, in turn, causes the two front pins to rise upright slightly farther apart than they were before. You won't notice the difference.

If you roll the ball squarely toward the center, as the flattie showed you, it will squeeze between the front pins and hit only the rear one. If you play from the side, the most you can topple is two—and that loses.

Also depending on lever action is a popular item that the raided manufacturer shipped to carnivals in San Diego, Calif., St. Louis and other towns. The idea of this game is to knock stuffed canvas cats off a rack with baseballs. Usually you'll send one or two to the ground, and that's as far as you can get.

To keep you from winning, the operator simply pulls a lever concealed in a two-by-four near the front of his stand. You're too far away to see, but this swings up a narrow, hinged board level with the rear of the shelf where the cats sit. The extension keeps them from falling off backwards even if you do succeed in knocking them down. And it's off the shelf or no count.

Cheating with Weighted Balls

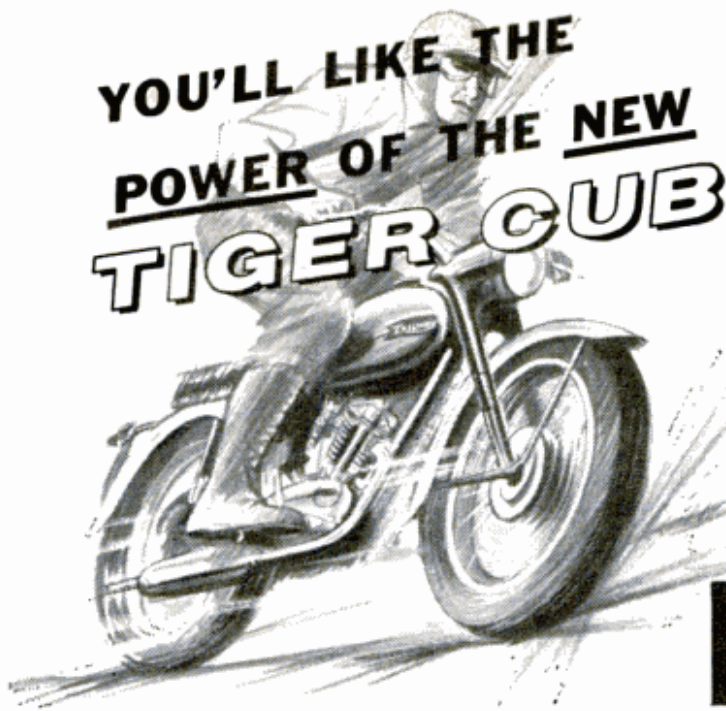
A game that has emptied pockets in Louisville and Honolulu consists of two pool balls, a cue and a 20 by 52-inch felt-covered table with a canvas pocket at one end. The operator places one of the balls in a circle painted on the table and piles three coins on top of it. Your job is to drive the cue ball so that it hits this ball and throws the coins out of the ring. It's not as easy as it seems.

What you don't know is that the two balls are of different weights. If the coins are stacked on the heavy ball, it's impossible for the lighter one to hit it with enough force to knock the coins clear of the circle. The operator switches the balls at will as he retrieves them from the pocket.

Pockets are often essential to a cheat. Take the bucket game, a popular item at many fairs. It consists of a small six-sided bucket, tilted and bolted to an easel. You win a prize if you can pitch three baseballs so they strike the nearly vertical bucket bottom, then drop down through a hole in

(Please turn to page 190)

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Step Right Up, Folks

(Continued from page 188)

the bucket's underside into a leather pouch instead of bouncing out on the ground.

"Like playing the cats, you may be successful on the first two throws," Witsman says. "But after that, the balls spring out like they were rubber."

The secret? A circular block of wood is nailed to a frame in back of the bucket and covered with canvas so you can't see it. As the first two balls come to rest in the pocket, they press against the lower portion of the pivoted frame. Its top then moves slightly forward, bringing the floating block flush against the bottom of the bucket. When you toss the next ball, the added resilience sends it flying out. Automatically, you lose.

Simple Tricks Fool, Too

For many games, the gaffs are not so complex. Often, in fact, they are so simple it seems that only human trust keeps the marks from detecting them.

When you toss hoops at beveled wooden blocks in an effort to win a costly watch, for example, you are wasting your time and money. Often the blocks are cut so

they can be looped only from the rear—an unlikely happening even if you knew the secret.

The aluminum milk bottle you try to knock off a stand with baseballs may be weighted with lead. If you toss hoops to loop-numbered clothespins, the operator may skillfully cover up part of a number with his thumb when he shows it to you, should you happen to snare a real winner. You can lose even as you win.

If you favor games that involve counting up points, the flattie may give you a fast—and inaccurate—count. You may think you're pretty handy with a hammer until you try to drive three nails into a soft pine block with one stroke each. One or two of the nails are certain to curl, either because they're made of a special soft alloy or because the operator has bent the points minutely before letting you take over, according to Witsman.

"The list of carnival gyps could go on forever," he told me as we pawed through the confiscated material. "But the point is the same: The only way to keep from being taken by this stuff is not to play it."

"When you visit a carny, stick with the rides, the shooting galleries and the side shows and you're a lot less likely to come home broke." ★★★

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Detroit's '66 Surprises

(Continued from page 75)

have no trouble adapting to fine-handling fwd cars such as Citroen, Austin, Morris, Saab and DKW. The old fwd Cord, on the other hand, was called a killer.

The changeable handling characteristics of fwd prompted Olds to offer their car only with automatic transmission. With practically no engine braking (in Drive it's almost like freewheeling), the transition from understeer to oversteer is less severe.

Another drawback of fwd is that the engine must be yanked out to get at many mechanical components. This is why fwd isn't practical for smaller U.S. cars; compact-car owners aren't willing to pay so much more for repairs.

Big Cars Get Facelifts

The rest of the full-sized Olds line will get modest styling changes. The Starfire may be abandoned, with the name transferred to the current Jetstar I. Incidentally, some GM luxury cars, including the Olds fwd, won't have vent windows. Most will be airconditioned, so extra ventilation isn't needed—especially since vents are a source of wind noise and water leaks. And GM will use a system similar to Ford's flow-through ventilation, with an air intake on the cowl and extractor ducts behind the rear window. While you won't be able to flick your cigaret ashes out the vent any more, the ventless windows will thwart car thieves. Window vents are on the way out.

Chevrolet will have new front and rear sheet metal, but will keep its present roof line. There'll be more models, including a Caprice two-door and wagon.

The 230-inch Six should sprout 33 extra cubes and about 25 more horses, while the 283 V8 will be phased out. Chevy's new 396-inch engine, which puts out up to 425 hp, will be hogged out to 427 inches, and horsepower should reach 450. By '67, the same engine may be displacing 440 inches.

The two-speed Powerglide automatic transmission will give way to a new, conventional three-speed.

Big Pontiacs, whose current coke-bottle shape resembles a floating fat man with an inner tube around his middle, will look more trim and svelte in '66. Their facelift will include new grilles, taillights and front and rear sheet metal. They—and probably other cars—will use chrome-plated plastic grille inserts, made possible by a new chrome-plating process, vacuum deposition.

Cadillac will continue basically unchanged, but will squeeze more power out

of their 429-cu.-in. V8. A V12 is in the works, possibly for '67.

In coming years, there'll be more differences in engines among GM divisions. There's lots of body and running-gear interchangeability, so each division is getting more freedom in the engine area.

More Whoa Power

Disc brakes, an important safety feature, will be standard on GM high-performance cars and optional on other corporation models. They'll be made by GM's Delco-Moraine Division.

The big Ford will keep its squared-off shape. Grille bars will change from horizontal to vertical and will carry Ford lettering. The roof line will resemble that of the current Pontiac Grand Prix, and the rear window will be recessed. Taillights will remain the same. So will the popular dogleg dash, recessed in front of the passenger for extra room.

Ford also is scheduled for a new automatic transmission. Cruise-O-Matic will die, leaving FoMoCo with two basic automatic boxes for its various car lines.

Merc won't change much, since its big changes came in '65. Lincoln, however, will have new, sleeker sheet metal with a kickup around the halfway point on the body. There'll be a four-door pillarless hardtop. The Thunderbird is due for a new grille and roof, and full-width taillights; but, despite rumors, there'll be no four-door model for '66. The 'Bird will be completely redone in '67.

Lincoln and Mercury will offer pop-out windshields—a safety feature in the event of a collision—and Mercury will have optional disc brakes.

An intriguing feature for '66 Mercury and Comet station wagons is a tailgate with hinges at the side as well as the bottom. Turn the handle one way and the gate drops down. Turn it the other way and the gate swings to one side for easy entry.

Lincoln is developing floor pedals that are almost flush with the floor. These have appeared in several idea cars, but may not reach production until '67.

Some standard Lincoln equipment will be optional next year. Reason: Lincoln, loaded with more goodies than Cadillac, costs \$600 to \$1000 more. Bad sales psychology, you know.

Lincoln will make engine news by stretching its 430 block to 462 inches. Mercury will raise the 390 Ford block to 410 inches, with a 428-inch option.

Bigger engines allow numerically lower axle ratios. Around 2.5:1 will be common throughout the industry; advantages in-

(Please turn to page 194)

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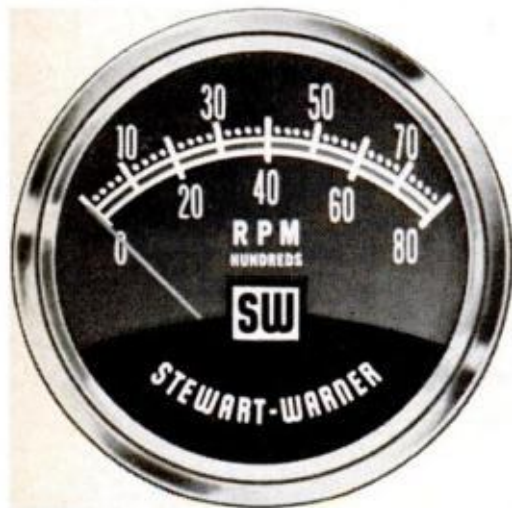


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Detroit's '66 Surprises

(Continued from page 192)

clude lower revs, less engine noise, better economy and—with the increased power—about the same acceleration.

Hemi, Anyone?

Plymouth and Dodge are readying street versions of their hemispherical-head racing V8s, detuned with lower compression, hydraulic lifters and water-heated intake manifold. Price of the 426-inchers will be high, but there's a demand for super-engines.

Full-sized Plymouths and Dodges will be facelifted. Plymouth will sport new rear quarter panels, vertical quad headlights, horizontal grille and extra-long horizontal taillights. The big Dodge will also have new rear quarter panels, a grille that's enlarged around the headlights, and (at least on the Monaco) a full-width taillight. Plymouth will offer tilt and telescope steering.

The Chryslers will get a modest facelift. The 300 will feature a pointed nose and a Buick-like sculptured rear.

There's been talk of Imperial switching to unitized construction. 'Tain't so—not until '67. By '68 or '69, all Chrysler Corp. cars will be back on frames. Next year's Imperial will share more parts with Chrysler, and its 413-inch engine will expand to 440 cubes.

A new Jeep-like four-wheel-drive vehicle, the Bronco, will be introduced by Ford in September. It's a civilian version of the Mutt, which Ford has been supplying to the military for \$2461 per unit. Without military accessories, the civilian model *could* be produced even cheaper.

Extra Extras Coming

The average car buyer now spends about \$500 on options, and he should spend even more next year. Ford will offer a four-speaker stereo tape recorder and possibly a small, detachable rear-mounted TV set.

Most makers still shy away from shoulder harnesses (it's hard enough to convince people to wear lap belts, they say). But Chrysler may offer them next year.

There'll be changes in tires. Radial plies may be on Olds' fwd and some Fords, though everyone is interested. Cords run at right angles, like a zebra's stripes; conventional cords run at about 36 degrees from the tire center line. Radial plies with inextensible (sometimes steel-cord) bands under the tread give less rolling resistance, better fuel economy and much longer tread wear.

(Please turn to page 196)

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Detroit's '66 Surprises

(Continued from page 194)

Another tire being checked out by car makers is the polyester. It has the advantages of nylon without the big disadvantage—flat-spotting (the bumpy ride you get in the morning until the tire becomes round again). Chrysler bypassed the polyester temporarily for another new development—Du Pont's N-44G nylon. It flat-spots less, and dampens noise frequencies, a problem with some tire sizes.

On the lighter side, service-station attendants will be bugged by more tire models. Tires will be styled for particular cars and supposedly won't be interchangeable. Magenta sidewalls, anyone?

You can expect a crash program to reduce smog from cars. The fix will take the form of a manifold air-injection pump to provide a cleaner exhaust. The engine-driven pump will be made by GM's Saginaw Division and used by GM, Ford and Rambler in cars sold in California.

One thing's certain: A better answer than crankcase ventilation in present anti-smog systems is needed. In fact, Ford recently dropped PCV (Positive Crankcase Ventilation) on all cars except those sold in California, where it is required by law. The problem is lack of maintenance by motorists. When the vent clogs, air flow to the carb is reduced and engine efficiency suffers.

Some other industry-wide trends for '66: Bumpers will be higher, for increased protection. Glass-shielded headlights like those of the Chrysler will multiply. As engine compartments grow more crowded with bigger engines and accessories such as airconditioning, look for more transistorized ignitions. With plugs and points increasingly hard to reach, it will be nice to forget about tuneups for up to 50,000 miles.

For the complete picture of '66, check the October issue of PM. ★ ★ ★

Gold Toughens Steel

Gold films, 50 millionths of an inch thick, have been deposited on steel samples in recent experiments by a University of Florida professor. The ultra-thin gilding provides resistance to hydrogen embrittlement, which cuts steel's strength and promotes cracking, reports Dr. F. N. Rhines.

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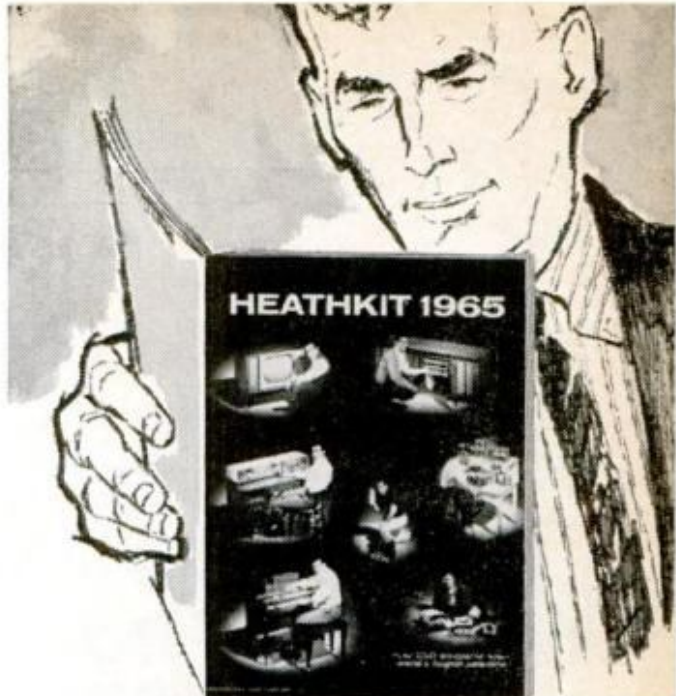
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Half a Mile Down With Scuba

(Continued from page 69)

open system, can last a man for hours. Carbon dioxide is removed from the circulating air chemically in the large center tank. Helium is replaced only as necessary to make up for minor leaks and losses. The current Krasberg machine, no bigger than other professional aqualungs, holds enough gas for a six-hour dive.

Although men would rarely want to work at great depths for six hours, any practical scuba rig must hold enough gas for an extended underwater stay if divers are to avoid another great danger: the "bends."

A diver gets "bent" when he comes up too fast. While he's on the bottom, the gases he breathes are absorbed by his blood. If he pops to the top quickly, pressure is suddenly released. To see what happens, shake a bottle of soda and then open it. Gas dissolved in the liquid under pressure is suddenly freed. It bubbles out furiously. The same thing happens in a diver. Gases bubble out of his blood and other body fluids, causing intense pain and even death.

The solution is slow decompression. Generally, a diver who has been working at several hundred feet for an extended period will ascend slowly. At 10-foot intervals, marked by knots in a rope, he stops for specified lengths of time. The slow ascent gives the gases time to escape gradually, so they will cause no harm to the diver.

After an hour at 400 feet, for example, decompression time is more than 7½ hours. That's a long time to spend crawling up a rope. For most practical purposes, in fact, it's out of the question. The Navy works a maximum of 30 minutes at 380 feet. Even at that, it still takes more than three hours to come up.

Cuts Decompression Time

Decompression, obviously, seriously limits both the depth to which man can go, and the length of time he can stay there. Krasberg's unit provides increased capability through efficient use of its gases. But it also has another feature that shortens decompression time. It's been known for a long time that decompression could be minimized by gas switching; that is, by changing the proportions of the gases used at various levels. The greater the oxygen content of the breathing mixture—below a point, of course, where oxygen poisoning will occur—the less helium the blood will absorb. The result is a shorter decompression time.

Here's how Krasberg puts the principle

to work on a typical dive, say 300 feet with 20 minutes on the bottom. Navy diving tables show that maximum safe oxygen pressure for such a dive is 1.6 atmospheres. So the oxygen regulator is set to maintain that level. As the diver descends, the oxygen regulator begins to function at 35 feet, limiting oxygen to the maximum allowable level. Helium begins to flow into the breathing system. During ascent, the diver stops at 150 feet and turns a valve to dump the helium he has been breathing. Then he switches to compressed air.

The oxygen system senses that the percentage of oxygen in the air is lower than the allowable maximum, and turns on the oxygen. By the time the diver has reached the surface, he's breathing pure oxygen and is rapidly getting rid of the dissolved gases in his system.

The 300-foot, 20-minute dive, using conventional equipment, would require a 2½-hour ascent. With the Krasberg rig, it can be done in 57 minutes. A 90-foot, 2-hour dive would require no decompression at all. A diver could work for two hours in the morning, pop up for lunch, swim down for another two hours of work in the afternoon.

With conventional equipment, the first ascent would take as long as bottom time, a full two hours. The second ascent, because of a cumulative effect, would take even longer.

Aids Exploring From Chambers

Krasberg's system of oxygen regulation is also applicable to deep-water chambers in which men might live beneath the sea for days or weeks. Such chambers eliminate daily decompression. Only one period of decompression should be necessary—at the end of the underwater stint.

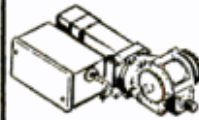
One weakness of the chambers constructed so far is that breathing gases are regulated and supplied from the surface. The umbilical cord from the chamber to the mother ship is vulnerable. Last summer the Navy put in Sealab—a mammoth tank containing all the comforts of home—182 feet under the Atlantic off Bermuda. Four men lived in it for more than a week, swimming out in their scubalungs to work on the bottom each day like so many commuters on the move.

The experiment was a success and it proved that men could live under high pressure for an extended time. But it had to be terminated after 11 days because of an approaching storm. It had been scheduled to last three weeks.

Because Krasberg's system gets good mileage out of its gases, future undersea

(Please turn to page 200)

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Half a Mile Down With Scuba

(Continued from page 198)

chambers could take along enough gas for the entire stay. The Navy's Sealab II, in which a team of Navy divers will live for a month at a depth of 240 feet, will use the Krasberg control to maintain the proper gas mix. That test is scheduled for this August.

1500 Feet Down on a Free Swim?

How deep will man, using the Krasberg scubalung and other advanced equipment, eventually be able to swim freely in the sea? Some experts think that helium might produce its own form of narcosis in the vicinity of 1500 feet. But that's just a guess.

"There may be a gray area down there," says Krasberg, "below which diving won't be practical. It might be 1500 feet—or deeper. For short periods, we might even be able to penetrate such zone."

If it exists, the zone may take some time to find. Testing of the Krasberg scubalung is going on now at a Navy test station. Dives of 300 feet have been made in the test chamber, and the 200-foot mark has been reached in the sea. Further open-sea tests are scheduled for this summer off Key West. But it's slow work. In the interest of safety, Navy divers insist on a series of successful dives at progressively deeper levels before really deep dives are made. It's estimated that it may take a year or more before Navy testers get down below 1000 feet.

But the Krasberg rig and experiments like Sealab II are bringing man within reach of the underseas treasures now tantalizingly just beyond his grasp. If man could work in safety and comfort 1000 feet down on the continental shelves, says Edwin A. Link, inventor of the famous Link aviation trainer and today an expert in underseas exploration, "he would at once possess the key to more than 10 million square miles of sea bed. He could tap the scientific secrets and mineral, animal and vegetable wealth of these immense submerged plains, exploring ancient wrecks, mining diamonds or gold, farming the sea floor, feeding and herding fish like cattle.

"A few years ago, the prospect of working at such depths was pretty dim," says Krasberg. "The textbooks said the absolute limit for human diving was 600 feet. Below that you'd have tissue damage from the tremendous pressure. But then divers went deeper and the limit was supposed to be 800 feet. Now, not many people are making guesses about where the limit might be."

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