

CHEVROLET, FORD OWNERS' REPORTS

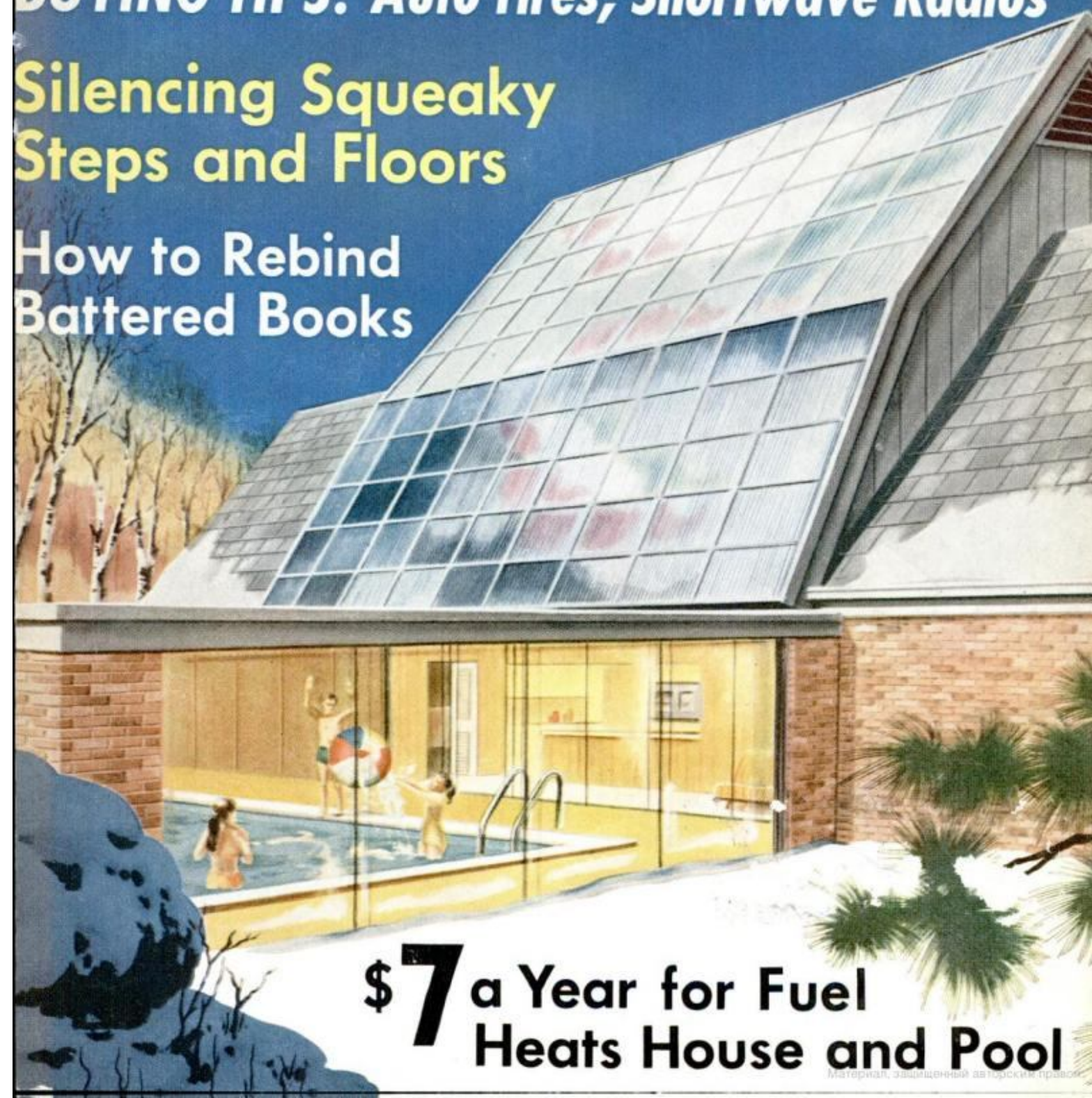
# POPULAR MECHANICS

FEB. 1965  
35 CENTS

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# POPULAR MECHANICS®

FEBRUARY 1965

VOL. 123

NO. 2

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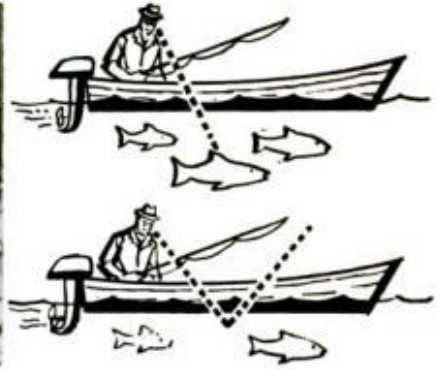
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View without Lunette Glasses



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See photo illustrations above. These were taken with a camera lens. With the human eye, you will see even better! Even with a camera, though, you can see how water reflects glare. Without glasses, you see only the surface. Put these Lunette Radar Glasses on and you see below the surface! Now fishermen can see fish before they bite. Now you can bring your line close to the fish and watch the movement of line and lure . . . now you can see

your line and lure working . . . now you can take your line in faster because you can see fish take your bait. **NOW YOU CAN FISH "SMARTER"—NOW YOU CAN TAKE MORE FISH—EVERY TIME.** With Lunette Radar glasses, you save precious fishing time. You see into holes—even in swift-running streams. You see through brush-piles, weeds—down into lakes, ponds and salt water.

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**COUNTY** ..... **AGE** .....

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(Fill in number of years completed)

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High School ..... years

College ..... years

Other ..... years

### PRESENT EMPLOYMENT:

Kind of position .....

Hours of work ..... A.M. to ..... P.M.

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Estimated spare hours per week available for study .....

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### HIGH SCHOOL

- High School Diploma
- Vocational Course

# Over the Editor's Desk

## It's Not Hot

I think that your T-18 story (*First All-Metal Plane Anyone Can Build*, page 80, December PM) fits the situation very well.

However, I will not be content to let any of my designs be thought of as "hot" in the sense that they might require exceptional skill to fly safely. It is true that Bill Warwick's T-18 does stall abruptly without warning and does fall to the left before it pitches down. Both characteristics are contrary to my philosophy of safe flight behavior.

If the next T-18 to fly shows up with similar behavior, I will make design changes to:

1. Provide aerodynamic buffet prior to stall;
2. Cause a pitch down at stall;
3. Provide no roll at stall; and
4. Make the ailerons always effective beyond stall.

Burbank, Calif.

JOHN W. THORP

My compliments on a well-written article on the T-18.

So many times facts and figures get transposed or distorted from negligence on the part of the writer and builder that most "we fly" information should be accepted with tongue in cheek. It was therefore a great pleasure to read your story without having to blush from false claims.

BILL WARWICK

## Add-On Rifle Barrels

In your interesting article, *That Antique Gun . . . Fortune or Forgery?* (page 138, November PM), you tell of one man who bought a Kentucky long rifle that looked genuine, but when the gun was cleaned, "the collector found that it was really made up of two barrels welded together to make one long one."

One gun authority says that in making a Kentucky long rifle, the barrel was forged by wrapping a strip of hot iron spirally around a rod—then heating and hammering it until it was welded into a tube. He adds that in order to get them off the mandrel, barrels had to be made in two short lengths and welded together afterwards.

So perhaps the long rifle in question is actually genuine after all. I hope so.

I have seen several genuine specimens, one of which is said to have been taken to England by a Tory recruiting officer to

show the English what they would be up against when fighting the "rebels" over here. Recruiting is said to have fallen off quite a bit.

Northport, N.Y.

DABNEY HORTON

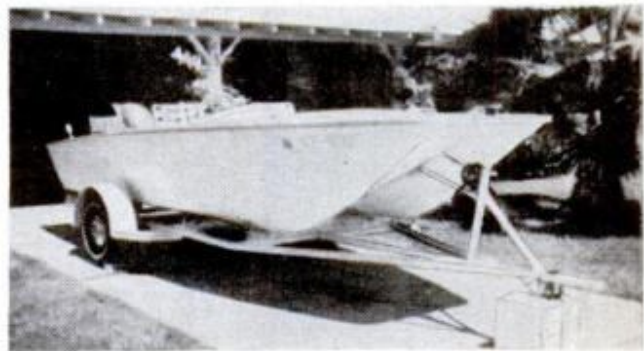
*The rifle was pretty certainly a fake. In commenting on Reader Horton's letter, Mr. T. E. Hall, curator of the Winchester Gun Museum, said, "The Kentucky rifle mentioned in the article did have two different barrels welded together, for the rifling of the two sections did not match. The lugs under the front part of the barrel had been moved to accommodate the cross pins holding it to the original stock."*

*(And it seems to us that those Tory recruiters would've done better to claim that the rebs were using slingshots.)*

## Just What He Wanted

The *Sports Sled* (p. 144, March '64 PM) was just what we had been looking for. Only this type of boat, with its large cockpit area, could fulfill our needs, and I decided almost immediately to build it.

This was my first attempt to build a



boat, and I found it to be an enjoyable and rewarding experience.

I started the frames on April 16, and after a considerable number of delays in ordering hardware and having a welder build a trailer, we launched the completed boat on August 1.

We have received many compliments on this boat and we are very proud of it.

Scottsdale, Ariz.

LESTER DEAN

## They're Not Just Sitting

In the article, *Don't Just Sit There!* (page 84, November PM), your figures show that nurses and college students, each walking 4.7 miles, are second only to mailmen in distance walked per day.

I'm a saleswoman in a department store on Fifth Avenue in New York, and I sell on an entire floor. I wore a pedometer and I found I averaged seven miles a day.

New York City

DONNA FRANCES CLARK

I question the statement: "the average mailman walks 22 miles per day." On an

[\(Please turn to page 10\)](#)

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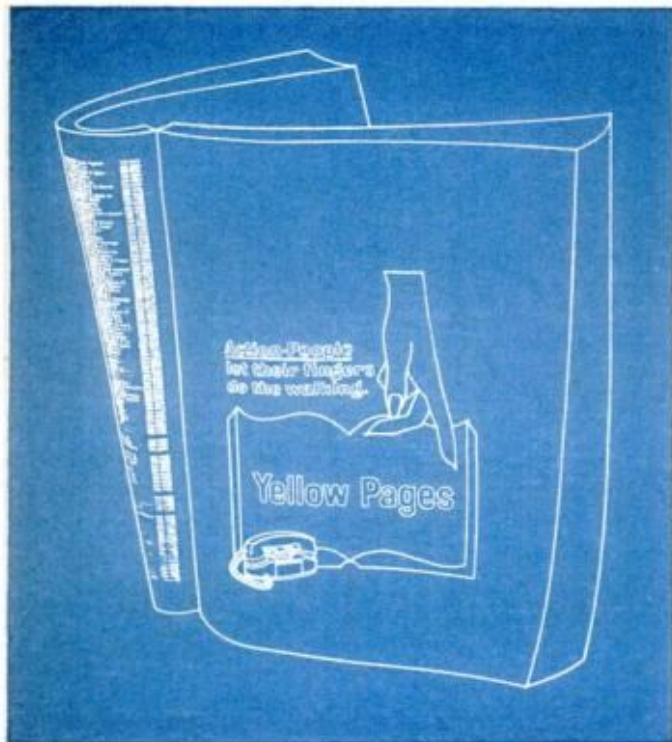


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FEBRUARY 1965

# Blue-print for action



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## Over the Editor's Desk

(Continued from page 8)

average foot route in Seattle, my supervisor estimates we walk 10 to 12 miles delivering mail. We spend a minimum of three hours preparing our mail—leaving at least four hours to deliver it.

As three miles per hour would be a fast pace for distributing mail, the "average postman" in your article must spend his entire day walking on his route.

Seattle, Wash.

LEIGH WHITFORD

Well, the "average postman" in Wilmette, Ill. (where Scholl Manufacturing Co. conducted its tests) seems to spend most of his day walking, the folks at Scholl tell us. But the national average for a residential letter carrier is 12 miles, according to the U.S. Post Office Dept.

## Father and Son's PM-38

My father and I built PM-38 (page 140, August 1962 PM) and found it to be a great performer.

We were able to haul four skiers quite easily with a 40-horsepower engine. The



boat planes quickly and has great turning ability. However, we found the use of a fin quite unnecessary on sharp turns.

I'm sure we have many years of enjoyment ahead with PM-38. Congratulations, on a fine design.

Renton, Wash.

DOUG JAYNE

## Reclining Files?

This is the second issue of PM to carry an article indexed on the backbone of the magazine. We thought this would be a useful reminder for you home craftsmen who like to stack your copies. But do you like to stack them horizontally or vertically? As you can see, we're assuming you pile them up horizontally. You might let us know your preference.

*The Editors*

# BLITZKRIEG! The event that changed all our lives, revealed with a clarity impossible at the time!



Under wily Rommel, the "Desert Fox," the Germans blitzed across a continent.



Nazi Blitzkrieg made Europe a captive fortress. LCVP survivors off Omaha Beach.



At last Allies took their brand of "lightning war" into heartland of Germany.



Meanwhile, across the globe, Japanese launched their own Blitzkrieg at Pearl Harbor.

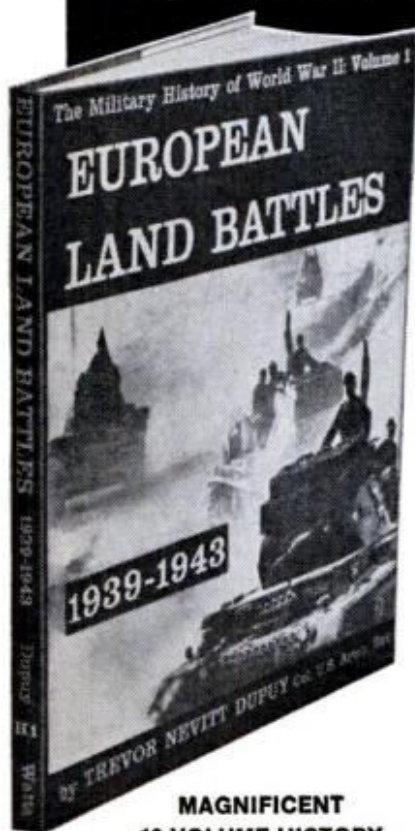
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**Olympics in '68.** Mexico City's 7500-foot elevation probably won't affect the performance of unacclimatized sprinters but is likely to slow down distance men.

That's the opinion of Dr. Bruno Balke, University of Wisconsin researcher, who explains that the heart and lungs function at a maximum level during an endurance-type competition and therefore can't work harder to compensate for the fewer molecules of oxygen available at higher altitudes.

"Slightly subnormal performances," says Dr. Balke, "must be the consequence in events requiring maximum efforts in excess of one to two minutes' duration."

**The ultimate** in gas station attendants soon will be refueling jets at New York's Kennedy Airport. The attendant—a General Electric 412 process control computer—will automate the control of the flow of about a million gallons of aircraft fuel a day.

**Red spots** on the purple flower of a plant called spiderwort can measure radioactivity as accurately as most Geiger counters. Dr. L. W. Mericle of the University of Michigan developed the flower, a hybrid. You need a microscope to count the red spots, but their number reflects the level of radioactivity with an accuracy of 1/5000th roentgen.

**Energy waves** that have traveled 10 billion light-years may soon be picked up by France's new radio telescope, the largest of its type. It has a 1000-foot metal-network "mirror" to concentrate faint radio waves into measurable impulses. (A light-year is approximately equal to six million-million miles.)

**Glass-blowing works,** machine shop, aquariums and four different kinds of laboratories will all be part of a marine biology ship now being built for the Scripps Institution of Oceanography in California. Labs are for the immediate

handling of sea creatures that can't be kept alive until the ship gets back home. And the shop and glass works are to support the labs and to perhaps improvise equipment as needed.

**Listening post.** U.S. scientists recently used a unique observatory—a small steel chamber equipped with hydrophones—to snoop on the Weddell seals living in McMurdo Sound in Antarctica. The chamber was suspended seven feet below the five-foot-thick covering of ice on the sound.

What did the scientists pick up with their hydrophones? "I've never heard such an underwater racket before," reported one of them. Though the Weddells keep mouth and nostrils tightly closed underwater, they are capable of making noises resembling whistles, buzzes, beeps and chirps.

## Gadgetry Doesn't Win Science Fairs

If your son or daughter plans to enter a high-school science fair this spring, it might pay the youngster to consider some words of advice from an expert. A teacher at John Hopkins University and a former science fair finalist himself, he was a judge at last year's National Science Fair at Baltimore. Here's what he told this column:

"It takes scientists to make science, so I consider the student himself the most important part of the project. I want to learn the depth of the student's understanding and whether he is honestly seeking knowledge.

"I don't care if a student has a simple or complex project—it's what he's done with it that counts and what he can tell me about it in our interview.

"You can quickly detect those students who are there simply to win a prize—everything they've done is directed toward that end. What happens is a compulsion to produce results at any cost. As a result, the student will sometimes fake results.

"For instance, at this fair I saw a couple of experiments that were taken from texts. With the equipment exhibited, the student couldn't possibly have obtained the results he showed. Of course, I gave those exhibits no further consideration.

"Students should learn early the spirit of science, the intellectual honesty that science must be based on. That's why I liked one boy. He was candid enough to show results that were way out of line with his experiment. I promised him that I would come back after the judging was over and look at his calculations."

The Johns Hopkins scientist did just

[\(Please turn to page 14\)](#)

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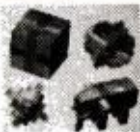


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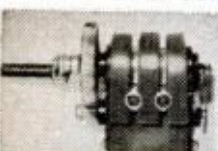
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## Science Worldwide

(Continued from page 12)

that, spending a good hour poring over the lad's notebooks. As it turned out, he couldn't find the mistake either—but both had a rewarding hour of discussion.



The Milky Way has become a yardstick for measuring dim light. This famous feature of the night sky is made up of millions of stars and casts a very steady light. So the Bureau of Standards in Washington has devised a way for scientists all over the earth to check their light-measuring instruments by the Milky Way. This way, they all will know that their instruments are measuring on the same scale and that their results are truly comparable.



Blowing berries off the bushes instead of picking them is a method of crop gathering developed in Great Britain. The new harvesting device works off a tractor. It slides a pair of plastic baskets under the bush—one on each side—and blows. Compressed air from a nozzle plays over the bush, and ripe berries drop into the baskets.



Do supersonic booms make nervous wrecks out of livestock? That's what the British Ministry of Aviation is trying to find out because a number of farmers have made claims against the Government, saying they've suffered economic damage because of noises from the sky.

So, scientists are busy bombarding herds of cows and flocks of chickens with booming noises and counting eggs and measuring milk. Early results show that the booms seem to have a temporary effect on egg and milk production. But soon, like city dwellers, the cows and chickens get used to the racket.



Two scientists—one from Purdue and one from Florida State University—have come up with a computer method of evaluating the water potential of an area and determining where to drill wells.

They provide the computer with thousands of statistics about an area—the water levels of a great number of wells at many different times, and the day to day rainfall—and the computer creates a map showing zones of unusual water accumulation. These zones are the best places to drill.

*John F. Pearson*  
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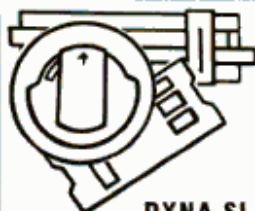


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## Sidelights from the **SERVICES**

By William R. Kreh

A whale killer aided missile research recently. The Army Missile Command is developing a high-acceleration experimental booster rocket. During its development, engineers wanted to attach an electrical cable to the rocket during early test firings for reporting data during the first moments of flight.

But first they needed to know what kind of cable would work, how it must be attached and how it would react under extreme acceleration. So the contractor for the project—Boeing Aircraft—borrowed a harpoon gun from the U.S. Fish and Wildlife Service.

Machinists fashioned a blunt-nosed harpoonlike projectile to which cables being tested could be attached. Engineers used the gun for three weeks, testing various types of cables and making high-speed movies of the firings.

The dust cyclone caused by whirring rotor blades as a helicopter hovers over unpaved terrain may be eliminated with a new landing pad being tested by the Marine Corps.

Working much like the tarp used to protect a baseball diamond during rain, the 150-ft.-square pad is nylon fabric laminated on both sides with vinyl. It weighs about 2800 pounds.

The accordion-folded sheet is unfolded from a fork-lift and spread out by a squad of Marines. A road grader rapidly excavates ditches on all sides of the sheet and then back-fills to anchor the pad in place.

A "slush hydrogen" plant is being built at Wright-Patterson Air Force Base, Ohio. Hydrogen forms a snowlike solid at 436 degrees below zero. In this state, it can be stored in less space than it can either as a gas or liquid, is less expensive and can be heated back to liquid form for use in space vehicles when needed.

Astronauts returning from the first long mission in space who faint at their reception when they get back, probably won't do it from the excitement of the moment. The Air Force's School of Aerospace Medicine has been experimenting with volunteers who spent four weeks in bed to simulate the inactivity of space flight. They all tended to faint when they got up.

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"I did the Sorority House in one day for \$360. This business is in its infancy."

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Each of the men quoted here had talents and abilities different from those of all the rest. *But each had one thing in common*—a desire to win personal independence in a business of his own. And each man took five identical steps to reach his goal.

1. Each one read an announcement such as you are reading now. 2. He wrote for complete information. 3. He read the literature we sent him. 4. He gained new confidence in himself and the belief that he could succeed with Duraclean. 5. He accepted our offer to help him get started. Later, he wrote to tell us about his success.

In each case, remember, *the first step was to write to Duraclean for information.* If you would like to own a business of your own, why don't you do as these men did—*right now.*

When I hear from you, I will send you facts about the Duraclean Franchise that will open your eyes. You will see why a Franchise business such as ours makes success for the individual the rule rather than the exception.

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*Grant Mauk*  
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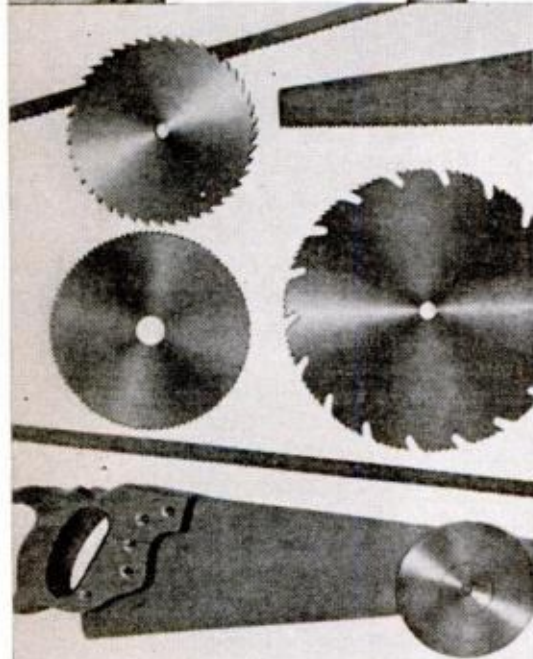
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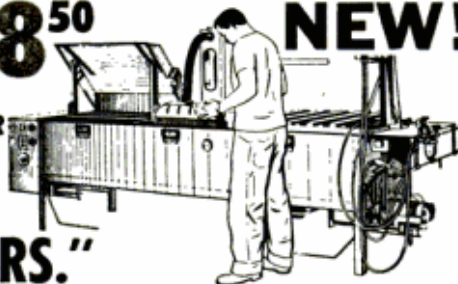
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*Sidelights on*

**AVIATION**

Electronic aids in the cockpit have been introduced so rapidly lately that a story about them (beginning on page 110) had to be revised twice to update it while it was in preparation.

No sooner had the Bendix Corp. announced its device to help pilots "see" the runway through an impenetrable fog, than Trans World Airlines demonstrated another aid that would actually fly the plane down the glide slope automatically without the pilot ever seeing the runway—or touching controls—until the plane was 100 feet above the ground, the point at which the final flare-out is usually begun.

And no sooner had we absorbed this, and revised the story to reflect it, than United Air Lines put on still another demonstration, this time taking the plane, automatically, all the way down.

Like, "Look Ma, no hands!"

The United demonstration, visually, was by far the most jaw-dropping to those who witnessed it. The cabin door was open, and the pilot and co-pilot (it was a twin-jet *Caravelle*, incidentally) just sat there with their hands in their laps, occasionally raising them as if to show us, "See, I'm not touching anything," and that plane flew right on down all by itself, even flaring out and touching down.

We witnessed four such landings during the demonstration, but United says it has made more than 50 using the original Sud-Lear equipment without repair or replacement. The pilot said, understandably, that during his first landing using the system, "I had a firm hold on the release button," but after three or four he got more confidence in it. "Now," he says, "I can tell way out at the beginning of the approach that it's going to be good."

Our story, incidentally, is a well-researched one. Hans Fantel, who wrote it, travelled all the way to Geneva, Switzerland, to see one of the automatic navigation systems in action, and flew through a demonstration of the Bendix landing system. *PM's* aviation editor rode along on the TWA and United demonstrations.

We just hope that nothing new is introduced between the time this is written and the time this issue hits the newsstands—like automatic take-offs.

*Kevin V. Brown*  
Aviation Editor

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NO SALESMAN WILL CALL

## Items from All Outdoors

Fishermen have been writing for information about the Upperman bucktail jig, which Matt Mattfeldt (page 28, June 1964 PM) claimed was the best all-around lure in existence. We just had a letter from Matt and he writes: "Get ready for a jolt as Morrie does not fill orders. He can't make 'em fast enough. It's a good lure—that's why." But he did include the address: Morrie Upperman, 120 S. New York Ave., Atlantic City, N.J. So, interested readers can inquire directly—if you don't mind gettin' jolted.



Water pollution is currently in the news as citizens' groups battle against two major electrical generation projects which allegedly threaten rivers in the East and Midwest. At such a time it is good to see a large industry recognizing the pollution problem and doing something about it. In Houston, Tex., where the Humble Oil & Refining Co. empties its waste water into the Houston Ship Channel, the company has installed a three-stage purification system that returns the water cleaner than when it was removed. The water is aerated and passed through a sequence of three lagoons before it is returned to the channel. This is an expensive project, but more than that, it is a major industry using natural resources in a responsible manner, adding something to that resource instead of just taking away, an attitude more industries should emulate.



We sometimes grumble about buying a fishing license each time we fish in a different state, and feel that one license should be honored in all states in the same manner that a driver's license is honored. But a few items on the high cost of angling from the Sport Fishing Institute make our grumbings sound hollow. In England, on the River Wye, a salmon fishing lease on a 1130-yard stretch of river bank is up for sale at \$5 per foot. And this is only one bank. But, even worse, on Norway's Maals River there is a spot called the Malangsfoss Pool that is about 250 miles above the Arctic Circle and is supposed to be the best salmon pool in the world. To fish this pool costs \$435 a day!

**STUART JAMES**

Outdoors Editor

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F. W. COX, Hollywood, Calif., averaged \$150 a month spare time while training, now has his own full time TV-Radio service business. ALLAN R. TOWNSEND, Topeka, Kan., is a missile officer at Atlas ICBM site, fixes radios and TV sets spare time. R. L. WOOD, Fargo, N. D., got his FCC license and is Master Control Engineer with KXIB-TV. J. J. JENKINS, San Diego, Calif., says his NRI training is priceless. He is Frequency Coordinator for the 11th Naval District.



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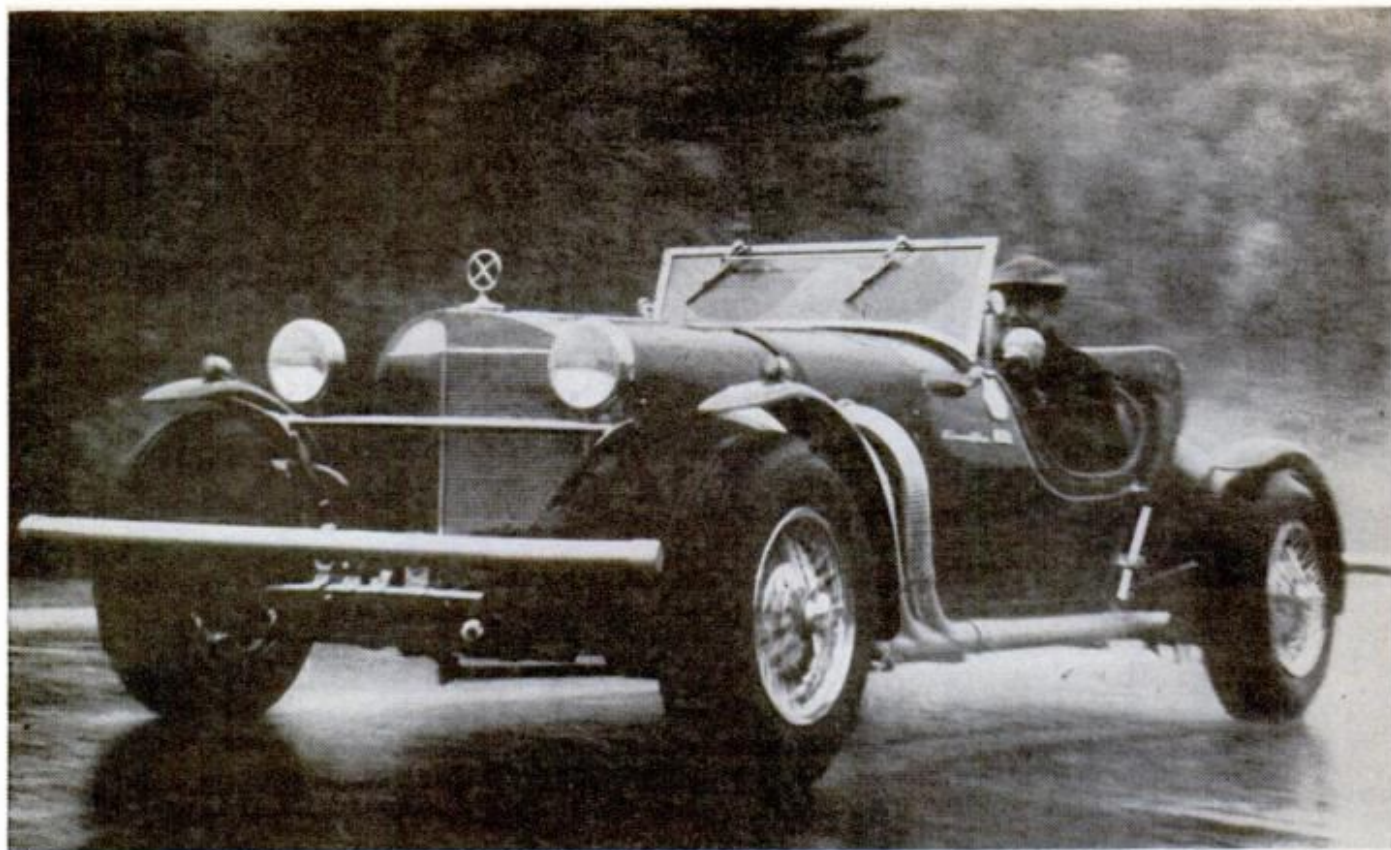
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## Spotlight on the New

*Its look-alike once tickled Dad's fancy. Now this modern bomb hits 60 m.p.h. in under 5 seconds*

By John Fitch

**P**ICTURE A RAINY DAY on the Lime Rock, Conn., race track. Tires hissing. Streams spraying from cycle-fendered wire wheels. The great louvered hood of the Excalibur SS stretching out ahead.

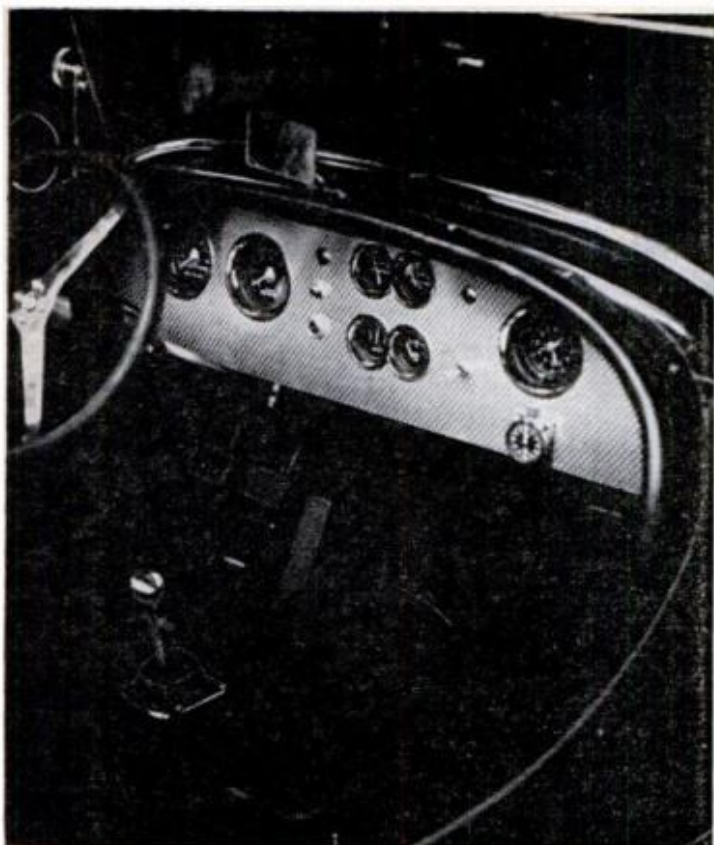
A vintage-car fan, watching from the sidelines, might mistake the big roadster for a 1927 Mercedes SSK—until he got a closer look. Surprise! Hidden by that starkly-styled body is a 327-cu.-in. Corvette V8 and modern Detroit chassis. Even more surprising, you can order one—if you have \$6800 or more to spend.

I put the car through its paces on the twisting road course, and found it's a bomb. Touch the loud pedal in a turn and you immediately set up an oversteering slide, precisely controlled by the amount of throttle used. Acceleration? You can snake the car clear down the half-mile straight,

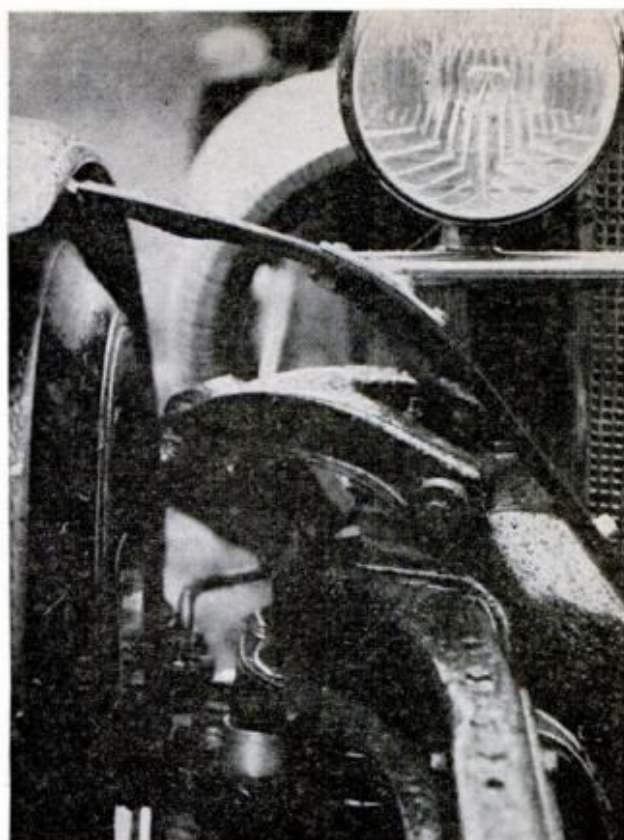
thanks to 300 hp. and a mere 2350-pound all-up weight. This power-weight ratio exceeds that of anything you're likely to meet on the pike, including full-house Corvettes. If you want more, you can get the optional fuel-injected 375-hp. or Paxton-blown 400-hp. Corvette engine. But the 300-hp. cooking version is more tractable, and does 0-60 in under five seconds.

The transmission is a Borg-Warner all-synchro four-speed, one of the best. The chassis is from the most sophisticated Studebaker, the 109-inch-wheelbase Daytona.

The Excalibur SS harks back to older, sterner days when men carried hip flasks and motored in the open, by Jove. It doesn't try to be an everyday, go-to-work car. The room, convenience and comfort of ordinary modern automobiles simply can't be provided within the physical limitations of this type of car. But the certified car nut will happily put up with all sorts of inconveniences—and there are many. For example, there is a rag top, which is not weatherproof. But in a rainstorm, at a time you unfold the metal frame



**ATTRACTIVE** machined dash houses big, round speedo and tachometer, along with an ammeter, clock and gas level, oil-pressure, water-temperature gages



**DAYTONA FRONT END** carries disc brakes—effective on Studebakers and even more so on lightweight Excalibur SS. Individual headlights are chromed

# Excalibur SS

cure the many snaps, you're wetter than if you'd gone on to your destination without delay.

With the top up, it's impossible to climb in with any semblance of dignity. Side curtains must be unsnapped and unzipped, after which you squeeze in over the side of the body (there are no doors). Once in, you're faced with the problem of resecur-ing the side curtains; the zipper and snaps, unfortunately, are on the outside. The top also leaves huge blind spots on either side, making a side-view mirror a must.

The nonadjustable seats offer no lateral support. The small, racing-type steering wheel is mounted close, but with the heavy steering, this is a necessity. Legroom is cramped. Headroom is also less than generous, and with the top frame directly over your head, a seat belt is called for.

The hand brake is a long reach under the right side of the dash, and the shift lever is too close and too far back. And you have to twist your clutch foot to clear the pedal, but one soon gets used to this. The clutch travel is short, stiff travel of the

clutch takes longer to get used to. It en-gages *right now*—fine for fast shifts on the open road, but nervous as a jumping bean in traffic. Gas and brake pedals are spaced for easy heel-and-toeing. Bad weather prevented a really thorough test of the brakes (discs in front, drums rear), but they felt fine.

The 1927 Mercedes SSK, after which the Excalibur was patterned, epitomized perhaps better than any other model those Teutonic fire-breathers that racked up victories from Tripoli to Sweden since be-fore the turn of the century. My good friend, the late Rudi Caracciola, achieved a greater share of those victories than any other driver. To travel with him, even in modern cars on public roads, was to know what demands were put on the SSKs in their day. They won races, and they *had* to be tough.

I've driven an SSK in recent years. Though it was similar to the model that won the Mille Miglia—a 1000-mile race on second-rate Italian roads—its steering was incredibly heavy, the clutch stiff, the

[\(Please turn to page 34\)](#)

## Spotlight on the Excalibur

(Continued from page 33)

gearbox reluctant, the suspension harsh and imprecise. It drove like a truck. The crowning disappointment was the lack of response when the mighty compressors engaged with a banshee wail—and hardly anything happened. It was like a Disney cartoon in which a great cannon is prepared, carefully aimed and fired, whereupon an undersized projectile dribbles from the muzzle and plops fizzling to the ground.

I'm not saying the SSK was a fraud; the record book wouldn't allow it. The only explanation lies in the remarkable engineering advances since the late Twenties.

### Two Plusses and a Minus

The areas in which this new Excalibur outpoints the Mercedes SSK are the smooth transmission and the flexible, light engine. However, the stock Studebaker chassis, used to save on costs, entails certain compromises. Spring rates were designed for a load of 3500 to 4000 pounds, instead of the 2350 pounds of the Excalibur. There's no substantial steel body to stiffen the frame—just a light aluminum shell on the prototype we tested. And the live rear axle and suspension were designed for a different ratio of sprung to unsprung weight. The result is a stiff ride on rough roads, frame flexing, cowl shake and a general feeling of looseness. Washboard bumps in a turn also induce side-hopping chatter in the too-heavy rear axle. Bad as all this sounds, it's far from intolerable for the vintage-car buff, who finds it all very true to type.

Our test car was the first one made, and was loaned to us by Don Allen Chevrolet in New York, an Excalibur distributor. Since this car was built, designer Brooks Stevens and his son, William, have anticipated most of my complaints. Production cars will have stiffer cowling with fiberglass body construction (except for the louvered hood, which will remain aluminum), four inches more legroom, softer spring rates with more wheel travel, and more seat and cockpit padding.

Why buy an Excalibur? A vintage-car collector, with luck, may find a restorable Mercedes SSK for \$6000—and then the expense and trouble begin. Restoration can cost \$5000 to \$10,000 and many anguished months. He then has a machine that's delicate and expensive to maintain. The Excalibur has a modern engine and chassis for which parts and service are readily available. And it goes faster—and much longer.

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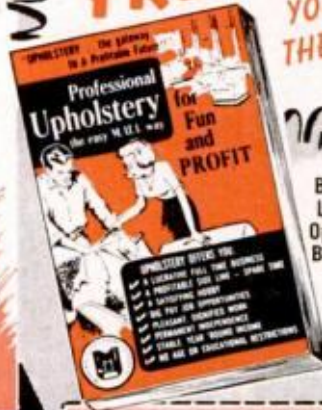
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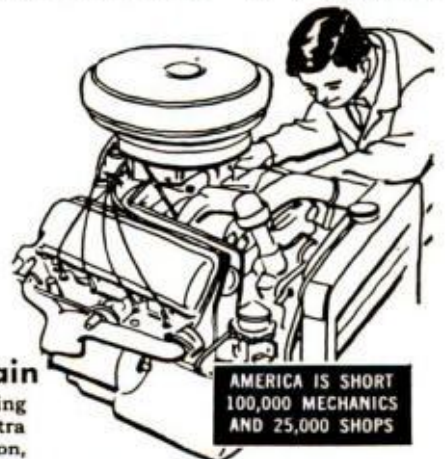
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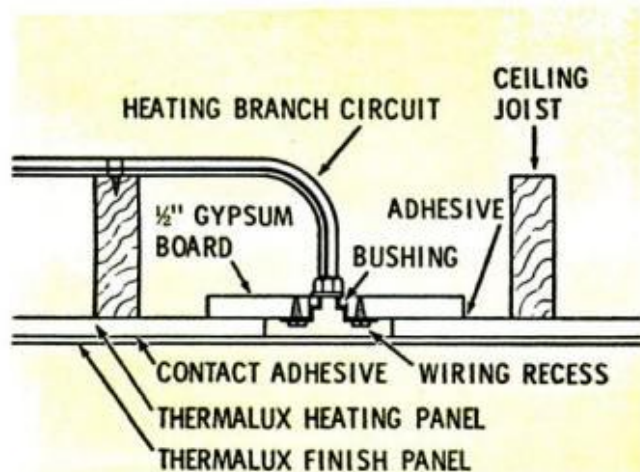
In each panel, the heating element is a thin layer of graphite sandwiched between two layers of asbestos insulation. The 120-volt a.c. or d.c. current is carried to this filament by two copper elec-

trodes embedded near the panel edges. Operating temperature is about 100° F.—cool enough to touch. Heat output is 15 watts, or 50 B.T.U.s per square foot.

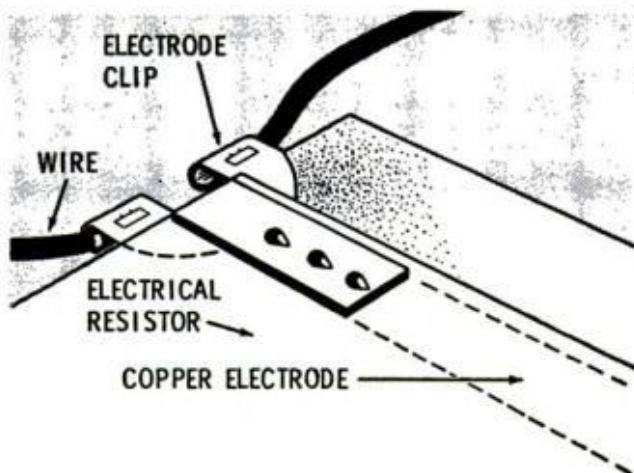
The panels are a half-inch thick, four feet wide and 10 or 12 feet long. They are fastened to the ceiling joists with special nylon-insulated nails, and may be cut to any length with a knife. Special filler panels (page 42), may be cut to any width between 24 and 48 inches.

(Please turn to page 42)

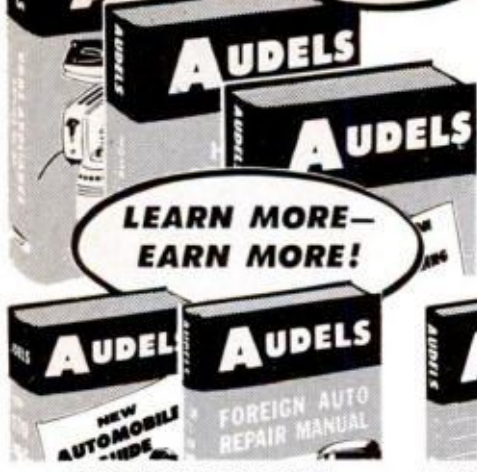
**CONDUIT THAT CARRIES WIRING** to panels terminates in special bushing set in standard wiring recess



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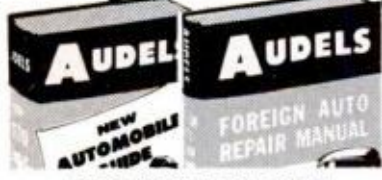
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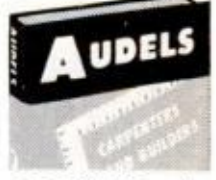
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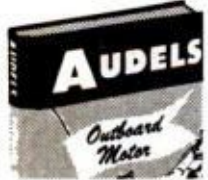
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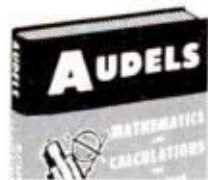
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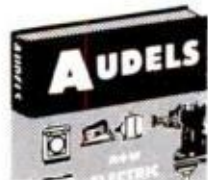
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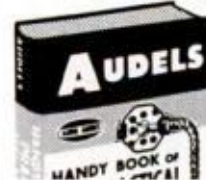
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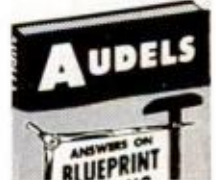
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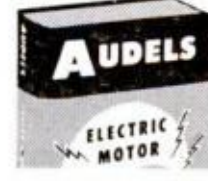
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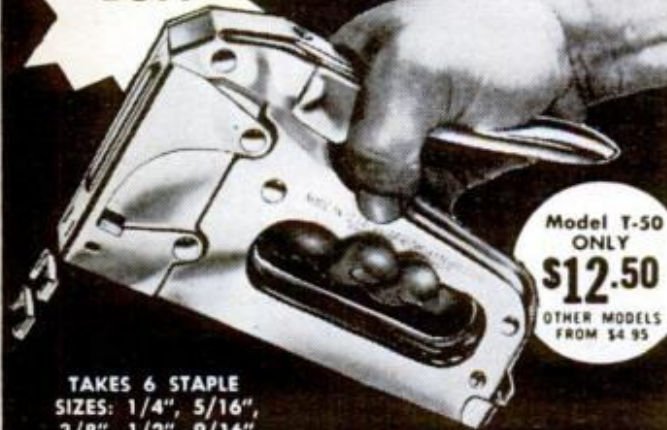
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## Heating with Gypsum Board

(Continued from page 40)



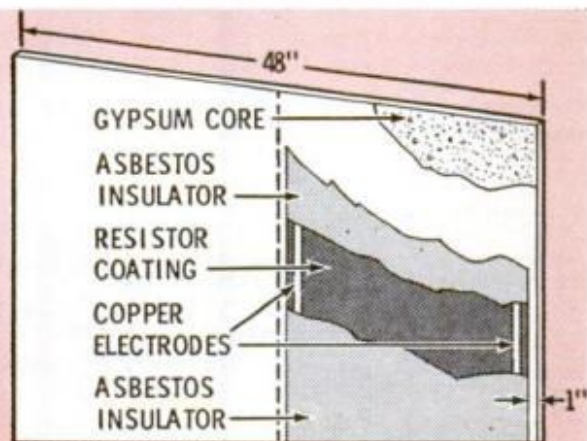
WIRES THAT CONNECT PANELS are stapled to ceiling joists. Space above joists should be well insulated

Once in place, the panels are wired in parallel by means of clips attached to the electrodes. Wires are fastened to these clips with a crimping tool.

After all connections are made, finish panels—quarter-inch gypsum board without filaments—are contact cemented over the heating panels. Joints are taped, and the ceiling can be decorated with any interior paint, but not acoustical tile. The manufacturer says water from a leaking roof won't damage the filament.

The system, called Thermalux, is being test marketed by U.S. Gypsum, 101 South Wacker Drive, Chicago 6, Ill. According to U.S.G., installed cost runs 50 to 80 cents a square foot, is competitive with other heating systems. But Thermalux, like other electrical radiant systems, has no piping, ducts, radiator or furnace.

FILLER PANEL is same as full-width heating panel, but half-size filament allows cutting to odd widths





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Your car runs because gasoline is fed into the cylinders where a spark causes it to fire. This action causes the gas to explode—this explosion pushes down the piston. Now here is the important thing to you. The larger this spark is, the more powerful the explosion. The more powerful the explosion, the more power you get from a given amount of gasoline. Poor explosion means wasted gas—loss of power, poor getaway, bad starting, a sluggish car. Good explosion means more miles per gallon, more horsepower, blazing pickup, instant starting; an exciting car to drive!

## WHAT CONTROLS YOUR ENGINE'S EFFICIENCY

Your spark plugs control the efficiency of that explosion. And not only do they give a small, weak spark to begin with, but they get worse every mile you drive. And that you can see for yourself. Put a new set of spark plugs in your car and then look at them at 100 miles, at 1,000 miles, at 5,000 miles.



Every time you look you will see more filth and carbon and you will see more of the electrode burning away. Why, some of the new high compression engines can burn up a set of plugs in a couple of thousand miles of driving. Now you ask yourself how a weak, inefficient spark from a filthy, burned-out plug can possibly give you the kind of flashing, economical performance you want.

## STOP USING SPARK PLUGS — NOW!

Now read very carefully what we're going to suggest . . . that you stop using spark plugs in your car! That's right—get rid of them—forever. But—if you —get rid of your spark plugs, what will make the engine run?

Well, please remember that if you were told a couple of years ago that your car could run without a carburetor you wouldn't have believed it—yet today you can have gas injection and get far more mileage, efficiency and power from less gas—and in a few years gas injection will have completely replaced the carburetor on most cars. In the same way, now is the time to replace your old-fashioned, temporary, inefficient spark plugs with a modern, efficient, permanent fire injection system, and you can do it yourself in 15 minutes if you've never handled a tool in your life!

## MECHANICS AND ENGINEERS — READ THIS CAREFULLY

Now, this fire injection system is so inexpensive that it can pay for itself in gas savings alone in one month of driving. Forget, for the moment, about the extra pep, power and performance you are going to get. Forget about the savings in spark plug servicing and replacement, the savings in wear and tear on your pistons and cylinders that come from unburned gas washing the protective oil coating off the cylinder walls. Just remember that this fire injection system will pay for itself in gas savings alone in a single month of driving. Here's how:

A spark plug jumps a spark of electricity across an air gap; this is most wasteful, and limits the size of the spark.

A fire injection fires on the surface of an electrical conductor. You get a heavy, powerful flame

that will not blow out at pressures far greater than those created by even the highest compression engine!

On ordinary spark plugs the air gap is always getting bigger, wasting power and gas. Your plug is constantly accumulating filth and carbon because of inefficient ignition.

A fire injection has no air gap and no electrode to burn away. It never needs cleaning or setting; it actually becomes more efficient with use. It will actually outlast your car, delivering maximum efficiency without servicing or replacement. There is no waste gasoline, no loss of power.

## NOW — USE REGULAR GAS!

With ordinary spark plugs you are using, or should be using premium gas, which costs from 4 to 8 cents more than regular gas.

With fire injectors regular gas will give you up to 8 more gas miles per gallon, up to 31 more horsepower, plus easier starting in all weather.

Ordinary spark plugs have to be replaced regularly. In some of the new high compression cars, a set of plugs will burn up in two months.

A fire injector installation is guaranteed for the life of your car, without cleaning, servicing or replacing.

## HERE IS POSITIVE SCIENTIFIC PROOF!

Now, when you get your set of SA FIRE INJECTORS, here is all you do. If you have automatic transmission, make a note of how fast your car crawls forward when it is in the drive position, with the motor idling. If you have a



sports car, a racing car or a boat, make a note of the RPM's as indicated on the tachometer when the engine is idling.

If you have a regular transmission, put your car in low gear on a level road and notice its speed with the motor idling. Next, take any inexpensive auto spark plug wrench and remove your spark plugs. You'll never need them again! Just screw your injectors right into the spark plug openings. Then—no matter what kind of gas you have been using—fill your tank with the poorest regular gas you can buy. That's all you have to do to see the most amazing results you could ever imagine in all the years you have driven an automobile!

## CHECK YOUR RESULTS CAREFULLY!

If you have automatic transmission—now put your car in drive and let your engine idle. If your car stood still with spark plugs, it will move forward at from 4 to 6 miles per hour; that means that the amount of gas that just kept your engine turning over will now carry you up to 6 miles at no cost to you!

If you have a racing or sports car or a boat, your RPM's will increase up to 200 more at idling—up to 300 more at higher speeds.

If you have regular transmission, in low gear and with your motor idling YOUR CAR WILL MOVE FORWARD 4 TO 6 MILES PER HOUR FASTER. In other words, no matter what you drive, here is absolute proof that you can go further, faster and cheaper when you put proven SA FIRE INJECTORS in your car!

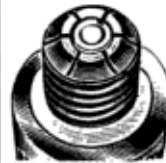
## CHECK THESE DIFFERENCES

### SPARK PLUG



Fires across air gap  
Wire electrode burns away  
Carbon ruins firing tip  
Needs cleaning and setting  
Needs periodic replacing  
Needs premium gas  
Must have exact heat range  
Spark blow out under pressure

### FIRE INJECTOR



NO air gap required  
NO wire electrode  
NO tip deterioration  
NO cleaning or setting ever  
NO replacing  
NO premium gas needed  
NO heat range  
NO blowing out even at highest compressions

## GUARANTEE

Take your set of SA FIRE INJECTORS and install them immediately; then give your new injection system every test you can think of . . . starting—acceleration—gas mileage—motor pep and smoothness for 10 full days. You must get more horsepower—more miles per gallon—increased engine RPM's—faster starting, blazing acceleration, freedom from knocks and pings, easier starting in all kinds of weather . . . AND DO ALL OF THESE THINGS ON REGULAR GAS.

If any SA FIRE INJECTOR does not continue to deliver maximum performance for as long as you drive your present car, we will replace it free of charge.

## Order Your Fire Injectors Now!

If you're the kind of driver who wants his car to move when he steps on the gas—not 30 seconds later—if you like your car to start when you touch the starter button—not after you grind your battery down, if you want every nickel's worth of mileage from every single gallon of gas you pay for—instead of wasting it in the firing chamber; if you're sick and tired of cleaning, setting and replacing spark plugs—you'll order a set of SA FIRE INJECTORS today!

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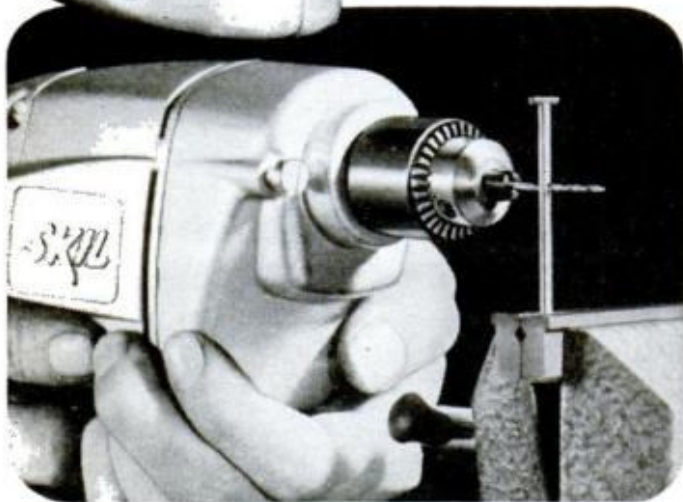
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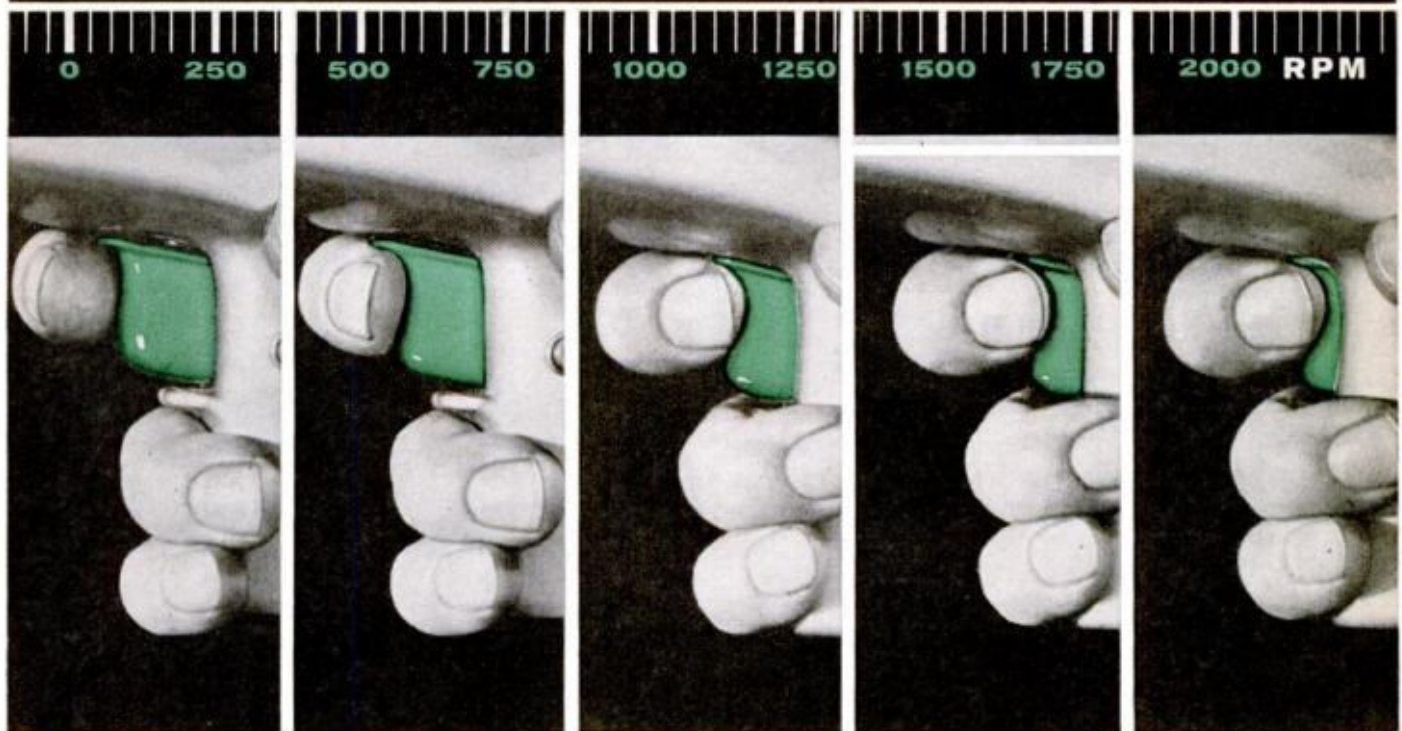
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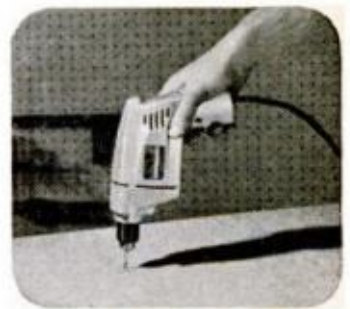
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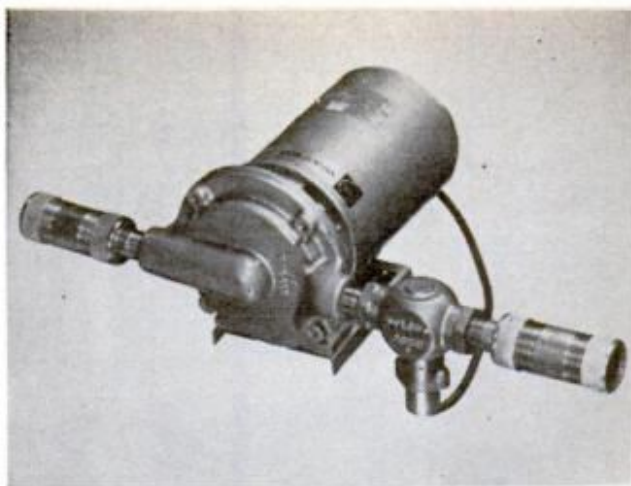


**WORKSHOP**

## New on the Market

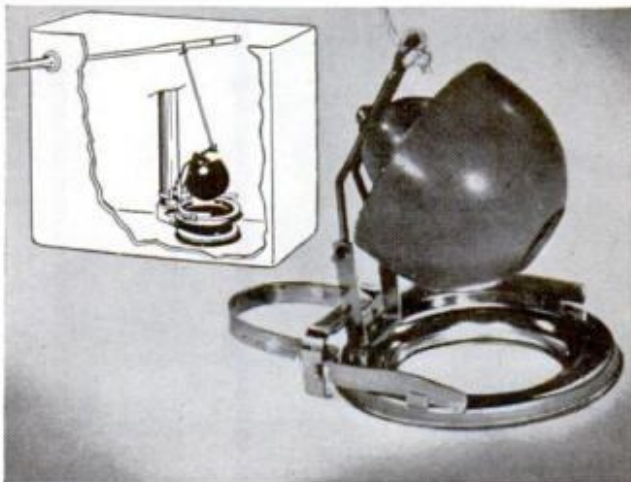
### Gives Water Pressure a Boost

You can raise your house water pressure by as much as 20 lbs. with the Home Booster Pump. Connected to your plumbing, it turns on automatically in response to any heavy demand for water. Costs \$80. Sears, 925 S. Homan Ave., Chicago, Ill.



### Flush Valve Installs Easily

A new toilet-tank valve assembly, called Miracle Valve, can be installed quickly without the use of tools. The stainless steel valve seat is placed over the existing seat, and is held in place by a clamp that fits around the overflow pipe. A rubber ball valve fits the new seat snugly to give a tight seal. Since it's hinged to the seat, it can't be jostled out of position. A Dacron string is used to connect the ball to the trip-lever arm. Guaranteed for the life of the toilet, it's \$3 from Pacer Products Co., P.O. Box 582, Moberly, Mo.



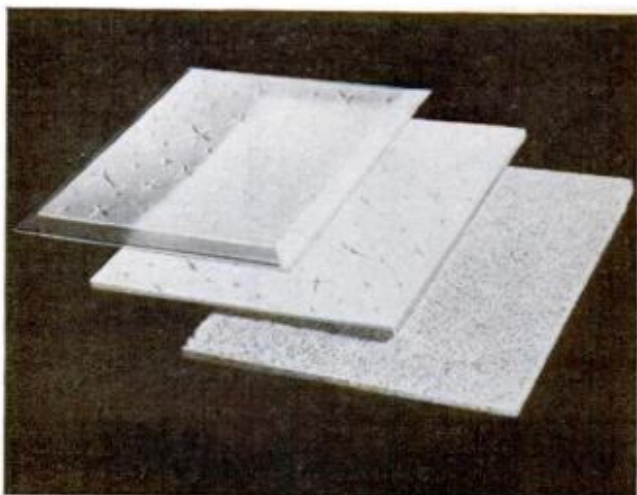
### Fix Concrete Floors in a Jiffy

Jiffy Floor is an instant-setting granulated plastic compound for repairing cracks in concrete floors. After cleaning out the crack you apply a special primer, then pour in the Jiffy Floor compound. To set the material, you tamp it or run over it with a wide-wheeled hand truck. According to the manufacturer, the repaired floor can be used immediately. Prices, including primer, run from about \$3.70 to \$5 per gal., depending on the quantity ordered. Manufactured by The Monroe Company, Incorporated, 10703 Quebec Ave., Cleveland, Ohio 44106.



### New Look for Grid Ceilings

Two unusual panels now increase the flexibility of grid-ceiling treatments. One, shown in top of photo at right, is translucent, and is installed under light fixtures. With light off, it closely resembles the manufacturer's Cotillion panel (center of photo). With light on, it becomes luminous. Cost is \$2 in 2x2-ft. size, \$4 in 2x4 size. The other new panel, called Woodstran, is made of compressed wood fibers that create a swirled texture. Costs \$1.15 in 2x2, \$2.30 in 2x4. National Gypsum, Gold Bond Bldg., Delaware Ave., Buffalo, N.Y.



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## Front drive for Olds and possibly Riviera; Variable rate steering for Pontiac, Cadillac?

The latest rumble from the General Motors mechanical kitchen is that front-wheel-drive systems still are boiling on the front burner. GM division chiefs continue to refuse comment, but Olds now is definitely in the swim for the '66 model year. Pontiac's chiefs have definitely rejected the idea, but Buick is still considering it—with an eye toward changing the Riviera for 1967.

Pontiac is giving the eye to another possibility—the “car-of-tomorrow” power steering system from Bendix that PM reported on last August. This variable-ratio system is tailored so response is fast when you're making a sharp corner; at full lock the ratio is less than 6:1. At highway speeds, where turning is much more gradual, this would present near fatal tendencies for over control. So when you're pointed dead ahead, the ratio available is closer to what we think of as normal (actually 17:1, most power units today are in the low 20s).

That means you turn the steering wheel 17 degrees for a one-degree pivot of the front wheels. But by the time you've pulled the wheel to full lock, it takes less than 6 degrees at the steering wheel for a degree at the front wheels.

The new Jaguar 4.2 is the first production car to offer the Bendix Varamatic system, and Pontiac may be the first domestic car. Cadillac, too, is studying variable ratio, but is more interested so far in a similar system from Saginaw Steering, a fellow GM division. Saginaw's system is also developed to the point of being ready for mass production—as soon as the decision makers decide it'll sell.

Variable ratio doesn't require much additional gear under the hood, but there is still a cost penalty. It depends on a worm gear with a pitch that changes from one to the other. Special tooling is required. The odds are that for a few years it'll be an extra-cost option. Then when tooling is largely paid for it'll become standard equipment.

In Dearborn, Ford has dropped—at least for now—plans for an independent rear suspension on the Mustang. Two Mustangs, after all, won the Tour de France

competition with live rear axles. Performance like that won't convince the accountants that a costly independent rear is needed. And Mustang as it stands is selling like ice cream on the Fourth.

Instead, minor suspension changes will help Mustangs take full advantage of the control properties of radial tires planned for next fall.

A Michigan reader asks us whether engineers have ever considered driving airconditioners with electric motors instead of from the car's engine. He suggests that during the off season there'd be less wear on the airconditioner—it would simply be turned off.

It's an appealing idea: Why run those wheels and pulleys in the winter? But an automotive air conditioner actually requires 3 to 5 hp. That works out to about 4200 watts of power—350 amps at 12 volts.

Car batteries, so far, are a long way from that capacity.

Know why you so rarely see cashew nuts in their shells? A resinous oil from the thin inner shell is valuable—as a binder in making brake linings. So cashews are sold after they've been undressed. Besides, the oil gives many people a dermatitis similar to poison ivy or poison oak, hardly the sort of thing to sprinkle on your vanilla sundae.

The 3M Company, which says it's the world's largest importer of raw cashew nut shell liquid, says the oil can also be used as an immunizer against poison ivy, poison sumac, and the like. But your exposure would have to be very carefully controlled.

It could happen before you read this—imported-car authorities are talking of reports that the MG-B will have, for '65, a new V4 engine. Designers at MG are inventive and imaginative enough to do it, but why would they? Engine life might improve some, but a big gain would be in under-the-hood space. And today's straight Four isn't particularly crowded.

Automotive Editor



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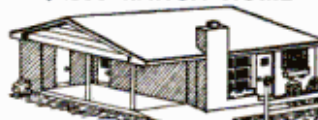
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# CLINIC FOR HOMEOWNERS

**Q** My front door has no protection. It's an older type door and I've noticed that it's beginning to pull apart at the joints and the paint is peeling at these points. I've cleaned and repainted it once, but now the paint is peeling again. There are a few small paint blisters at other points. What's the probable cause and remedy?—W.S., Ky.

**A** When you say "no protection" we assume you mean there is no storm door or canopy. If this assumption is correct, then there are two probable causes, 1) water, from driving rains is working into joints between stiles and rails and being absorbed. This causes paint to peel about the joints, particularly lower ones. 2) Moisture condensation on the room side of the door may also be a cause, or at least a contributing cause. Moisture in the form of water vapor, seeking the colder, drier air outside, can force its way into the joints, causing the wood to swell and then shrink, resulting in paint peeling from the adjacent areas. A tight-fitting storm door will help to prevent further deterioration as it will shield the inner door during the colder months. It will also tend to equalize the temperature at the outer surface of the inner door, largely preventing absorption of condensate.

**Q** I'm thinking of renting a floor sanding machine to renew my old hardwood floors. The varnish, or whatever is on the floors, is in bad shape and may be difficult to sand off. I'm told that if I use turpentine, it will prevent clogging of the sandpaper and make the finish easier to remove. Is this true?—K.H., Mo.

**A** The question of using a solvent when machine-sanding a floor has been discussed before in this column. For obvious reasons we cannot recommend the use of a solvent, either flammable or non-flammable, as an aid in floor sanding. Using a flammable solvent, such as turpentine, there is an ever-present fire hazard should the abrasive on the machine drum strike an exposed nail head, tack, or other metallic object. In using any solvent for such work, there is not only a possible

fire hazard, but a health hazard as well, due to the fumes released from most volatile solvents. Generally it is best to use a coarse open-coated abrasive on the machine for the first time over an old floor. By guiding the machine at an angle with the floor boards where possible, you will have less trouble with clogging of the abrasive, as the latter will cut faster when run at an angle with the grain of the wood. In some cases it may be necessary to make two passes with the coarse abrasive, running at an opposite angle about equivalent to that of the first pass, in order to remove all the old finish down to bare wood. Once you have all the old finish off, change to a finer abrasive and sand with the grain.

**Q** I'm planning construction of a home with brick outer walls, cinder block backing and plaster directly on the blocks. But my contractor says such a wall will sweat, that moisture will form on the plastered walls and cause trouble. He wants to furr the walls, insulate and install plasterboard over the insulation on all outside walls, so he says. It's more expensive. Is he right?—O.N., Ga.

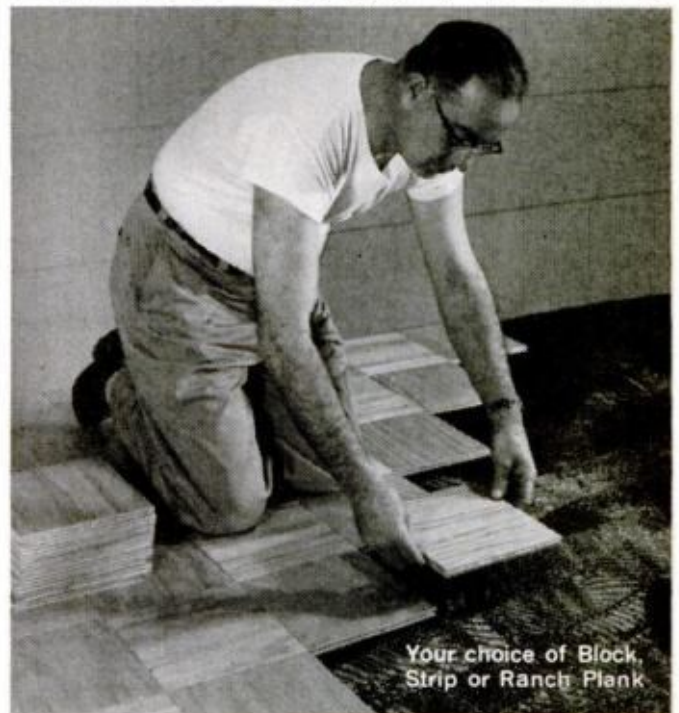
**A** He is right. Building an all-masonry wall and plastering the room side without furring and insulating with a vapor barrier is inviting trouble with moisture condensation on the room side of the outside walls of a home, more especially if the structure is built where the temperature falls below freezing and remains so for any length of time. Such walls tend to become colder than the air with which the surface on the room side is in contact. Condensate forms on the cold surface, resulting in "sweating." We suggest you follow his advice.

**Q** I want to make a filler for plaster cracks colored to match the paint I put on the wall. So far I've not been able to find a crack filler to match, but a matching filler is what I want. Can you tell me what materials to use, how to mix, and so on?—A.H., Fla.

**A** You can mix a small quantity of the paint you are going to apply to the wall with sufficient whiting to make an easy working paste. Nearly all interior wall paints can be mixed with whiting in this fashion. However, if your purpose in this is to prevent crack fillers from showing through succeeding coats of paint you may be disappointed. Try "sizing" the patches with a coat of paint and allowing to dry before final applications of paint.

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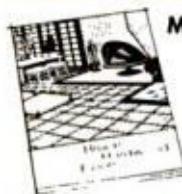


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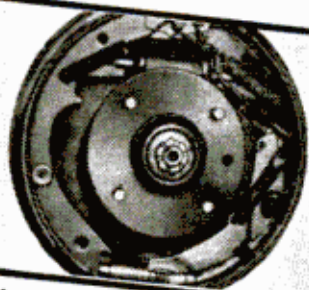
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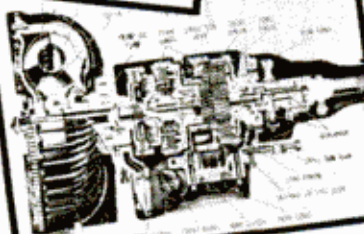
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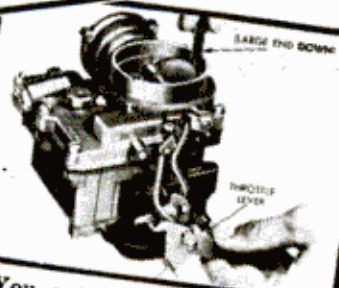
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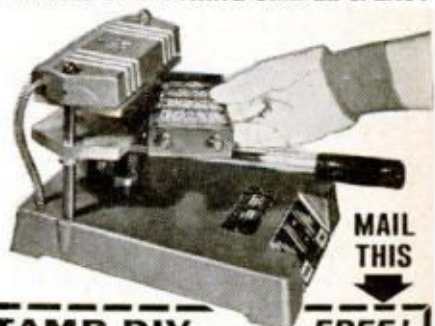


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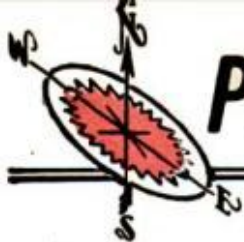
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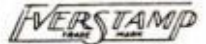
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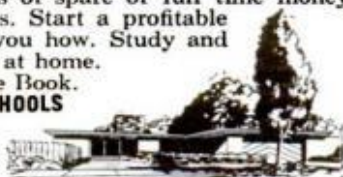
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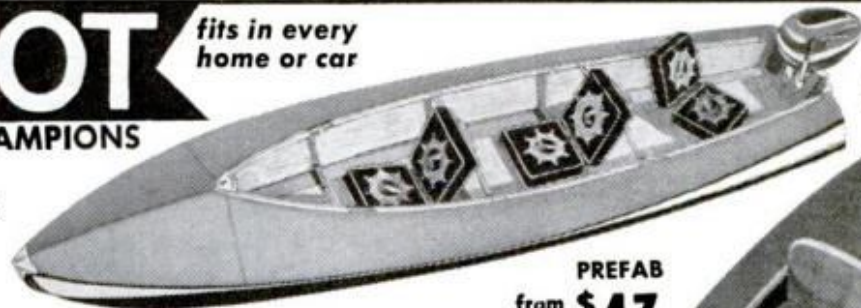
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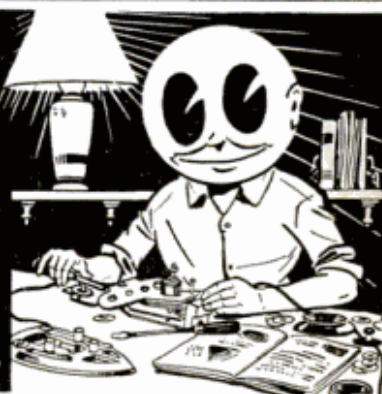
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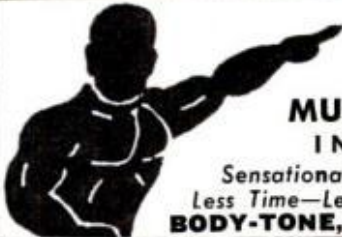
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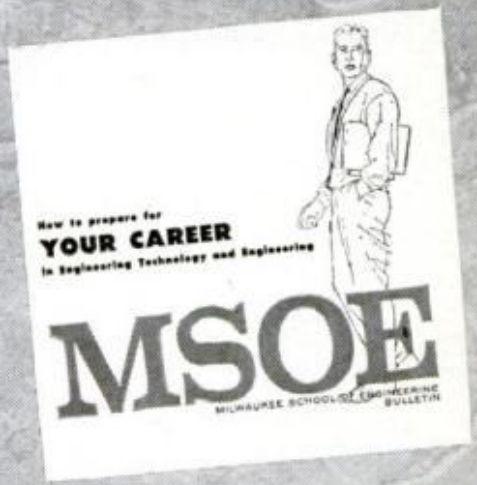


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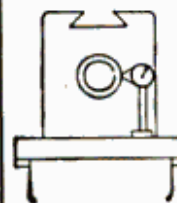
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# Here's all there is to know about this GMC pickup. Except for one small thing.

Husky wood floor is quiet and long lasting. None of that annoying drumming and rusting.

Strong. Quiet. Comfortable. Two walls of steel with a thick pad of insulation—not just one wall like some. Inside—adjustable seat back and foam seat.

No tangle of wires behind the instrument panel. In its place is a printed circuit. Only GMC has it.

Three letters that stand for three important things. Built by truck people. Sold by truck people. Serviced by truck people.

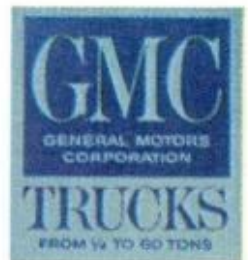
A GMC has four headlamps. Most other pickups have just two.

Progressive leaf rear springs automatically adjust to the load. Heavy loads, light loads or no load at all, the ride is steady and smooth.

Tires are king-size (8.15 x 15). Yet they're standard equipment on this GMC. Others charge extra.

The exclusive V-6 truck engine has gone 120,000, 130,000, even 150,000 miles before major overhaul. About half that is average. But the V-6 isn't just an average truck engine.

\*Based on manufacturers' suggested retail prices, the GMC V-6 model pictured above is never priced more than \$49 over comparable competitive base models. Often the difference is less.



GMC offers a proven total suspension system of independent front and progressive leaf rear springs. Result? Always a smooth ride even with maximum loads.

## The price. It's only \$49\* more than others.



## Why Camping Families Love Nimrods



**Mom says,** "Bless those slide-out beds. Bed clothes stay up off the floor — neat, clean. No struggle when you are weary."

"After a long day's travel, Nimrod's quick set-up is worth its weight in gold."

"On hot nights Nimrod's big windows catch every breeze."

"Nimrod's big floor space is wonderful — especially on rainy days."

"I enjoy looking stylish on the road. Nimrods are so pretty."

**Dad says,** "The way it handles on the road is great. So light and well balanced. And easy to maneuver by hand at the campsite."

"Three things—steel construction, undercoating and baked enamel finish—tell me I'll have years of good service."



"I like the design of Nimrod bed supports. They're firmly anchored in the trailer, not on the ground which might be soft or muddy causing beds to sag or bend."

**Kids say,** "Yippee! We're all going Nimrodding!"



"Yippee" is the word for the marvelous new 1965 Nimrods. Four great models. See your Nimrod dealer for a demonstration. Or write for free Nimrod "Magic Carpet" brochure.

**NIMROD**

Nimrod Equipment Division • 516 Ford Blvd. • Hamilton, Ohio  
Nimrod—America's largest selling camping trailer.

*For a World's Fair Campsite, see your Nimrod dealer.*



***“We think it’s smart to let  
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We’re Chevy dealers.”***

A Chevy dealer talks this way because he’d rather have a customer take his time and look around. For one thing, he has lots of cars on hand that his *new* Chevrolet customers traded in. And salesmen who’d rather help than hurry you in making up your mind.

Most important, he knows you’re more likely to find *exactly* the car you’ll be com-

pletely satisfied with. That will make you want to come back some day to buy another. Or maybe a new one.

And your Chevy dealer can offer you service *after* you buy, if you ever need it. So you’ve got every good reason to look for the OK sign. . . . Chevrolet Division, General Motors, Detroit, Michigan.



**SEE YOUR CHEVROLET DEALER FOR THE USED CAR OR TRUCK YOU WANT**



***Meet the New Yorker, created in honor of the New York World's Fair***

We hope you will soon be visiting the New York World's Fair—and our exciting General Cigar Hall of Magic. But even before you do, you can start enjoying this most extraordinary cigar.

Here is a big cigar for the big moments and the big pleasures. A cigar that's the very essence of New York, and the great new Fair. Yet, the New Yorker's unique blend of case-aged tobacco gives you both mildness and flavor—flavor you don't have to inhale to enjoy.

We'd be pleased to have you compare the White Owl New Yorker with any cigar you can buy—particularly cigars costing two for 25¢ and up. You'll see, quickly, that this newest White Owl does full justice to its name—and to your smoking pleasure.

So come to the World's Fair. "Meet us under the smoke rings." But before you do, meet the White Owl New Yorker. It's at your cigar counter now, in striking new Royal Red and White boxes and five-packs.

Материал защищен авторским правом

# *\$7 a Year Heats the*

# House with Sunshine in the Basement

**A** FEW YEARS AGO, I read a science news item somewhere regarding solar energy. It said that sunlight striking less than a 100-mile square of Arizona desert, if completely used, would be enough to power all the industry in the United States.

I remember being slightly appalled by the magnitude of all that potential power

going to waste. I also remember thinking that if such a small bit of sunlight, properly harnessed, could accomplish so much, it shouldn't take more than a tiny patch of it to heat a house all winter.

I knew there had been a number of attempts to do this in the past. Massachusetts Institute of Technology pursued sev-

By Harry E. Thomason as told to Omer Henry



**BOTTLED** sunshine even heats indoor pool in wing of solar house. Roof of the pool has a highly reflective surface which acts as a booster for solar collector

eral concepts to harness sunlight for home heating. Successfully, too. But to the best of my knowledge no system yet devised had the practical efficiency I had in mind.

The more I thought about it, the more intrigued I became. So did my wife, and for several years we both researched and ran experiments in various solar heating principles. The upshot, of course, was that we finally worked ourselves up to building a solar house, incorporating known principles as well as ideas of our own that we hoped would add the ingredients of economic and structural practicality.

### Item One: Sunshine Trap

The first job was to devise a cheap, efficient heat collector to capture solar energy. Since the sun shines on a given spot for only a few hours a day in winter, and often not at all for days on end, there also had to be an economical means of storing and retaining large quantities of captured heat. While a number of scientists have produced a variety of such devices, once again none has a degree of heat-storing efficiency high enough to be practical in North temperate areas.

Then there was the routine matter of heat exchange and distribution, requiring the usual ducts, registers, and thermostatic apparatus to control release of heat.

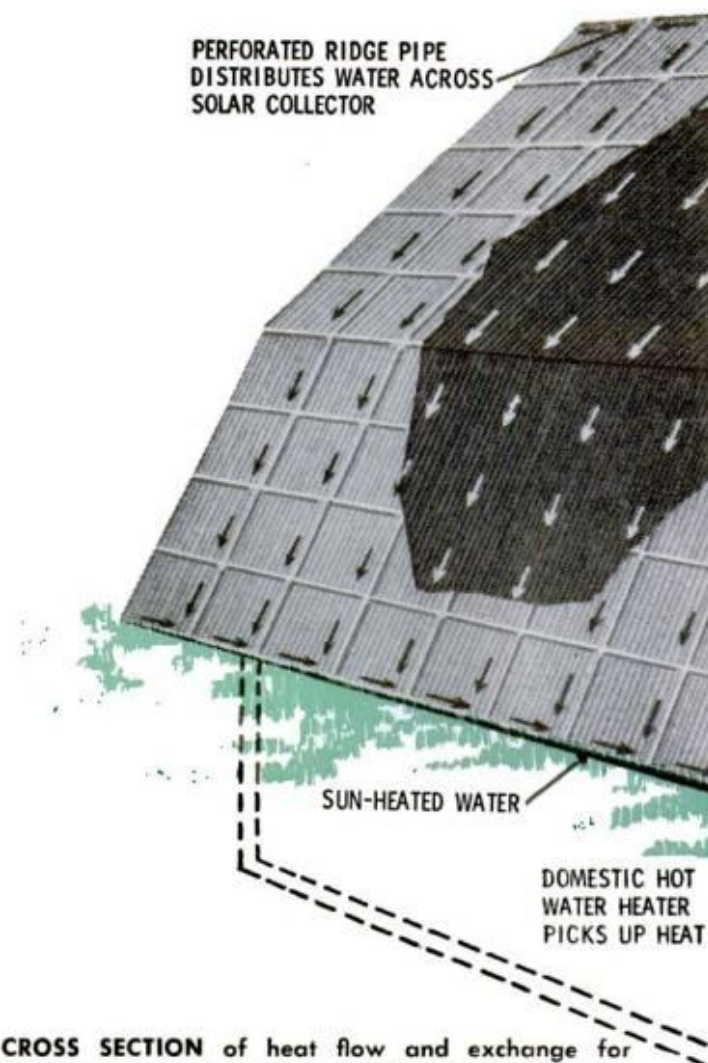
There was no point in stopping there. If you can heat a house with solar energy, you can certainly use the same basic system to cool it in summer by reversing the process. This had been done at M.I.T. Therefore I included airconditioning in my plans.

All went well with the construction until a truck delivered the 1,600 gallon tank that was to become the heart of my heat storage unit. Then, people became curious. They'd drive by slowly, looking at that over-sized tank. Pedestrians stopped to examine it, even to open the manhole and peer inside. Interruptions and endless questions nearly brought progress to a grinding halt.

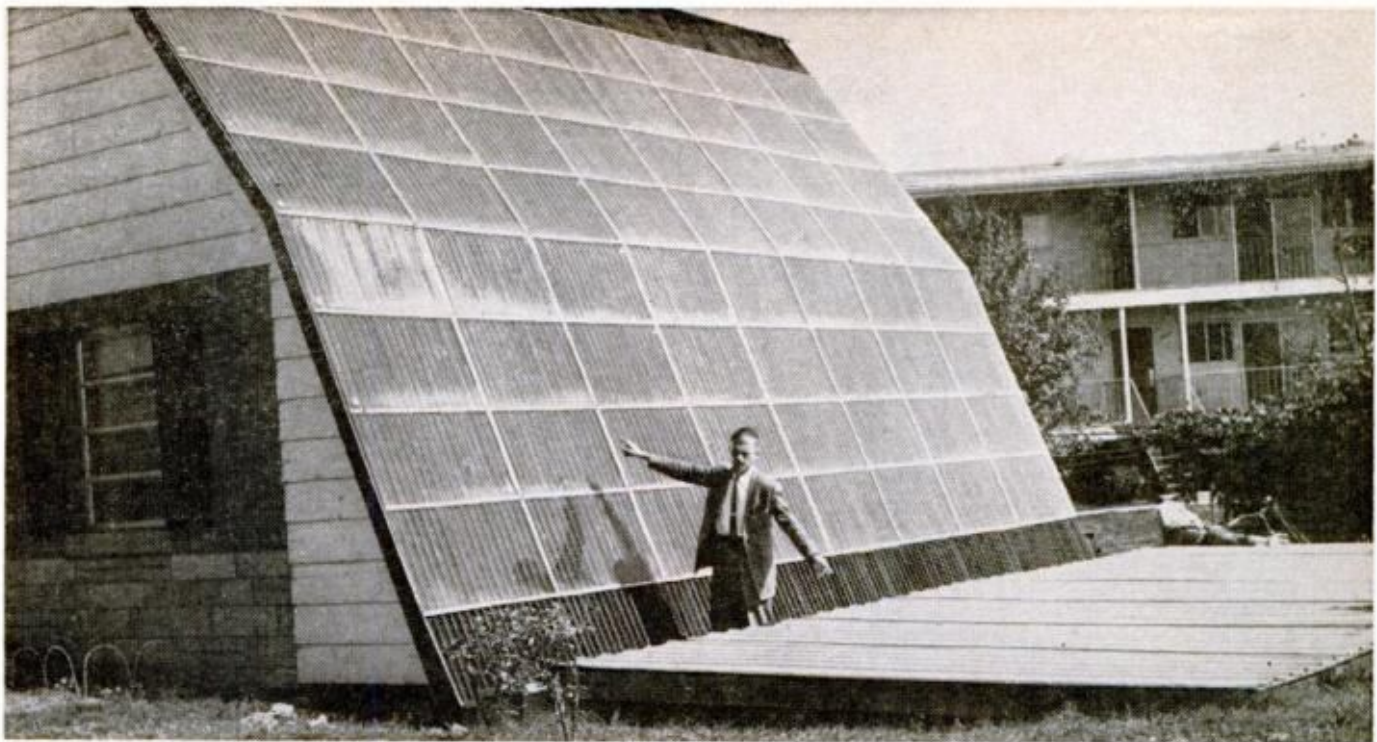
This nuisance didn't help my frame of mind at this crucial stage. The heat storage unit is actually the heart of the system. Since it was all my own design, I was plagued with a number of doubts about it. How much would it cost? How much heat could I store? How long could I hold it? How could I release it automatically and in controlled quantities as



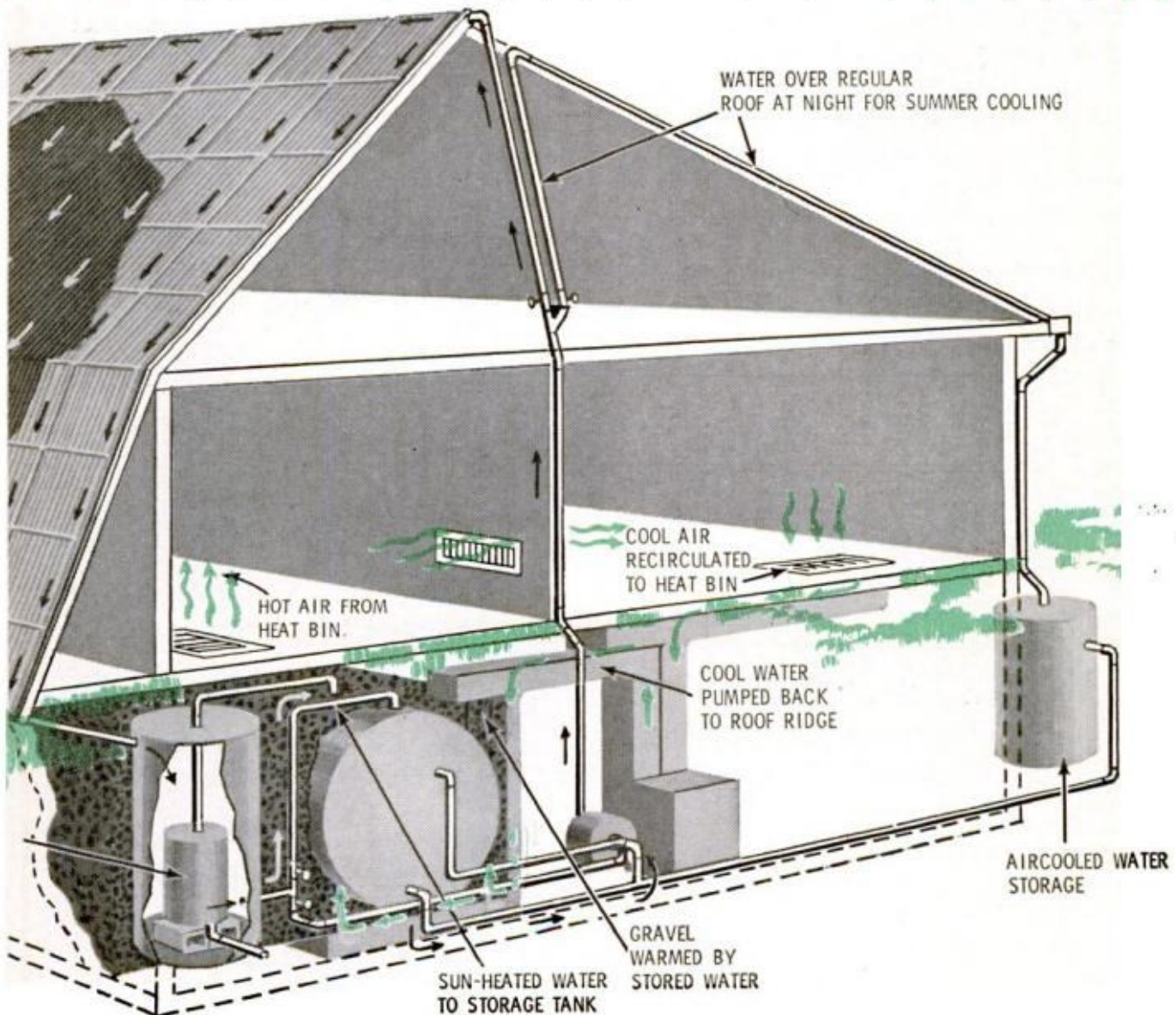
**OUTDOOR POOL** at Thomason's first solar house had its water warmed by solar energy stored in system's heat bin. The kids swam in it when snow was flying



**CROSS SECTION** of heat flow and exchange for Thomason's new house is shown here. In the interests of clarity, diagram doesn't cover airconditioning cycle. Water for it is collected in the tank at right.



**INVENTOR THOMASON** stands between heat trap, at left, and heat reflector on the ground—for house number two. Reflector increased efficiency of the heat trap by 30 percent; became roof of the pool wing on the newest house





**BUILDING** heat trap on roof of newest house. Roof itself is insulated. On top goes layer of fiberglass, corrugated aluminum, topped by glass panes

it actually became needed?

The heat bin went in first. It was 10 feet wide, 25 feet long, and 7 feet high. In it I placed the 1600 gallon drum. Since I'd decided on a hot air heating system, the bin was fitted with ducts, a blower, filter and registers.

Fifty tons of fist-sized rocks finally were dumped into the bin, around the tank. The sun-heated water would raise the temperature of the rocks which, as everyone knows, retain heat well. These rocks would become the immediate source of heat for my home. When this was done, I insulated and sealed the bin airtight.

Although the bin was completed as planned, I was uneasy about it. To do its necessary work, it had to be able to release enough heat to warm the house for periods longer than 24 hours. Unless it did, my system was of little—if any—value. Certainly, it would be no improvement over any existing systems. There were plenty

of people who assured me that such would be the case. With doubts looming, I contracted with a plumber to install the water piping system, while I set about constructing the solar energy trap. The trap had to intercept as much sunlight as possible. It also had to be inexpensive, long-lived, and immune from freezing on cold winter nights. To achieve these goals, I topped a base of insulation with blackened sheets of corrugated aluminum. Above that went polyester film and window glass transparencies.

This trap, forming one entire side of the roof, was angled to catch a maximum of sun's rays throughout the year. Water, pumped from the tank to the top of the trap, would run down the corrugated valleys, pick up solar energy from the heat of the sun, and return to the tank at much higher temperatures. This energized water in the tank would be circulated through duct work to heat the house.

As the heat trap neared completion, its 840 square feet of glass excited even more curiosity than the storage tank. As patents had not been issued on the devices I was using, I did not always answer visitors' questions. This gave my project an air of mystery, and aroused some resentment.

**PYRANOMETER** is used by the Thomasons to measure intensity of the sunlight. It provides an index to amount of solar energy being taken by system





One neighboring resident accused me of violating the zoning ordinances by setting up a business in a residential area. When I denied such intentions, with some bewilderment, he waved an arm in the direction of the solar collector. "You expect me to believe that you're building a private greenhouse that big?" he asked.

As the house neared completion, I devised several tests for the system. I invited several individuals to witness them—U. S. Army patent attorney Major Richwine, Weather Bureau scientist Torrance H. MacDonald, U. S. Patent Office Examiner J. C. Myhre, and the Chief Building Inspector.

On the appointed day the sky was overcast. Despite my anxiety, there was nothing to do but proceed.

When the last guest had arrived, I checked the temperature of the water going into the heat collector. It was 60 degrees Fahrenheit. This I announced.

If the heat collector really worked, water leaving it for the heat bin should be considerably warmer than 68 degrees—even on a cloudy day. With trepidation I inserted the thermometer in the large stream of water leaving the heat collector for the heat bin. A few minutes later I

removed it. The mercury stood at 78! This was better than I had expected.

"What's it say?" Major Richwine asked. For an answer, I held out the thermometer. My visitors were properly impressed.

In my collector, the sun was heating 13 gallons of water per minute—raising the temperature 10 degrees. How good is that? On a cloudy day, something like 84,000 BTUs per hour would be falling on the collector. I was recovering about 64,800 BTUs per hour. Only a fair recovery. But with adjustment in water flow I knew I could improve it.

### Reflector for Heat Trap

I'd have to if my system was to be practical. This meant tests, meticulous records, careful evaluation of all results and building more efficiency into the parts of the system that showed up badly.

In the meantime I re-examined my plan. It occurred to me that the more sunlight I could get on the heat collector, other elements being equal, the more heat I could trap. Therefore I built an aluminum reflector in front of the heat trap. I tilted it slightly so it would catch the low rays of the winter sun and bounce them against the heat collector. By measuring heat dif-

[\(Please turn to page 234\)](#)

**NEW POOL'S WATER** as well as the wing it is in, are heated by trapped sunshine. Here Thomason is shown taking temperature of the water in the pool

**COLLECTOR** closeup shows corrugations in the black-coated aluminum. Water running down these valleys picks up the sun's heat, and carries it to storage





A Nationwide Survey  
Based on 591,676  
Owner-Driven Miles

# Chevy's Liquid Lines Top Assembly Gremlins

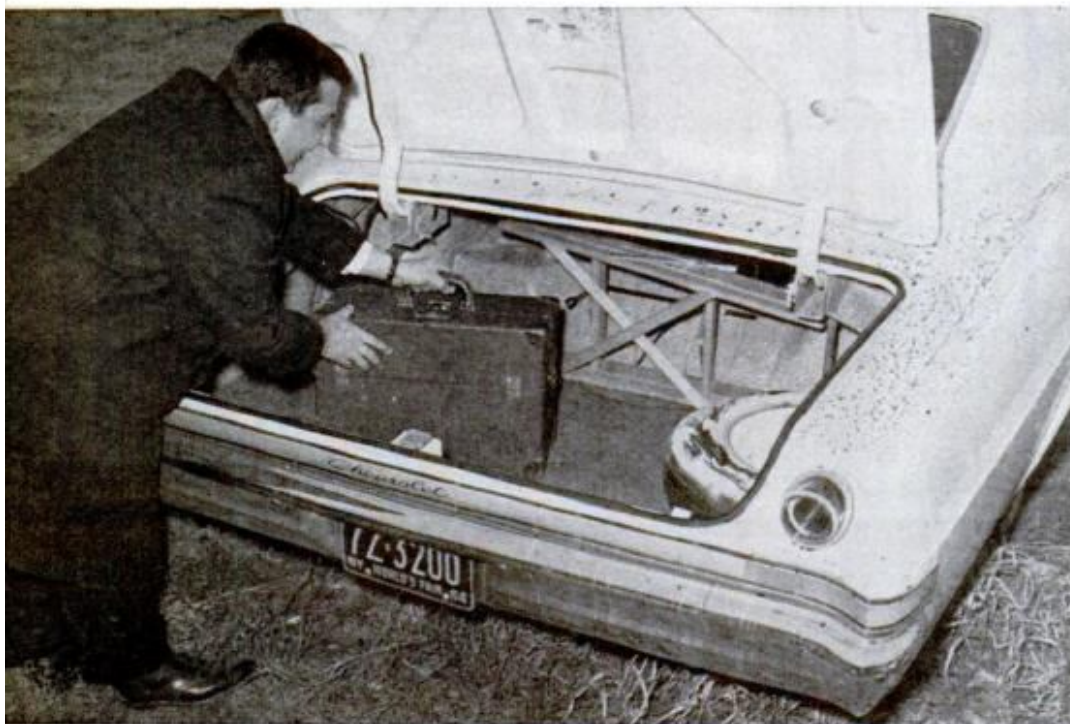
*Marginal and boldface comments by Ed Nelson,  
PM's Automotive Editor*

**T**HEY'VE NEVER MET, but the Nebraska professor and the Pennsylvania secretary agree on one thing: They like the flowing lines and semi-fastback sweep of their new Chevrolets.

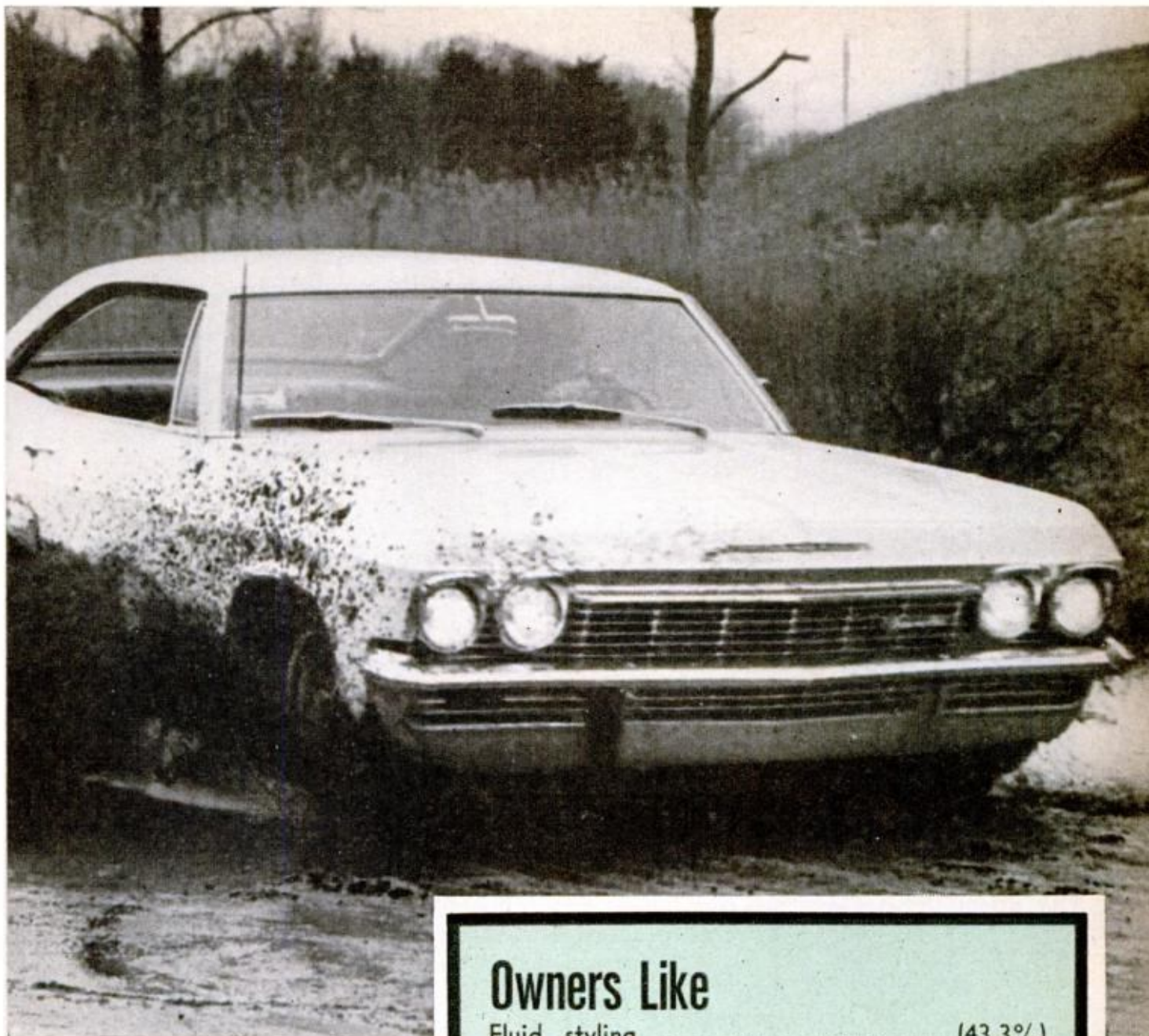
The Tennessee postmaster is more impressed with the way Chevy handles on curves, and the North Carolina minister says it "takes bumps like a Cadillac."

Less enchanted is the Texas manufacturers' agent. He told PM, "The car is better than a mule—but not by much. The tires are out of round, the doors don't fit and can't be unbuttoned when locked, upholstery is loose around the rear window and the glove compartment falls open."

These are typical of the features owners like most and least about their new Chevrolets, as reported in *Popular Mechanics'* first 1965 Owners Report. The enchantment outweighed the disenchantment, as it usually does. But the number of assembly and workmanship complaints is substantially higher than



**PM'S CAMERA CASE** does its regular duty as a size reference in the Chevy trunk. Grocery-bag high near front, it got owner salutes



**FENDER WELLS CONFINED** splash surprisingly well considering the amount of dirty water we threw up during this run through a muddy puddle. Owners paid tribute to good vision through wide Chevrolet windshield

**OVER-ALL FUEL CONSUMPTION** reported by bulk of owners was about 15-16 m.p.g. More than three-quarters of the owners had Powerglide transmissions. The basic 195-hp. V8 (283-inch) was most popular engine

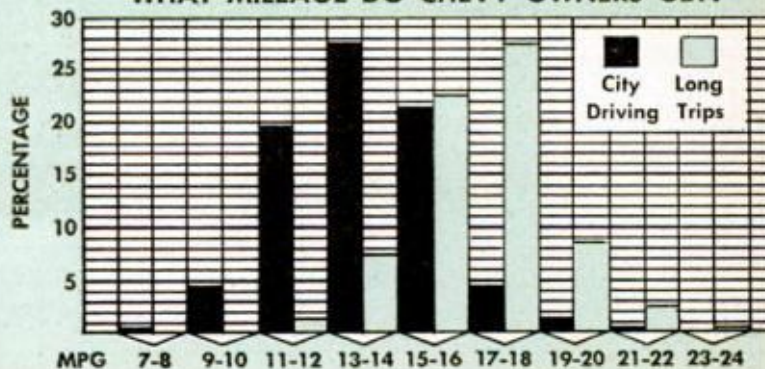
## Owners Like

Fluid styling .....	(43.3%)
Easy handling .....	(36.0%)
Cushiony ride .....	(25.6%)

## But Dislike

Assembly, workmanship .....	(16.9%)
Whistling windows .....	(12.8%)
Rattles and squeaks .....	(12.1%)

### WHAT MILEAGE DO CHEVY OWNERS GET?





**WHEEL SPRING RATES ARE SOFTER** this year, but the test Impala didn't wallow unusually. This sharp hole was swallowed up well with new shocks controlling springs. One fourth of the owners called ride their favorite feature

**This disenchantment →  
may fade as quality  
controls are improved**

we usually get from Chevy owners, perhaps because of the troubled production start-up this year. In spite of the problems, 86.2 percent of the Chevy owners we surveyed would buy a Chevrolet again. (Ford had problems, too, as the report on page 100 shows.)

Our test Impala had the curved-glass trouble mentioned by several hardtop owners—side windows wouldn't stay in their channels. We used the Tracktest fifth-wheel electric speedometer to check acceleration and paired it with the electric fuel meter for steady-speed fuel consumption figures. In spite of curb weight close to two tons and the handicap of Chevrolet's two-speed Powerglide transmission, the 195-hp. V8 reached a true 60 m.p.h. from a standing start in 11.0 seconds. Checking passing performance, we got 40-60-m.p.h. and 50-70-m.p.h. acceleration times of 7.7 and 5.6 seconds, respectively.

We checked constant-speed fuel consumption at a true 30, 40, 50, 60, and 70 m.p.h. and got an average 19.21, 20.22, 18.61, 16.52 and 14.13 m.p.g.

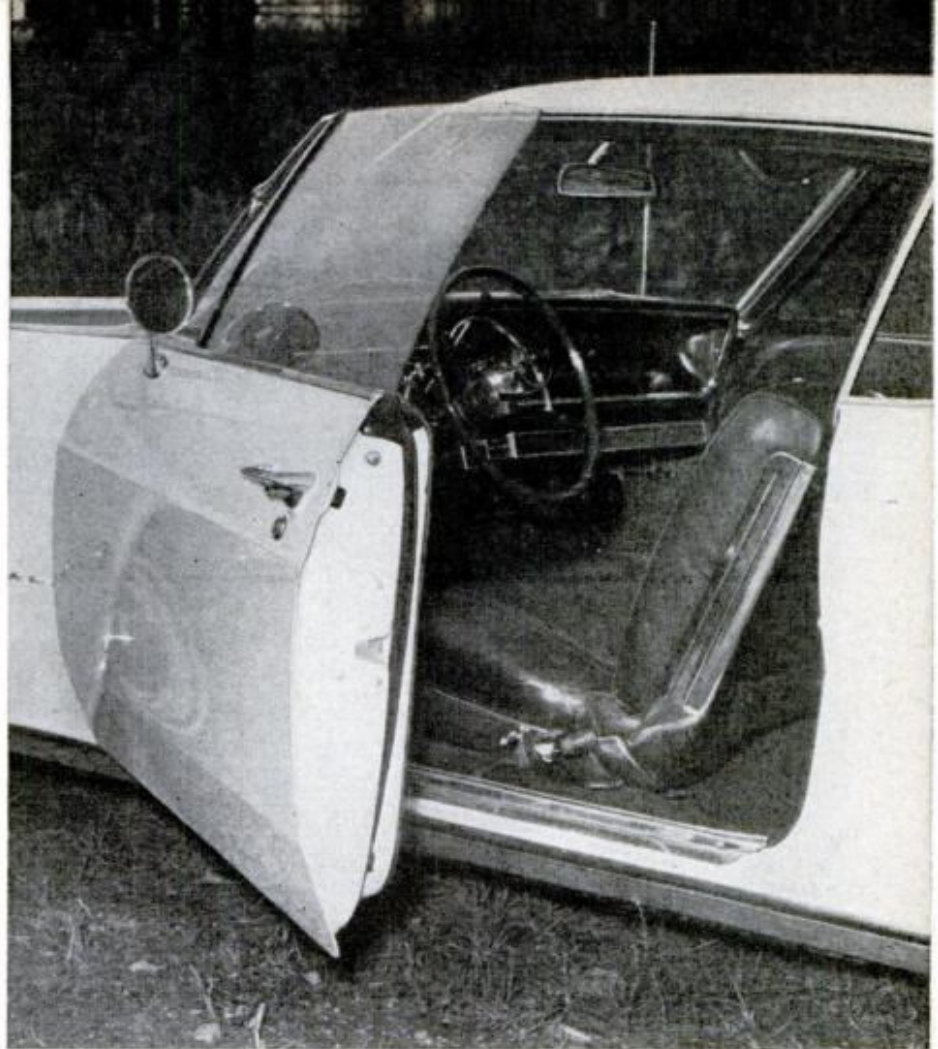
Now let's listen to the owners themselves. The five Chevy features praised most often, in the order of their popularity, were styling, handling ease, ride, power performance, and the attractive interior. Here are some sample comments:

"It looks like the Riviera."—Michigan plant manager.

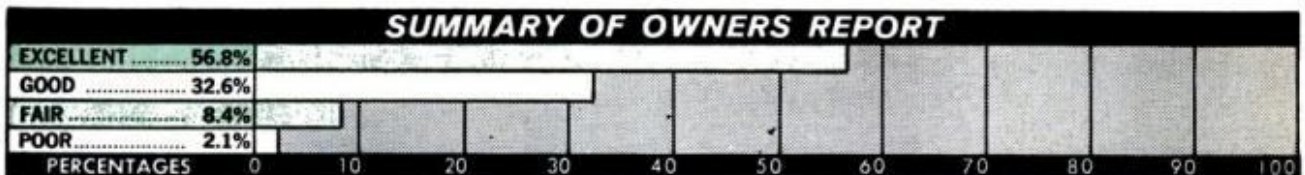
"The exterior style is very Corvette-ish, and I'm a 'Vette fan."—Pennsylvania teacher.

"It handles much better; there's a big improvement in front-

**Will GM's voluptuous  
curves outsell Ford's  
crisper lines? Tune in  
next fall for the next  
chapter** →



**CURVED WINDOW GLASS** without supporting frame or eye-warming trim got complaints. Owners reported they don't operate well or close tightly and generally blamed windows for wind noise. Noise was mentioned by 12.8 percent



<b>Fuel economy</b>		<b>Least-liked exterior style features</b>		<b>Other make considered</b>	
About as expected .....	50.9%	Front bumper .....	7.3%	Ford .....	15.9%
Better .....	15.2	No protective side trim .....	6.2	Pontiac .....	10.0
Not as good .....	24.6	Rear window .....	4.5	Buick .....	5.2
<b>Best-liked features</b>		Curved, frameless windows .....	4.5	Oldsmobile .....	5.2
Styling .....	43.3	<b>Best-liked interior features</b>		Plymouth .....	4.8
Handling .....	36.0	Dashboard .....	23.2	<b>Is Chevrolet family's only car?</b>	
Ride .....	25.6	Roominess .....	13.1	Yes .....	55.7
Power, performance .....	14.9	Upholstery .....	11.4	<b>Make of family's other car</b>	
Interior .....	10.7	Seats .....	9.7	Chevrolet .....	19.0
Roominess .....	9.3	Instrument panel .....	7.6	Ford .....	6.6
Comfort .....	8.7	Steering wheel .....	2.1	Plymouth .....	4.8
Steering .....	5.9	Luxury touches .....	2.1	Pontiac .....	3.1
<b>Specific complaints</b>		Gauges instead of lights .....	2.1	Buick .....	2.8
Assembly and workmanship .....	16.6	<b>Least-liked interior features</b>		Falcon .....	2.4
Wind noise .....	12.8	Dashboard .....	6.9	Chevy II .....	2.1
Rattles and squeaks .....	12.1	Ash tray .....	4.5	Oldsmobile .....	2.1
Rear visibility .....	10.0	Glove compartment .....	4.2	<b>Make of car traded in</b>	
Curved, frameless windows .....	5.5	Seats .....	3.1	Chevrolet .....	58.8
Paint .....	5.5	Headroom .....	2.4	Ford .....	6.6
Gas mileage .....	4.5	Console .....	2.4	Pontiac .....	3.1
New key system .....	3.1	<b>Decision to buy Chevrolet most</b>		Buick .....	2.1
<b>Mechanical trouble, if any</b>		<b>influenced by:</b>		Chevy II .....	1.7
None .....	67.5	Previously owned Chevrolet .....	8.4	Corvair .....	1.4
Carburetor .....	5.8	Styling .....	36.0	Rambler .....	1.4
Transmission .....	3.1	Resale value .....	20.8	<b>How is dealer's service?</b>	
Suspension .....	2.4	Price .....	13.8	Excellent .....	64.3
<b>Best-liked exterior style features</b>		Economy of operation .....	7.3	Average .....	24.9
Smooth, clean lines .....	12.1	Trade-in .....	6.2	Poor .....	8.7
Fastback styling .....	7.6	Dealer service .....	6.2	<b>Would you buy another Chevrolet?</b>	
Front end .....	7.3	<b>Consider a different car?</b>		Yes .....	86.2
Roof line .....	5.9	Yes .....	43.6	No .....	4.5



**REAR VISION THROUGH SLANTED** back window is little help in parking, as this driver's-eye-level photo shows. Owners found this aspect a problem, but they were in favor of soft, semi-fastback styling and down-sloping rear deck

**A 327-inch V8  
small? Must be a  
Texan talking →**

end action."—North Carolina electronic technician.

"The car handles much better than my '63 in curves. The power steering is improved. And in severe braking it doesn't dip forward, it squats."—Indiana lubrication engineer.

"The ride is like floating in mid-air."—New York grocer.

"I decided against an Oldsmobile because the Chevrolet also rode and drove like a heavy car."—Texas railroad switchman.

"I decided on Chevrolet because of the performance of its small engine (250-hp. V8) pulling 4000 lbs."—Texas machinist.

"The 195-hp. engine gives good all-around performance."—Ohio millwright.

"It has good get-up-and-go."—New York laborer.

"The interior looks like that of a \$6000 car."—Tennessee highway worker.

"Beautiful interior design and upholstery."—New York teacher.

*There's lots to like, but there are still a few thistles in the garden. Besides assembly, owners mention wind noise, rattles and squeaks, poor rear vision and carburetor trouble.*

**Did someone in Detroit  
say "Ouch"? →**

"The car wasn't put together well. Muffler and tailpipe fell off, radio antenna fell off, interior screws were loose, interior lights shorted out, upholstery was torn."—Illinois rate analyst.

"Being a new model, one of the first off the line, interior fitting is a little 'chintzy.' Lots of little things add up to aggravation."—New York air traffic controller.

"Windows don't shut tight enough; there's always a draft."—New York chauffeur.

"Vents whistle at speeds over 40 m.p.h."—New York salesman.

"The body rattles sound like rain hitting the car."—Maryland lumberyard worker.

"I can't see the fenders through the rear window."—Illinois plant supervisor.

"Bad carb accelerator pump."—Missouri garage foreman.

"Trouble with the carburetor and timing."—Ohio farmer.

*With the praises numbered six through ten, Chevrolet owners get more specific:*

"There's more inside room,"—New York student.

"I like the size inside—about 4 inches more seat space."—Louisiana priest.

"Like the comfortable seats; they're higher than before."

**Backing those new  
fastbacks is something  
of a guessing game,  
but buyers  
like the shape →**

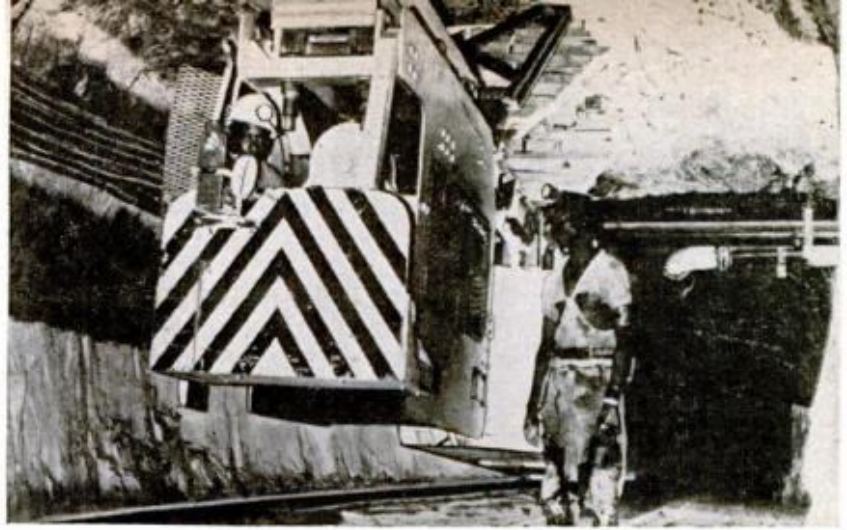
**Four-doors have a nice  
3½ inches more shoulder  
room in front, 3¼ more  
hip room in back →**

(Please turn to page 236)

## Monorail in a Mine

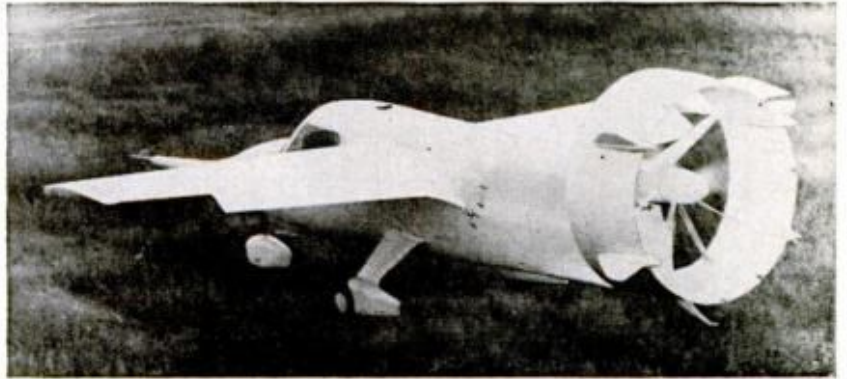
Powered by a 62-horsepower diesel, this small locomotive can pull a 30-ton pay load up an incline of 15 degrees.

Installed in a South African mine, it pulls a train of tubs along an overhead track fabricated from 10 by 8-inch steel joists. The train can negotiate curves of 25-foot radius.



## Pusher-Prop STOL

Variable-camber wings increase its lift, thousands of small holes in the wings through which air is sucked decrease its drag, and a duct around the propeller increases its thrust in this short - takeoff - or - landing plane produced by the University of Mississippi.



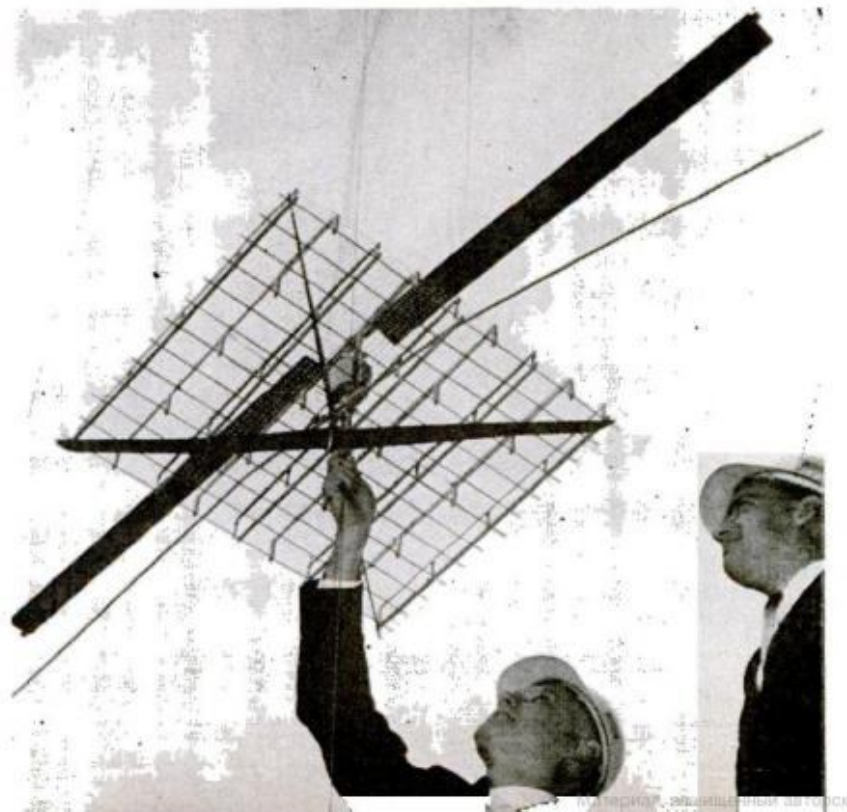
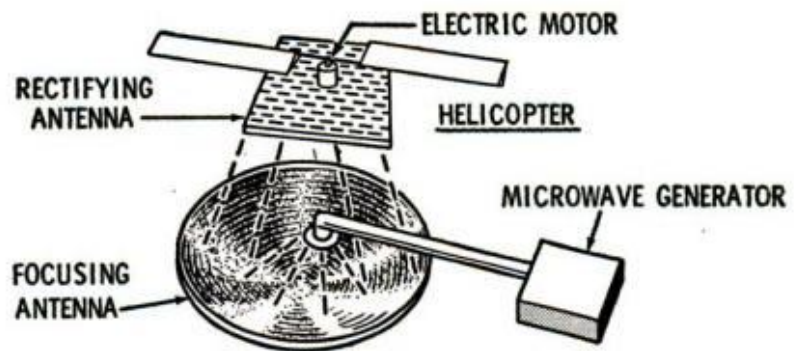
## Invisible Power

Microwave energy, like that used in radar, has—for the first time—been beamed through the air to power a motor without wires.

Demonstrating with a small tethered helicopter rotor, the Raytheon Company showed how microwaves beamed from a saucerlike transmitting antenna are converted by a rectifying antenna (a screen beaded with thousands of half-inch-long diodes), producing direct current.

Future uses of such power could be for "flying platforms" for television transmission, missile detection, aviation beacons, navigational and weather aids and surveillance satellites.

Ultimately, generators producing up to 500 kilowatts of power at 70-percent efficiency could maintain helicopters for extended periods up to 50,000 feet.





A Nationwide Survey  
Based on 504,510  
Owner-Driven Miles

# Ford's Lullaby Ride

*Marginal and boldface comments by Ed Nelson  
PM's Automotive Editor*

**"MY ONLY COMPLAINT,"** the civil engineer from New York told *PM*, "is that I own only one Ford. It's the best-riding ever, smooth, supple and extremely quiet."

A fellow new-Ford owner who sells real estate seconded the emotion. "The new ride is wonderful," he told us, "and the engine so quiet you can't believe it's there until you step on the gas. Then it's *there!*"

Not all owners agreed that their Fords were castles of silence, or would—as Ford ads indicate—top Rolls-Royce in quietness. As one Pennsylvania machinist said: "They talk so much about silent ride but we always hear the wind even with the windows closed—it's very annoying." And a Michigan

**CRISP, HARD-EDGED NEW FORD STYLING** is popular with owners of the '65, but it doesn't excite them as much as soft-look fans like Chevrolet's 1965 lines. Ford buyers appreciate their cars' rather flat cornering and comfortable ride





# Not Always Squeak Free

electrician noted: "We've been plagued with squeaks, rattles and vibrations."

Approximately 8.5 percent of the owners responding to *PM's* survey agreed with the man from Michigan, making rattles and squeaks the second most numerous complaint on these cars—all of which were sold to owners early in the new model season. But some 22.5 percent of the owners listed the new Ford's quietness as a best-liked feature, and this is up substantially from the 8.2 percent who praised the quietness of last year's Fords.

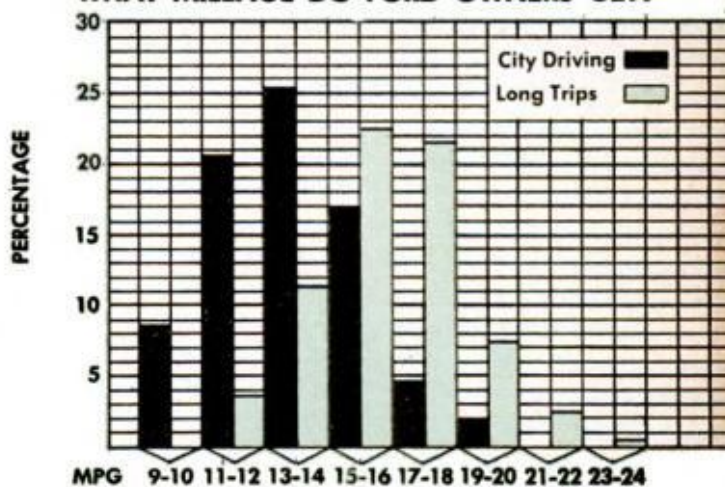
The new Fords also impress their owners as being more economical than the old ones. Some 18.7 percent of this year's owners found gasoline mileage better than expected; only 14.8 percent did last year. And complaints about gasoline mileage dropped from 14.8 to 4.4 percent.

Our test Ford was an LTD with automatic transmission and

FROM 13 TO 16 MILES PER GALLON over-all was reported by the bulk of Ford owners. Chart here shows city, highway driving fuel consumption breakdown



## WHAT MILEAGE DO FORD OWNERS GET?



## Owners Like

Well-controlled ride	(51.0%)
Effortless handling	(37.8%)
Square-cut styling	(34.0%)

## But Dislike

Sloppy assembly	(18.0%)
Rattles and squeaks	(8.5%)
Ashtray position	(7.1%)



**"DO SOMETHING BETTER WITH** tangle under the dash," one owner asked. Test LTD also had sound proofing blanket dangling from behind glove box



**AN EXTRA TWO CUBIC FEET** of trunk volume drew praise from 3.5 percent of Ford owners. It's a side benefit from squared-off style. Lift height is reduced

***This is pretty far off. Don't count on your own speedo being so optimistic***



a monster 300-hp., 390-cubic-inch engine. We expected it to use more gas and give warmer performance than a small-engined Ford. It did not disappoint us. At steady speeds, verified by *PM's* fifth wheel (throughout the range, the car's speedo read 5 to 6 m.p.h. high), we got these fuel figures: 30 m.p.h.—16.3 m.p.g.; 40 m.p.h.—17.8 m.p.g.; 50 m.p.h.—17.0 m.p.g.; 60 m.p.h.—14.1 m.p.g.; 70 m.p.h.—11.8 m.p.g.

Throughout several hundred miles of mixed city and highway driving, including acceleration and steady-speed testing, we averaged 13.4 m.p.g.

In our acceleration tests, the LTD reached a true 60 from a standing start in 9.3 seconds with a test load of about 315 pounds. We accelerated from a steady 40 to 60 in 4.8 and from 50 to 70 in 7.0 seconds using "drive" all the way. For the passing tests, the test load was held to about 250 pounds.

As usual, of course, the great majority of owners generally was satisfied with the '65 Ford. Only two percent say they wouldn't buy another; in '64, 4.5 percent said the same thing.

*Letting our owners' panel speak for itself, here are sample comments about the five features liked best:*

"They ride easier and smoother than before." Texas lineman.

"Superior riding qualities, especially over rough city streets."—Chicago policeman.

"The new suspension gives it a much better ride."—New York banker.

***Are cars better or owners more forgiving?***





**OWNERS OBJECT TO FRONT ASHTRAY** location that tempts the driver's eyes away from the road. But LTD has small extra trays in arm rests. Buyers also reported wide power brake pedal nearly traps your accelerator pedal foot

"I like the comfort and handling of the machine. There's not a bit of effort. Curves are no problem . . . no swaying or leaning."—Pennsylvania banker.

"Handles much easier than my old car ('62 Ford)."—Illinois retailer.

"I'm a hard driver and like the easy handling and flat cornering."—Illinois millwright.

"It has very harmonious lines."—New Jersey dentist.

"Our Ford is a well-built, beautifully engineered car that looks far more luxurious and expensive than the cost would indicate."—Illinois carpenter.

"It is very quiet compared to our '62."—Illinois farmer.

"There's lots of pep, if and when you need it."—Indiana salesman.

"The 150-hp. Six is very smooth and has plenty of pep."—Missouri photographer.

*Assembly and workmanship drew the most complaints, followed by rattles and squeaks, front ashtray location, wind noise, and poor finish. Here are samples of owners' reactions:*

"It is only half put together; I'd like a better assembly line."—Pennsylvania electrician.

"Radio speaker had to be repaired; chrome trim was bent; screws were out and are still falling out; left rear door doesn't fit and sometimes won't open; glass has brown blotches; the brakes seem to be going bad and the glove box must be pried

**The new chassis and new rear end make good partners in the twist**

**It's the old power-to-weight magic. Horsepower rating is up from 220 to 250 and weights have been shaved**

Even if the dealer →  
isn't interested in  
cases like this, the  
factory is. Particularly  
Ford boss Lee Iacocca

You're actually safer  
dumping your ashes  
on the floor →

open."—Illinois railroad conductor.

"There was hurried workmanship during assembly."—Texas Army officer.

"It's very noisy—doors fit poorly and there's extremely poor quality control in general. I'd best describe it as 'a pretty face with naught behind it.'"—Pennsylvania broker.

"Chrome trim seems to have been installed by accident, it is so loose and noisy and poorly fitted."—Pennsylvania salesman.

"The ashtray is inconvenient to the driver and too small."—New York restaurant operator.

"Ashtray and lighter too far away from driver."—Pennsylvania master brewer.

"There's too much wind noise at highway speeds, even with windows closed."—Missouri physician.

"The windows or vents do not seal off wind at 50 to 65 m.p.h. . . quite a bit of noise."—Texas retiree.

"Paint job not properly masked or compounded."—School guidance counselor.

"Finish not as good as in prior years."—New Jersey personnel director.

The plushy interior stimulated the first of the next group of salutes from Ford owners. With the most commented on features mentioned first, here are samples from numbers 6 through 10 of what owners liked:

"The best Ford interior ever. Good styling."—New Jersey housewife.

"Beautiful, luxurious interior with much room."—Illinois office manager.

"There's plenty of space, particularly in the front seat.

(Please turn to page 240)

### SUMMARY OF OWNERS REPORT



<b>Fuel economy</b>		<b>Best-liked interior features</b>		<b>Other make considered</b>	
About as expected	51.7%	Dashboard	16.3%	Chevrolet	22.8%
Better	18.7	Instrumental panel	12.6	Pontiac	10.2
Not as good	19.7	Upholstery	10.9	Oldsmobile	3.4
<b>Best-Liked features</b>		Seats	8.8	Buick	3.1
Ride	51.0	Roominess	7.1	Mercury	3.1
Ease of handling	37.8	Comfort	4.8	Plymouth	2.0
Styling	34.0	Trim	4.1	Dodge	2.0
Quietness	22.5	<b>Least-liked interior features</b>		<b>Is Ford family's only car?</b>	
Power, performance	17.0	Ashtray	16.0	Yes	61.6
Interior	10.2	Radio position	2.7	<b>Make of family's other car</b>	
Roominess	8.8	Seat belts	2.7	Ford	16.7
<b>Specific complaints</b>		Idiot lights	2.0	Falcon	4.4
Assembly, workmanship	18.0	Light on shift quadrant	1.7	Chevrolet	4.4
Rattles and squeaks	8.5	<b>Mechanical trouble, if any</b>		Corvair	2.0
Ash tray placement	7.1	None	72.8	Buick	1.4
Wind noise	5.4	Transmission	4.1	Pontiac	1.4
Poor finish	5.1	Power steering	2.7	Volkswagen	1.4
Gas mileage	4.4	Brakes	2.4	<b>Make of car traded in</b>	
Power steering	2.0	Oil leaks	2.4	Ford	67.1
Brake pedal placement	2.0	<b>Decision to buy Ford most influenced by:</b>		Chevrolet	6.1
Suspension system	2.0	Past Ford experience	44.9	Falcon	2.7
Dust leaks	2.0	Styling	37.8	Comet	1.7
<b>Best-liked exterior features</b>		Price	15.3	Thunderbird	1.4
Clean, chromeless body	18.4	Dealer	14.6	Mercury	1.4
Headlights	10.5	Trade-in	9.2	<b>How is dealer's service?</b>	
Front end	8.2	Ride	6.5	Excellent	53.1
Taillights	4.1	Operating economy	5.1	Average	32.0
<b>Least-liked exterior style features</b>		Power performance	5.1	Poor	7.1
No protective side trim	4.4	<b>Consider a different car?</b>		<b>Would you buy another Ford?</b>	
Rear end	3.4	Yes	44.2	Yes	86.1
Taillights	3.1			No	2.0

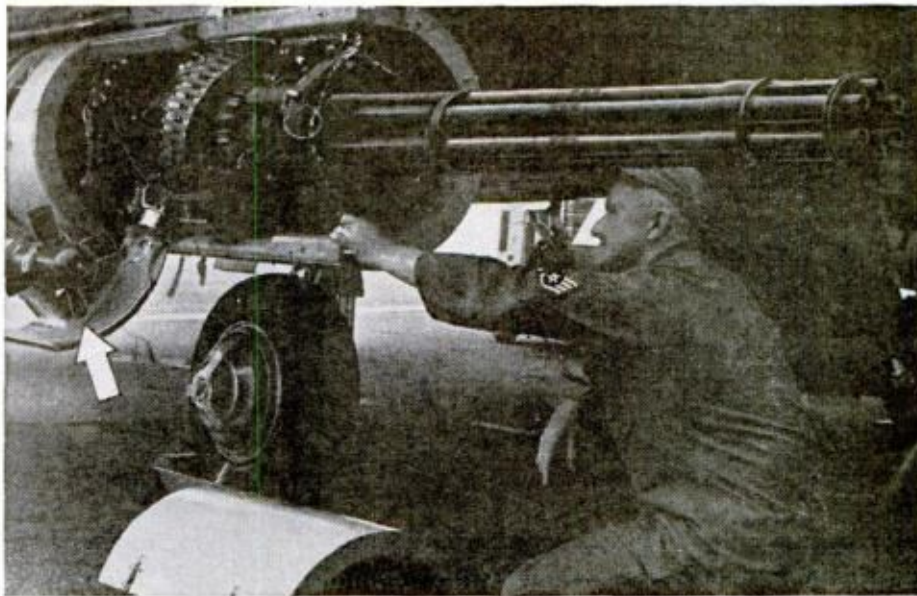
## Gun Pod

Strapped beneath the wing like a wing tank, a pod carrying a 20-mm. cannon will fire 6000 rounds per minute.

The gun, which is currently mounted permanently in the fuselage of some supersonic fighters, can now be attached quickly under the wings in the bomb pylons.

Called the Vulpod, it has a ram-air turbine generator (arrow) that supplies electrical power to the gun, and a linkless feed system that ejects the spent cartridges.

The cannon has six rotating barrels.



## Dummy in Moon Program

Moon-bound astronauts will know what to expect from acceleration and G forces thanks to this dummy, shown having his "brain" installed. In pre-manned flight experiments of Apollo program, sensing and transmitting devices in dummy's skull will register forces up to about 50 Gs.



## Wrap-Around Heels for Drivers

Shoes designed for sports car drivers have rounded, serrated heels to provide a comfortable rest for the foot on the accelerator. The heel design is also said to cut down wear on floor mats. Price is \$19.95 (plus 50 cents postage) from Fellman, Ltd., 6 E. 46th St., New York.



# Old-Time Sport in a

By John Boykin

THE GOOD KING KAMEHAMEHA I would spin in his celestial haunts if he could see what has happened to outrigger canoeing, the sport of ancient Hawaii.

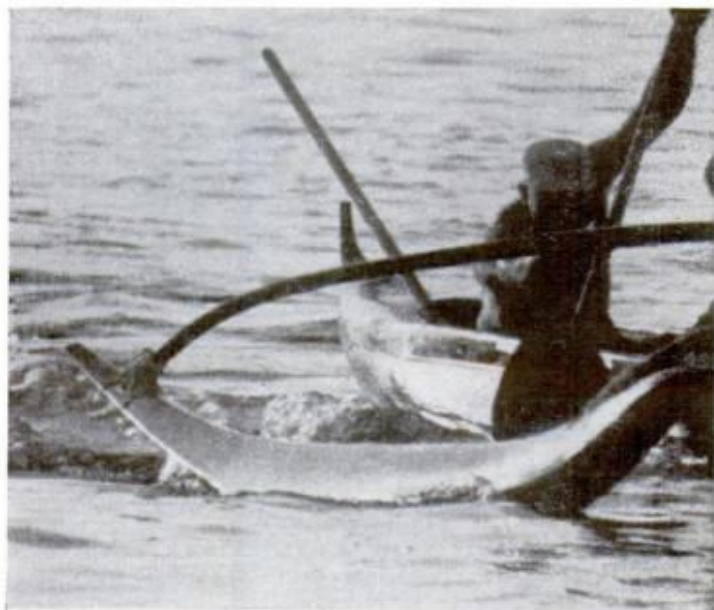
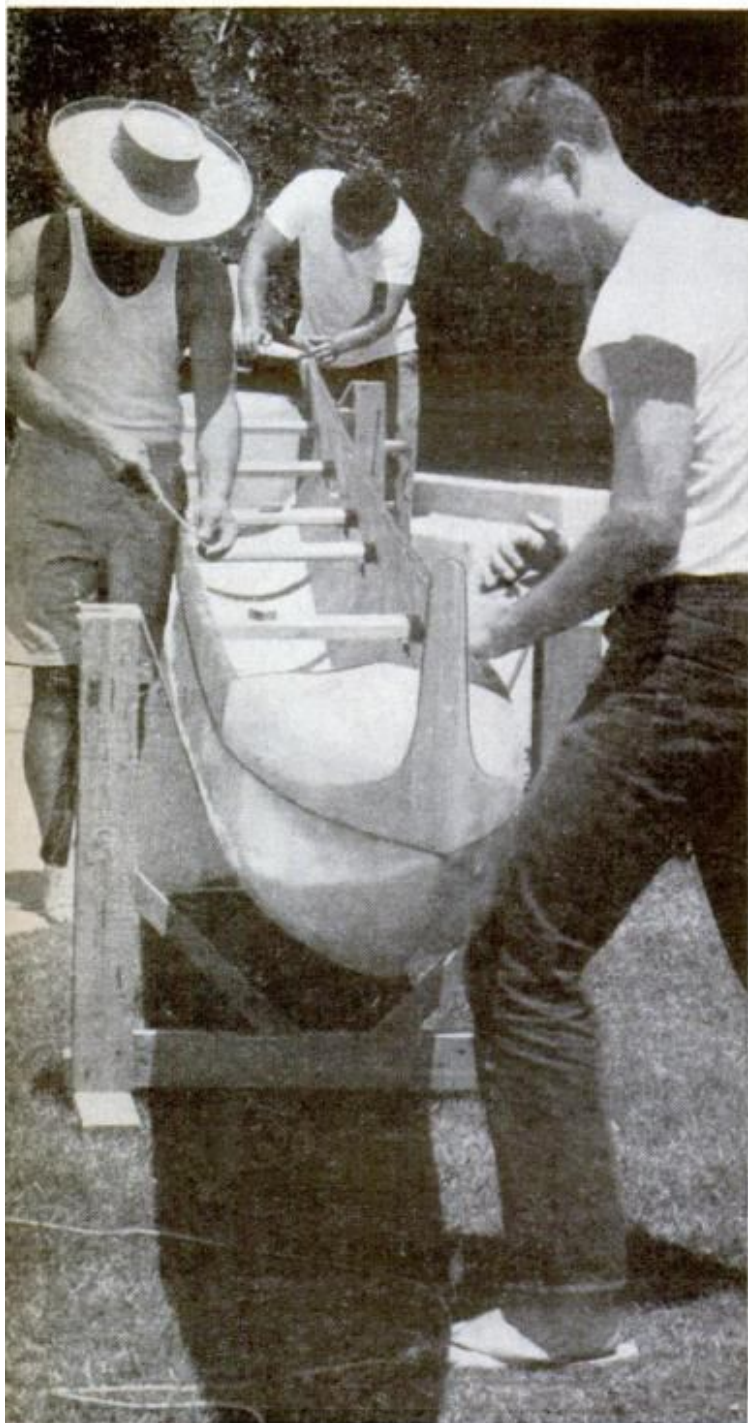
Fiberglass has happened, that's what.

With three 40-foot wooden racing canoes imported from Hawaii, the Balboa Outrigger Club attempted, a few years ago, to spread the island sport throughout California.

There was great interest, but the crafts-

manship required to carve a racing canoe from a single tree was lacking, and the cost of importing canoes from Hawaii was exorbitant.

So club members solved the problem with fiberglass. Using one of the wooden canoes as a model, they began turning out fiberglass shells. In the process they came up with an outrigger that was 150 pounds lighter than the original, is more rugged and requires almost no care while transporting. It was so good, in fact, that the



**FIBERGLASS SHELL** molded from an original Hawaiian racing outrigger is made to resemble original in every detail by members of Balboa Outrigger Club

**DIGGING FURIOUSLY** with fan-shaped paddles, the six-man crews of three 40-foot fiberglass outrigger canoes break from a start in a race in California



# Fiberglass Shell

fiberglass canoes are now being transported to Hawaii, where they are popular, and there is a special racing class for them.

In California there is now a state racing association which sponsors outrigger races, varying from sprints of a few miles to the grueling 26-mile Catalina Channel race.

Paddled by six strong men, the fiberglass outriggers cut through the water at speeds up to about 10 miles an hour, and superior crews have been known to maintain a speed of eight to nine miles per hour

for a stretch of 30 miles or more.

The canoe racing season in California extends from July to October. The crew that compiles the most points for wins is sent to Hawaii to compete in the World Series of outrigger canoeing, a 38-mile race across the treacherous channel from Molokai to Oahu, finishing at Waikiki's Duke Kahanamoku beach.

Lacking experience, the mainland crews have never placed in this race. But they get closer all the time.



**RHYTHMIC PADDLING** marks a superior crew, and they can push the delicately balanced outrigger canoe through the water at speeds up to 10 miles an hour. A recent race from Catalina Island to the mainland took four hours

**THEY'RE NOT SINKING;** this crew is just hidden behind an ocean swell as they fight for their lead in the race. The extra figure is in a small outboard

**SWAMPED,** but not defeated, a crewman bails furiously to empty the canoe and get back into the race. To accept any assistance would disqualify the canoe



# Vitamins Pep Up Old Books

INJECTING THE PAGES of rare and ancient books with vitamins to heal the crumbling fibers, monks in a Roman abbey are restoring priceless and irreplaceable treasures.

Chiefly the work of Don Mario Pinzutti, head of the Institute of Scientific Book Restoration, located near the Vatican, it involves analyzing the paper and inks, then injecting each page with a solution of vitamin PP and protein. This gives the pages greater flexibility. The paper is then submerged in a chemical bath which strengthens it before rebinding.

Many valuable documents, some dating back to the year 1000, have been saved by the process. The institute was founded by the late Pope John and continued by his successor, Pope Paul. Many unsuccessful experiments preceded the final solution.



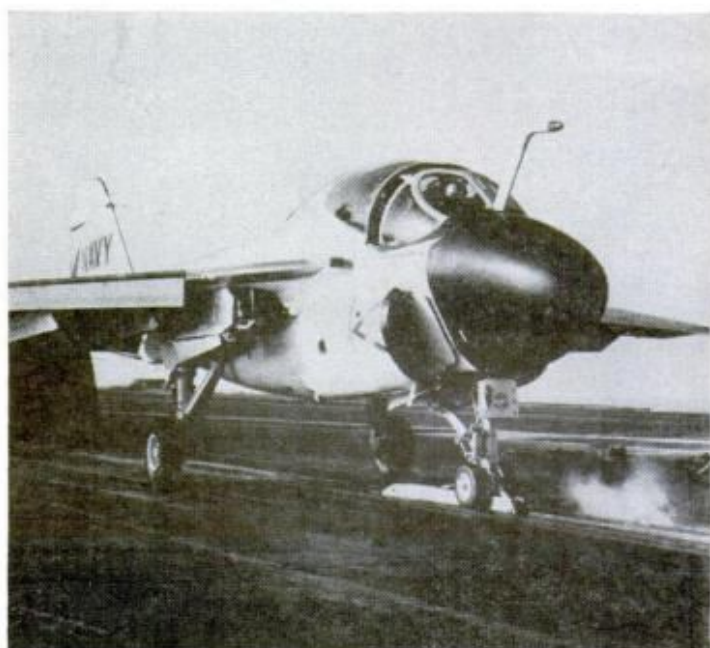
**DON MARIO** injects vitamins and proteins into leaves of ancient manuscript, after first studying them under microscope to determine their composition

## New Nose-Tow for Navy Carrier Catapults

Replacing the old wire-cable bridles used for launching aircraft from carrier decks (see *Riding the Navy's Floating Slingshots*, page 84, June *PM*), a new nose-wheel tow eliminates a five-man launching crew as well. It consists of a steel T-bar that drops into a special fitting

mounted on the standard catapult shuttle. The plane merely needs to be guided onto it. When sufficient tension is developed, a release element snaps and the plane is shot down the deck.

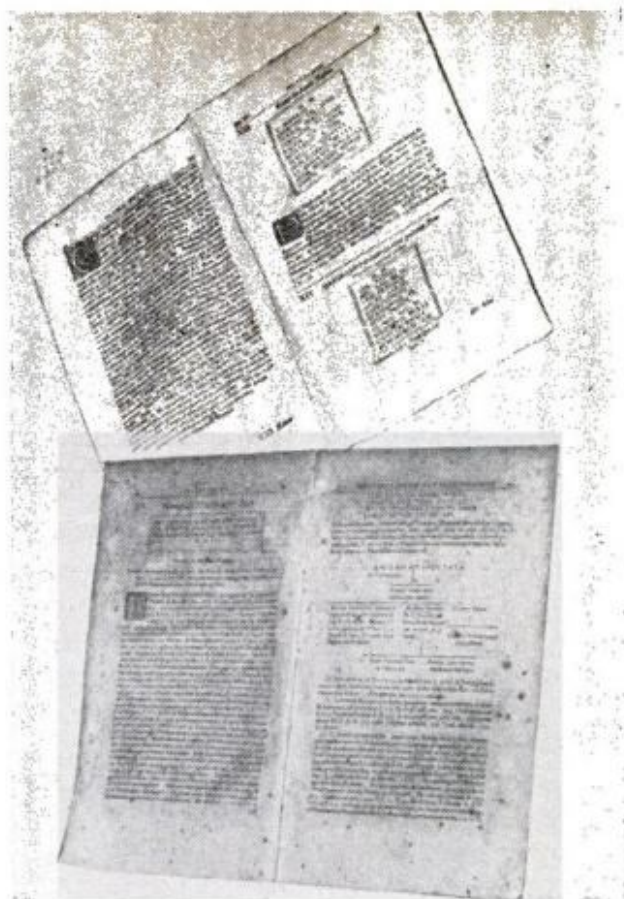
The old system used a second cable under the tail to hold a plane until release.







**CHEMICAL BATH** is used for leaves after they have been injected to strengthen them. It also cleans them up, removing spots from ancient parchments



**BEFORE AND AFTER** shows difference in pages which have been treated (top) from those which are still in unrestored condition, prior to vitamin treatment

## Pest Pacifier

Assailants can be warded off and marked for police identification by using a 2½-oz. aerosol which sprays a harmless chemical that irritates eyes, nose and throat. Made by American Jet Spray Co., Denver, Colo., "re-Pell" also contains a dye visible only under ultraviolet light. Price: \$3.95.



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## Arm Power for Handicapped

A patient with a paralyzed arm can eat and shave with the help of a research device developed at Cleveland's Case Institute. A powered splint controlled by a computer makes his arm move. The computer is activated by switches on his forehead that respond to eyebrow movements.



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# Is Aviation Going **AUTOMATIC?**

*New electronic aids all but eliminate pilots, flying planes almost from takeoff to touchdown*

By Hans Fantel

**F**OG HAD CLOSED every airport in the New York area. Except one—a specially equipped airstrip at Teterboro, New Jersey, used for testing Microvision, a new device for landing aircraft in any kind of weather.

"Ceiling zero, visibility zero," crackled the loudspeaker in the cockpit of the venerable DC-3 that the Bendix Corporation was using to check out its new landing aid.

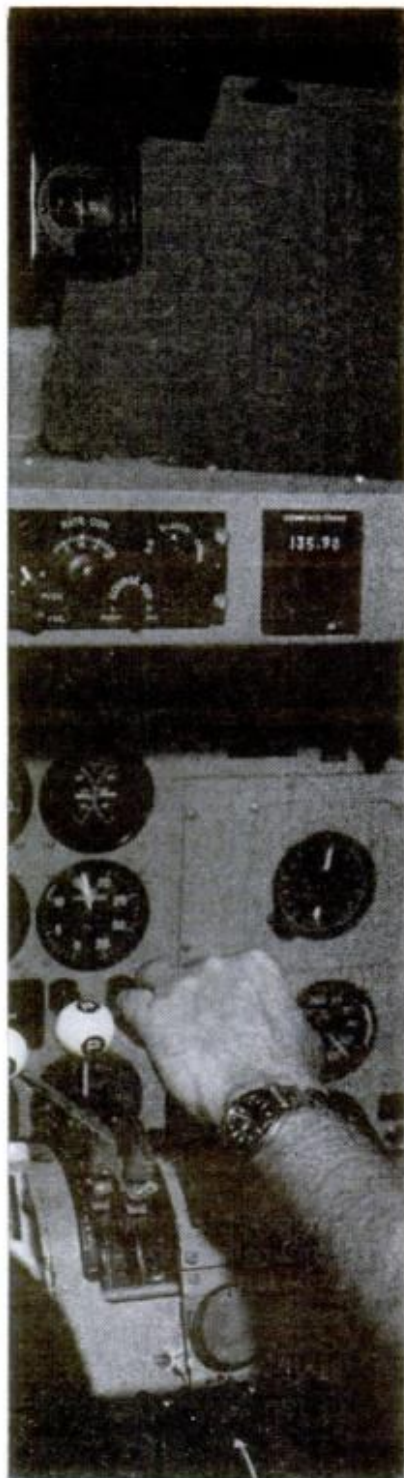
"Perfect!" grunted test pilot Earl Fredrickson. "We can't see a thing." Off we roared into the paste-gray miasma. In the co-pilot's seat I got an eerie feeling that we were flying through the inside of a featherbed.

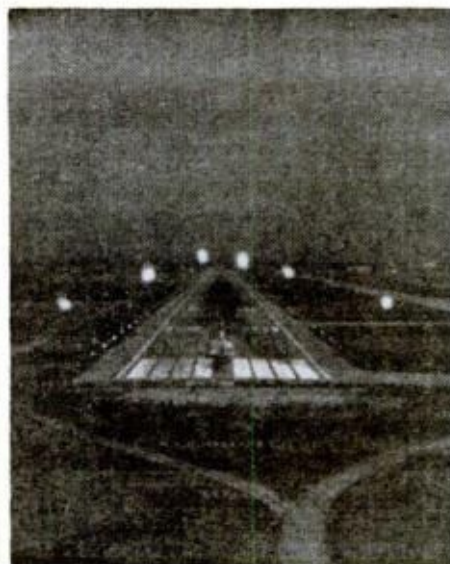
"Now let's try to get down again," said Fredrickson. Finding the airport was no problem. We just zeroed in on the radio beacon, making a standard instrument approach. But the regular ILS (instrument landing system) takes you down only to 200 feet. From then on, you're on your own.

"Here's where Microvision comes in," the pilot said over the intercom. He reached up toward a kind of TV receiver mounted above our heads and flipped down a pair of hinged glass panels—one in front of him; one for me. Suddenly, in these opaque "windows," we saw runway lights in the distance, just as they would appear in clear weather.

What we saw, however, were not actual runway lights, but an electronically simulated display on the small panels. No real

**LANDING AID**, called Microvision, projects two rows of lights that outline runway onto glass panel before pilot's eyes. Since panel is transparent, pilot can look right through it and see runway as it gradually becomes visible through fog. Transmitters buried along runway send signals





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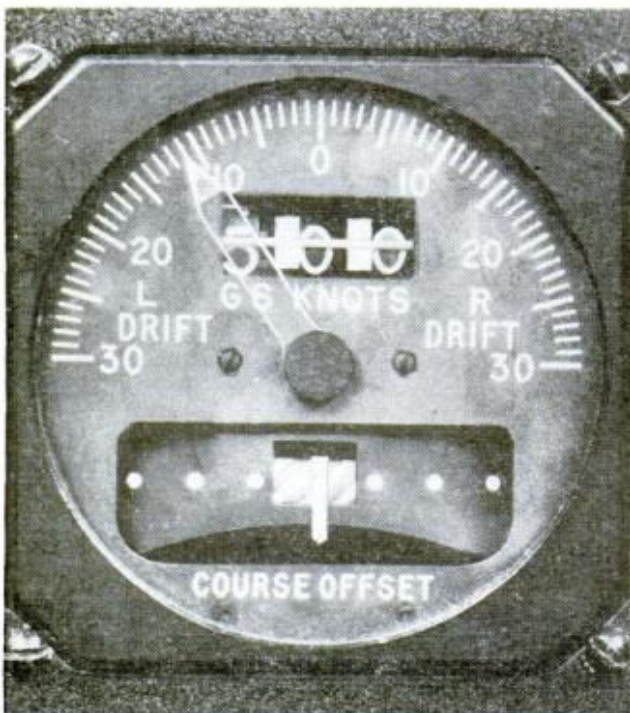
light could have penetrated the thick fog.

As we got closer, the perspective of the lights changed in a completely natural, realistic way, as if we were actually looking at the runway from the approaching plane. Two additional navigation aids appeared in our field of vision: A horizon line to indicate our attitude (nose up or nose down) and a vertical line to mark our heading relative to the center line of the runway. With the addition of those two lines to the display we could aim the plane at the runway as through a pair of crosshairs in a gunsight. It all seemed so natural I almost forgot that we were flying totally blind.

The landing was a snap. The electronically produced "runway lights" in the display had gradually crept up to the simulated horizon line as we swooped downward. When the lights reached the horizon line, we knew that we were almost level with the runway. Fredrickson pulled up the nose for the final flareout of his landing run. A moment later a soft thud confirmed a perfect touchdown.

Microvision is only one of several electronic devices designed to solve problems that persistently plague aviation, both enroute and during landings. Foul-weather landing is one of the oldest headaches. And new ones have sprung up with the jet age. The sheer speed of today's planes and tomorrow's SSTs (supersonic transports)

**DOPPLER PANEL** display gives pilot running account of speed in knots and drift angle in degrees. Miles left or right of course are shown at bottom



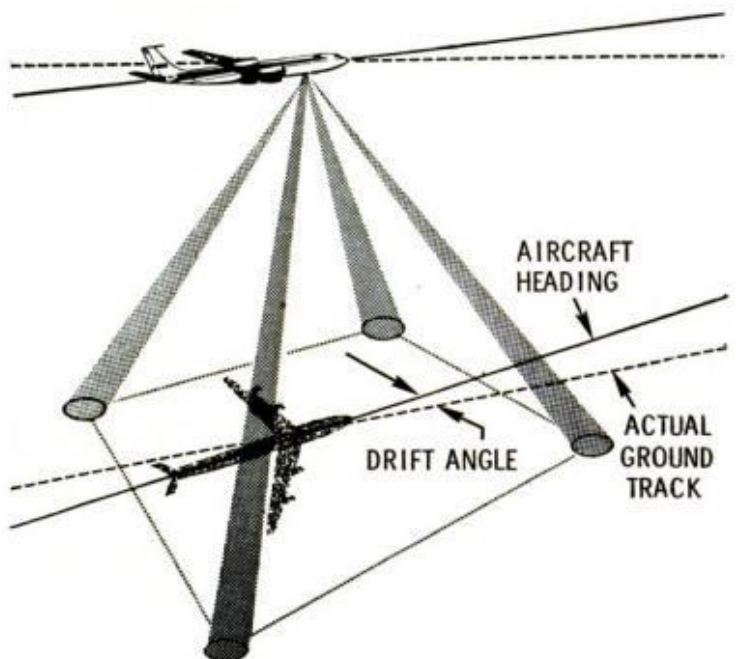
raises new problems in transocean flying, where ground guidance from shore-based radio beacons is only marginal. The new electronic flying aids have successfully tackled these difficulties. Blind-landing systems are still experimental; but self-contained navigation devices, independent of ground support, already are guiding over-water flights.

In principle, Microvision is distantly related to TV. Microwave signals are made visible on the screen of a cathode ray tube. Six small transmitters spaced along the runway send out narrow beams of these signals like invisible searchlights penetrating the fog. One pair of transmitters marks the start of the runway, another the middle, and the final pair marks the end. A special receiver in the nose of the plane picks up these signals through highly directional antennas that pinpoint the location of each runway transmitter. Thus they receive an electronic image of the runway outline, which then appears on a cathode ray tube screen. From there, an optical system projects the image onto the transparent display window.

"It's a heads-up display," explains John Lauricella, the development engineer who nursed Microvision to its present advanced state. "The pilot doesn't lose vital seconds looking back and forth from windshield to instrument panel."

TWA recently demonstrated a system

**DOPPLER SYSTEM** sends out four signals. Difference in frequency of return signals tell speed and drift angle. Information is fed automatically to autopilot



that goes one step forward. Microvision is merely a visual aid to the pilot who is still flying the aircraft. TWA's Auto-Scan actually flies the airplane, through the autopilot, down to within 1200 feet of the end of the runway and 100 feet above the ground. At this point the pilot, theoretically, can see the runway lights and take control manually.

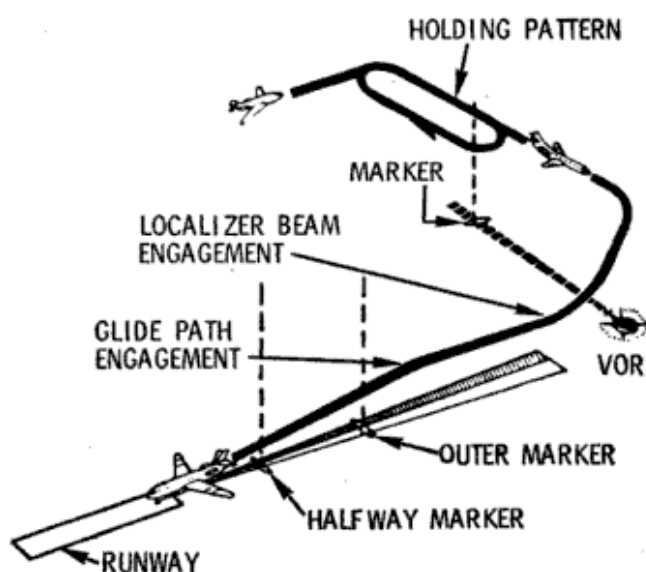
Auto-Scan "locks on" to the ILS, aligning the aircraft for proper direction and rate-of-descent, and adjusting the throttles during the approach for proper speed. At any point, the pilot can override the system if necessary.

Two more systems take the third step.

The more radical approach to landing problems has been worked out by the British. Their system, called BLEU (Blind Landing Experimental Unit) lets you land without even looking. In fact, the pilot just sits with his hands in his lap. An electronic computer, interpreting signals from two ground-based transmitters, is linked directly to the plane's autopilot and guides the aircraft all the way to touchdown. To guard against slip-ups, three separate computers are carried aboard, each checking the accuracy of the others.

Passengers won't be able to tell who—or what—is flying their plane with BLEU. Not even the moment of touchdown tells whether the landing was made by a pilot or a computer. "BLEU always gives you an

**AUTOMATIC LANDINGS**, completely "hands off," are accomplished through autopilot, locking on to localizer and glide-path signals in Sud-Lear system



average landing," says Raymond Bray, a British pilot who has flown BLEU tests for three years. "It's never cream-smooth, never rough—just a normal bump or two."

A likely competitor in this bracket is the Sud-Lear system, developed jointly by Sud-Aviation in France and Lear-Siegler Corp. in the U.S. It is now being tested in French Caravelle jet liners. Here, too, ground guidance grabs the plane at 200-foot altitude (at the end of a standard ILS approach when the plane is already lined up with the runway) and brings it down on a glide path within 50 feet above the ground, then pulls up the plane's nose into a flare-out for landing. Engine throttles are automatically controlled to assure a stall point inches above the runway.

United Air Lines, which has been testing the Sud-Lear system on its twin-jet *Caravelles*, may be the first American airlines to employ all-automatic landings.

### Pilots Are Skeptical

Despite thousands of successful tests of autoland systems, most airline pilots sniff at the notion of letting a gadget land their plane for them. They just don't like the idea of staking their own and their passengers' lives on a robot's judgment.

"Such objections are emotional rather than rational," muses one British airline executive. "Naturally the pilot resents just sitting their idly during the most critical 20 seconds of his flight. But the fact is that today's jets already are virtually automatic. The pilot just monitors while the autopilot does the actual flying. Automatic landing is the inevitable extension of electronic progress."

A battle seems to be shaping up between proponents of "hands-off" autoland systems and the partisans of pilot control with electronically provided visibility.

By contrast, things are fairly settled in the second major area of new electronic flying aids—self-contained navigation systems for enroute flying. These devices have successfully solved another jet-age problem: the navigation of high-speed aircraft over oceans and deserts.

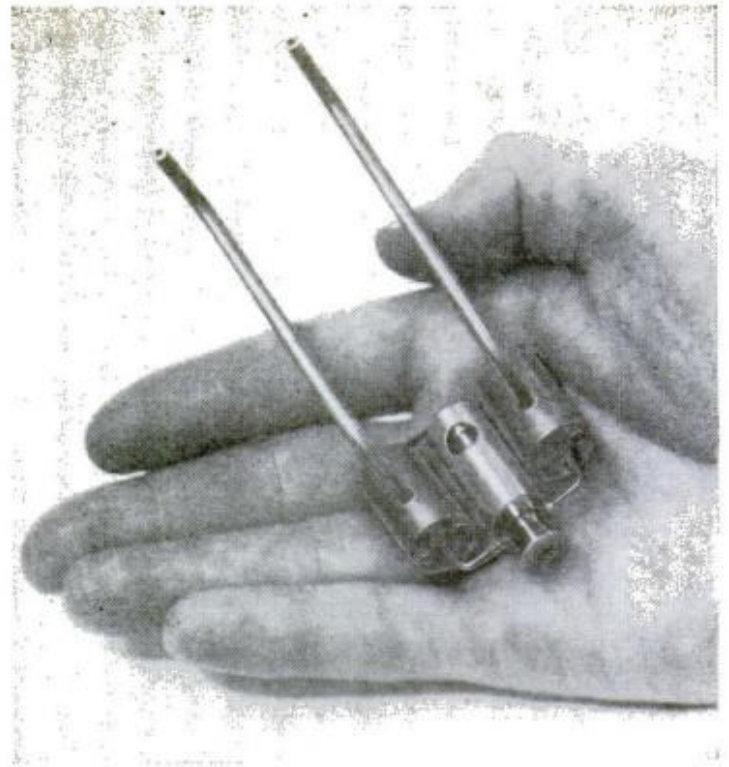
"On overland routes, you just follow the established airlines marked by radio ranges," explains Capt. Gordon Granger, chief of research and development at Trans World Airlines. "But we have lots of trans-Atlantic flights, and there are no radio

(Please turn to page 216)



### Quick-Release Back Pack

U.S. Marines may soon be replacing their canvas back packs with a 13-ounce nylon version that is three times more durable at one-third the weight. The XM-1964 also features quick-release shoulder straps for easy removal.



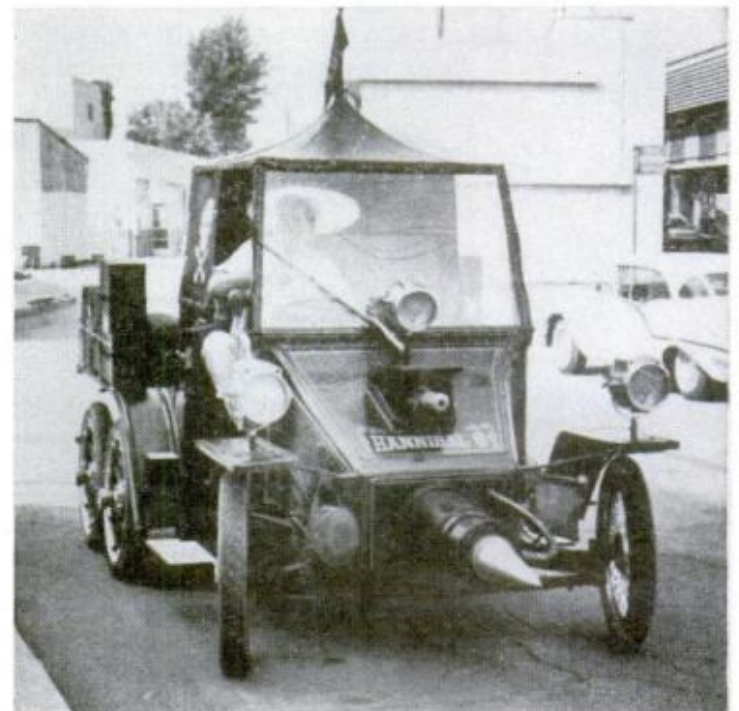
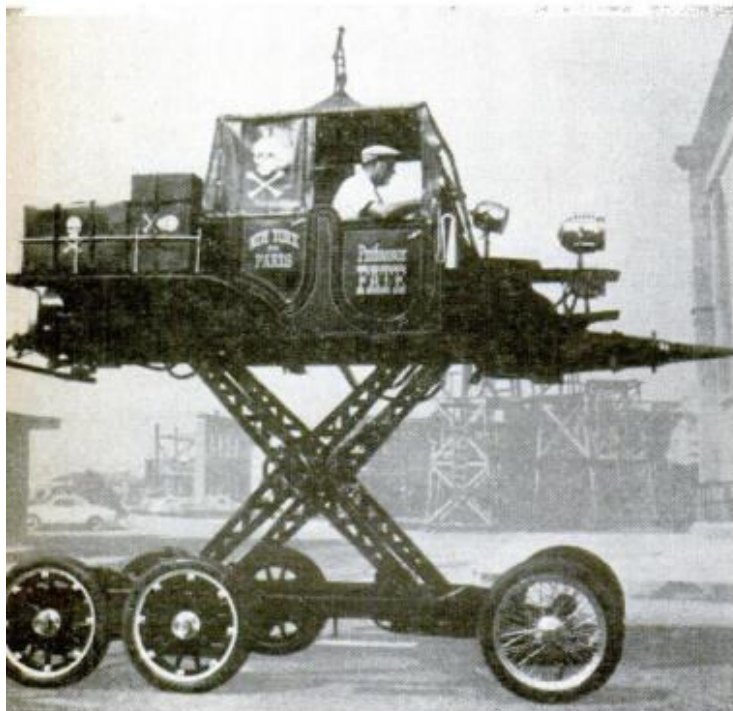
### Lowest-Powered Rocket

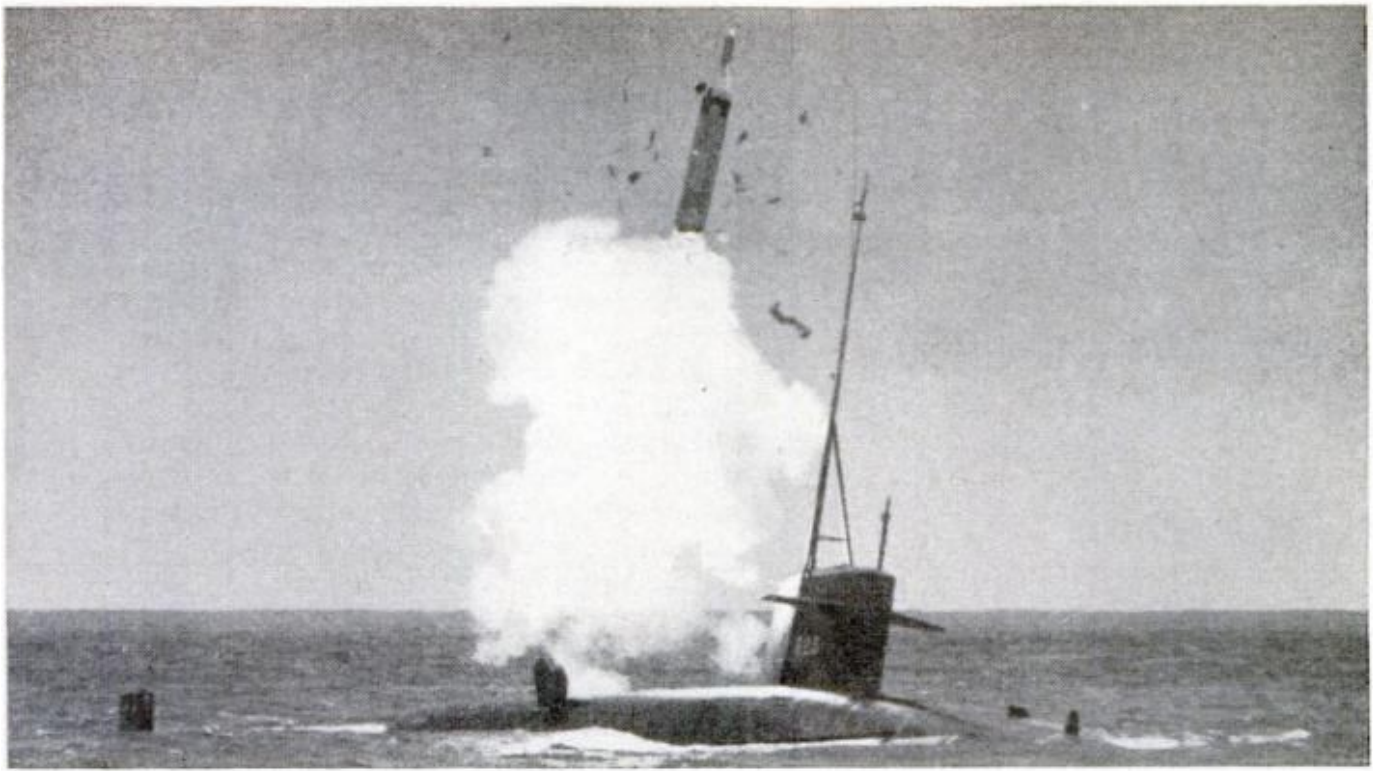
Capable of being throttled as low as five ten-thousandths (.0005) of a pound of thrust (the smallest yet for a high-performance propellant system) a tiny rocket will make slight position changes in space vehicles. It's by United Technology Center.

### Low Road or High Road—It Doesn't Matter

Warner Brothers—not Detroit—is responsible for one of the strangest cars ever built. It's called Hannibal 8 and will appear in a movie about a fictitious old-time auto race. Powered by an 80-hp. engine, Han-

nibal is designed to be a winner. It has a cannon for stopping competitors and a smoke screen generator. A hydraulic mechanism allows the body to scissor into the air (left) in crossing streams.





### **Polaris Missiles Launched from Nuclear Subs While Surfaced**

Designed originally to be launched from submerged submarines, Polaris missiles can be shot from surfaced submarines as well, recent tests proved.

The debris flying through the air in the picture are launch adapters designed to

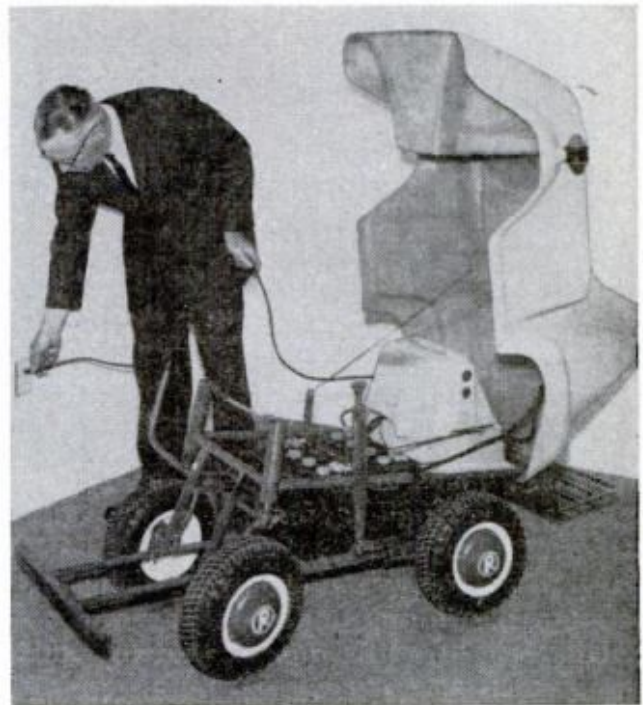
detach themselves immediately, once the missile has left the tube.

The submarine is the USS *Henry Clay*, and its slight port list is standard in surface launches. Thirty minutes earlier, it had launched another Polaris while submerged.

### **Mobile Easy Chair Runs on Battery Power**

Wheel around village, yard, golf course—you name it—in solid comfort, at speeds of one to 15 m.p.h. A new little electric car with fiberglass body, molded to fit people, boasts six speeds forward; six re-

verse. Two batteries yield 1½ hp.—enough to buck snow or climb a ramp. Plug it into house current for recharge. The basic “Reddy-Go” is \$495 from American Battery Car Inc., Middlebury, Ind.



# Buyers' Guide to Shortwave

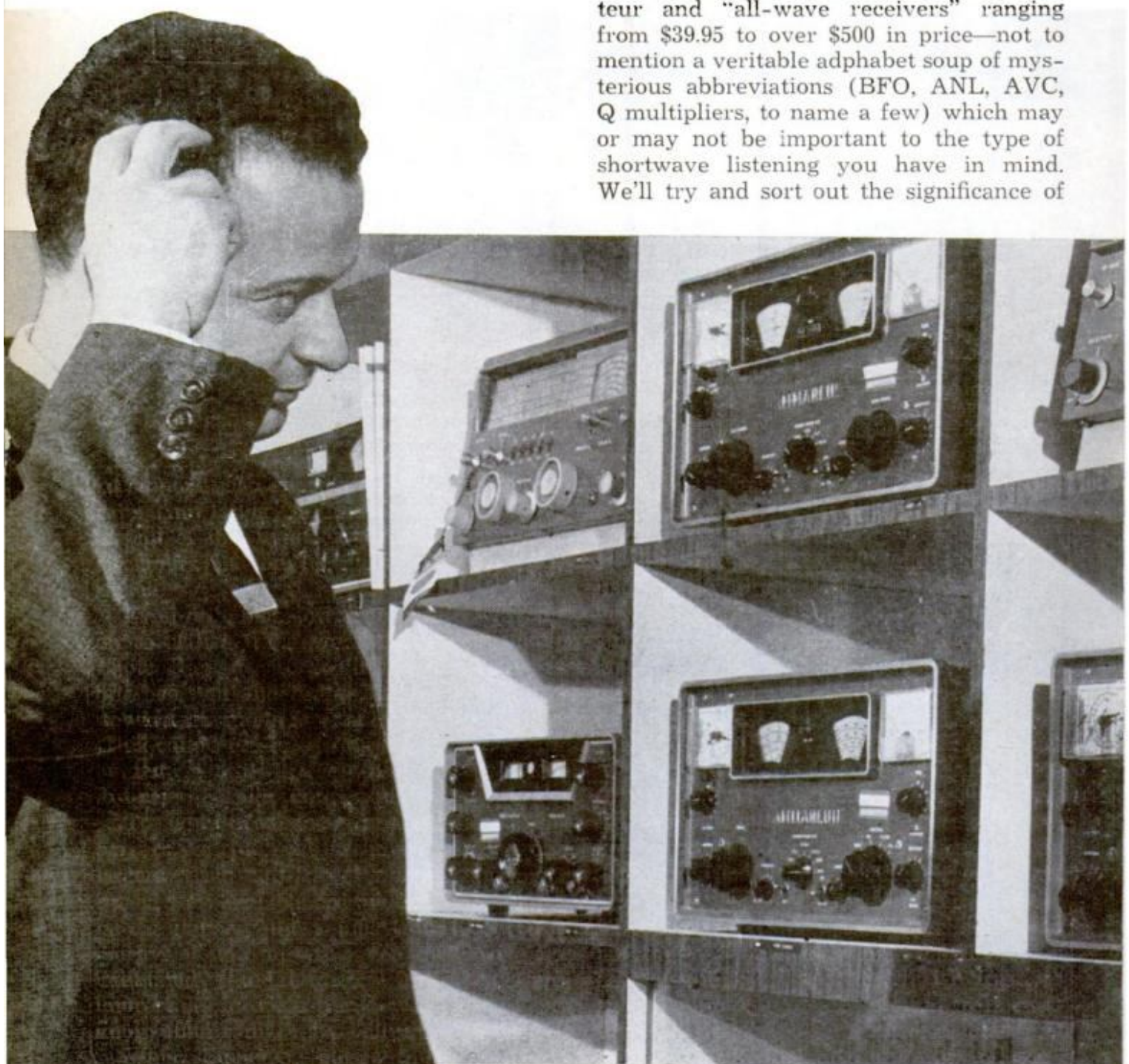
*Amateur or all-wave? \$39 or \$150? And how much of that alphabet soup of extras do you need? Try these shopping tips*

**By Larry Steckler**

**T**O TAP THAT WORLD of airwave adventure surrounding you—police calls, marine communications, satellite signals, radio amateurs, aircraft or foreign broadcast stations—you may think that you need only to switch on any shortwave radio receiver.

But step into a radio showroom, or leaf through the radio receiver pages of an electronics catalog, and you enter a world of confusion.

Suddenly, you're surrounded by amateur and "all-wave receivers" ranging from \$39.95 to over \$500 in price—not to mention a veritable alphabet soup of mysterious abbreviations (BFO, ANL, AVC, Q multipliers, to name a few) which may or may not be important to the type of shortwave listening you have in mind. We'll try and sort out the significance of





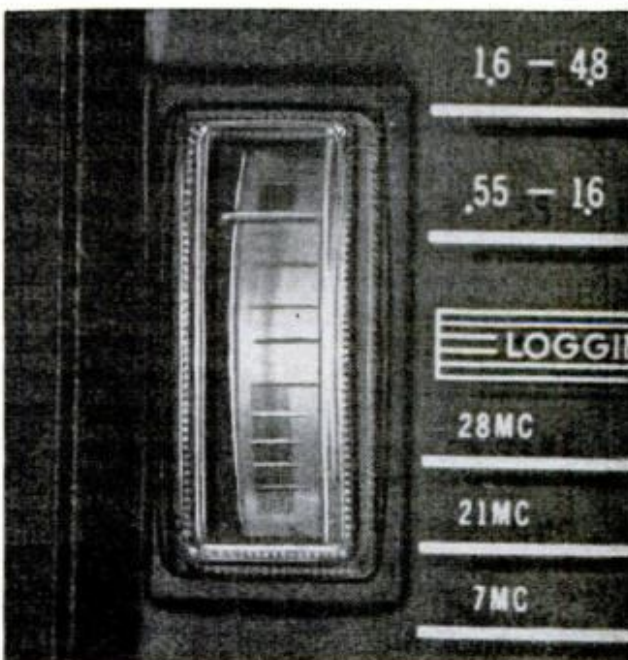
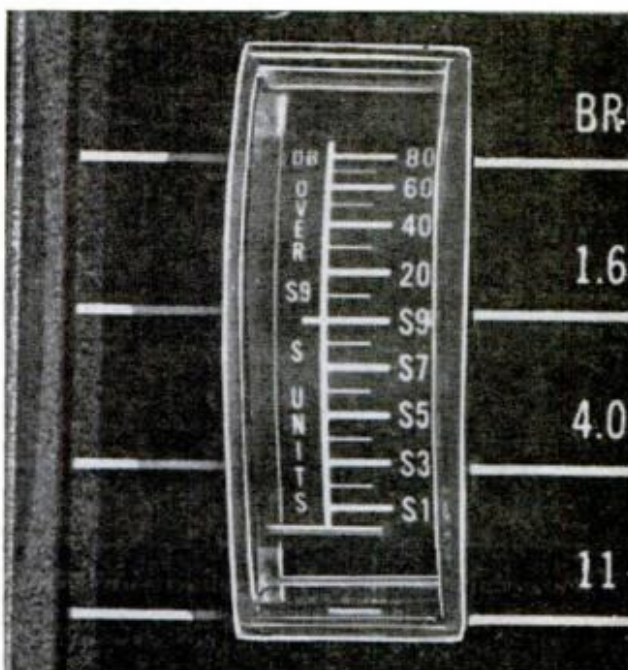
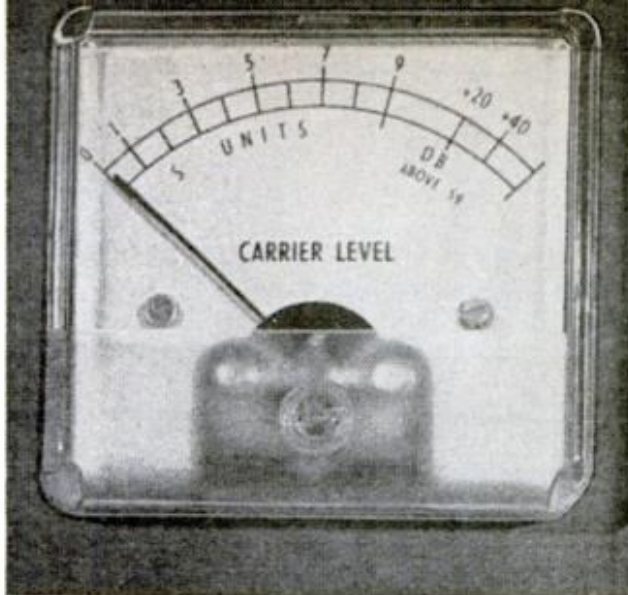
# Receivers

these alphabet extras for you in this article.

Before you walk into the showroom you should decide what type of listening you intend to do—amateur radio or general-purpose “all-wave” shortwave listening. The amateur receiver concentrates on the amateur radio bands at 3.5-, 7-, 14-, 21- and 28-megacycles. The bandsread dial on these sets is calibrated for these bands.

The general-purpose set, on the other hand, carries labels at around 1.6-mc. (1600 kc) for police radio, 2.5-mc. for ship-to-shore phones, as well as amateur frequencies and the most commonly used foreign-broadcast frequencies.

It is interesting to note that the 1.5 to 4-mc. area is generally good for reception up to 300 miles and nighttime listening. From 4 to 8-mc., expect 300 miles daytime



**S-METERS MEASURE** signal strength. Standard types (top) are easiest to read and large scale makes them most accurate. Current trend is to smaller vertical dial. Avoid the uncalibrated ones (center)

## What the Shortwave Dollar Will Buy

**PRICE: Under \$75**

**FEATURES**

- 4 bands
- No r.f. stage
- 540-kc to 30-mc
- May not have S-meter
- Fixed frequency BFO
- May not have headphone jack

**PRICE: Under \$100**

- 4 bands
- May not have r.f. stage
- 540-kc to 34-mc
- S-meter, but may not be calibrated
- Fixed frequency BFO
- Headphone jack
- May have basic Q multiplier
- May have basic noise limiter

**PRICE: Under \$150**

- 4 bands
- R.F. stage
- 540-kc to 34-mc
- 25:1 tuning ratio
- S-meter
- Automatic noise limiter
- BFO, may be fixed frequency circuit
- Antenna trimmer
- Headphone jack

**PRICE: Under \$200**

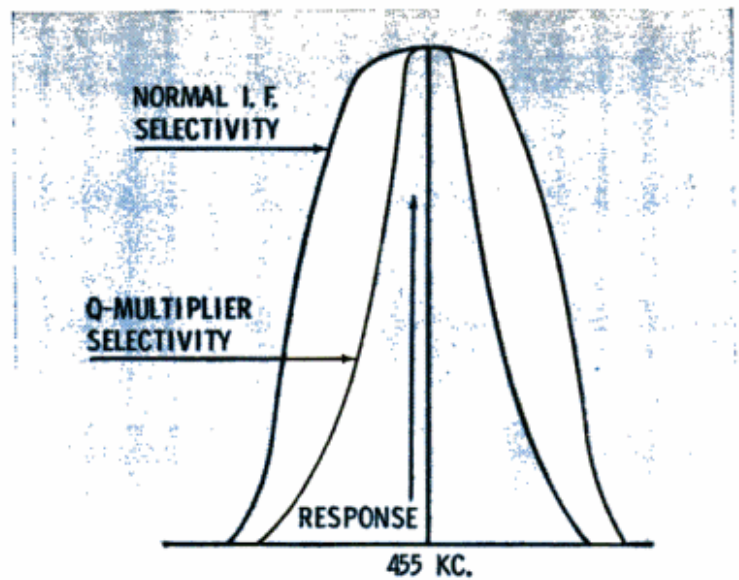
- 5 bands
- R.F. stage
- 540-kc to 34-mc
- 30:1 tuning ratio
- Calibrated S-meter
- BFO with pitch control
- Automatic noise limiter
- Basic Q multiplier
- Dual conversion
- Antenna trimmer
- Headphone jack

**PRICE: Under \$300**

- 5 bands
- R.F. stage
- 540-kc to 34-mc
- 60:1 tuning ratio
- Calibrated S-meter
- Variable i.f. selectivity
- Noise limiter automatic
- Automatic volume control
- Single-sideband reception
- Dual conversion
- Antenna trimmer
- Headphone jack

**PRICE: Under \$450**

- 6 bands
- 2 r.f. stages
- 540-kc to 109-mc
- AM and FM (27-MC to 109-MC)
- 60:1 tuning ratio
- Single sideband reception
- Automatic volume control
- Automatic noise limiter, adjustable
- Triple conversion
- Adjustable i.f. selectivity, notch filter
- Plug-in crystal tuning
- Push-pull 10-watt audio output
- Clock timer
- Antenna trimmer
- Headphone jack



**Q-MULTIPLIERS** narrow bandpass of the i.f. amplifiers resulting in greater selectivity in the receiver. Means more stations and less jumble to you



**WITH VERNIER TUNING**

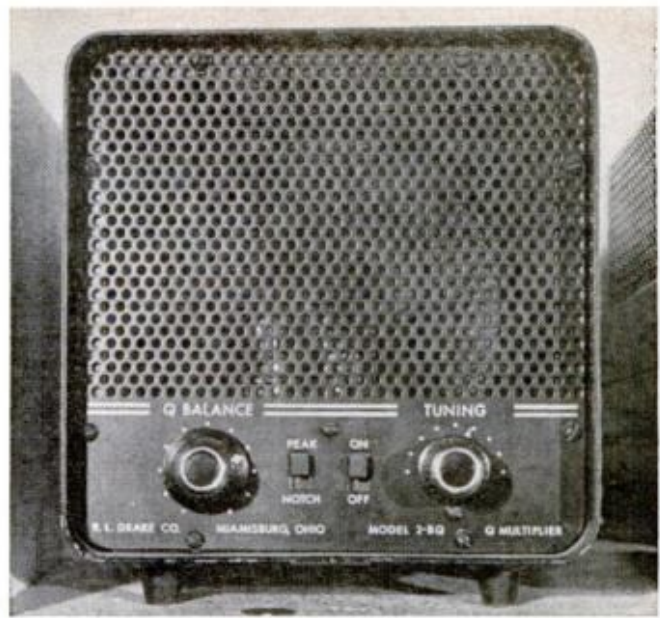
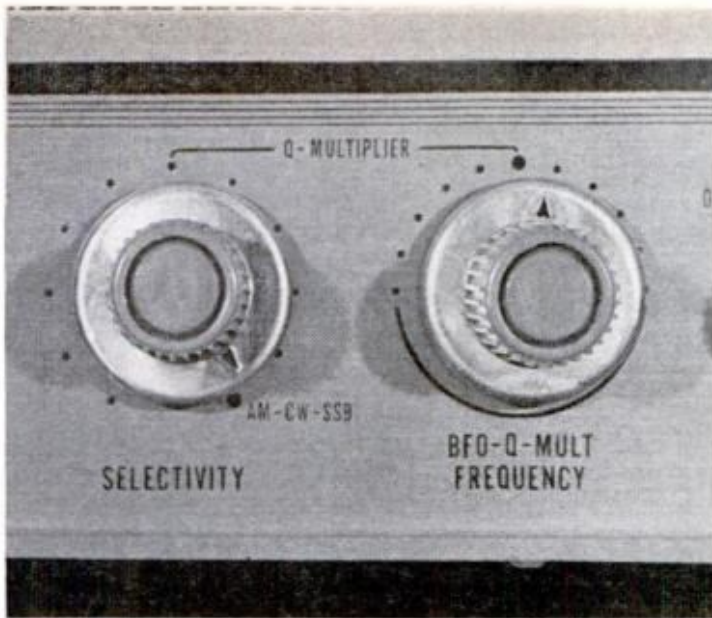
**WITHOUT VERNIER TUNING**



**QUARTER TURN** of high-ratio dial at left covers less tuning distance (colored band) than same turn of low-ratio dial at right. Simplifies tuning

and up to 1500 miles at night. From 8 to 14-mc., look for under 2000-mile range during the day and over 2000 miles at night. For 14-mc. to 34-mc., expect 1500 miles or more with best results in the early morning or evening.

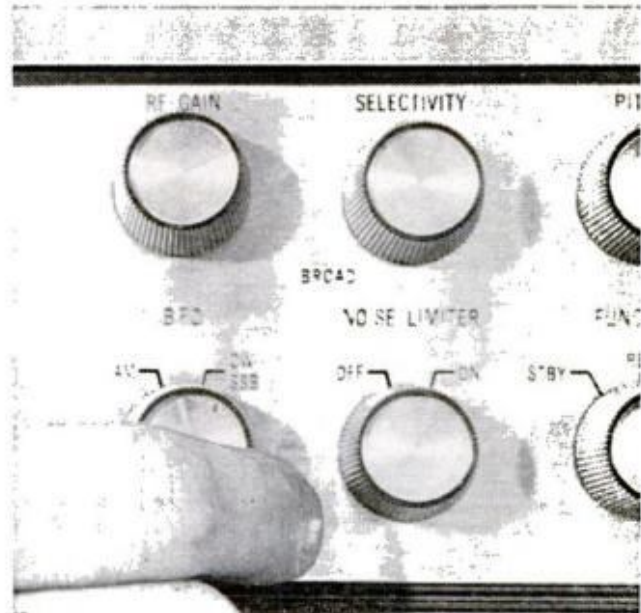
Portable all-wave sets are usually transistorized and come with a built-in pole-type antenna. In general, they will not perform as well as a nonportable receiver selling for the same price. The built-in antenna can only deliver a small fraction (as little as one tenth or less) the signal picked up by a long 150-foot single-wire antenna. Also the portable's transistor cir-



**UNTIL RECENTLY** Q-multiplier circuits were only available as accessories (right). Now they are being incorporated into design of newer sets (left). They help separate shortwave stations that are crowded together and overlapping



**PRESECTOR** can really bring in long-range broadcasts. This extra tuned r.f. stage is found in only the very best and most costly shortwave receivers



**CLUSTER OF CONTROLS** looks impressive; and noise-limiter knobs are switches, do not adjust. R.f. gain and selectivity controls are not calibrated

cuitry is inherently noisier. When you are listening to a strong station, this noise cannot even be heard. However, tune in a weak distant signal and you may find yourself getting more noise than signal. For best performance for the price, then, stick to a nonportable vacuum-tube type receiver.

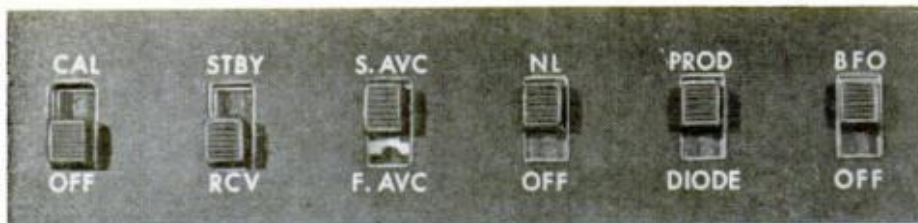
Speaking of price, a key difference between rock-bottom \$39 sets and more expensive ones is that cheaper sets usually have fewer tubes.

When comparing receiver performance in the store and trying some of the tests mentioned in this article, ask the salesman

to be sure that the sets you try are all connected to the same antenna. Most stores have a setup for switching any radio on display to a particular antenna. But if you really want to play it safe, don't rely on the switching. Try one set plugged into one particular antenna jack, then unplug it and hook up the next one. A good set hooked to a poor antenna will not perform as well as a poor set connected to a good antenna.

Three main factors determine quality. They are stability, sensitivity and selectivity.

**Stability** refers to the set's ability to stay



**SLIDE SWITCHES** always look neat but frequently lead to trouble. They are more likely to break down and require replacement or service than standard toggle switches

tuned to a station and not drift off frequency. Check by tuning in a weak station for 10 minutes or so. The station may fade in and out (volume level may change) but you should not have to touch the tuning control again.

**Sensitivity** is the ability of a radio to receive a weak station. Check by tuning in the same weak distant station on several sets. If one delivers a stronger, clearer signal than the rest, it's the most sensitive set.

**Selectivity** is the receiver's ability to pick out one station from a group of stations crammed tightly together. Tune a receiver to a crowded portion of any band. Then, using the bandspread control, see how many stations you can sort out of the jumble. Test several sets this way. The one that most easily tunes in the largest number of stations is best.

**The alphabet soup.** Almost all short-wave radios include a headphone jack and an S-meter. The jack should be mounted on the front panel for easy access. Headphones are a must for good listening to

weak or distant stations, and adding a jack to a set that doesn't have one can sometimes be difficult.

If you start collecting QSLs (confirmation cards from the stations you listen to), you want the S-meter to give you a signal-strength reading to relay to the station when asking for a card. But the S-meter should be calibrated and have a large easily read dial. If you have a real basic set that does not include an S-meter, there's an accessory meter you can add.

**Noise limiters** are electronic circuits intended to protect your ears against sudden loud bursts of static. Almost all receivers above the economy class include such a circuit. Automatic noise limiters (ANL) are handy, but should have a sensitivity control so you can select the point at which they go into operation; an On-Off switch is not enough.

To compare such circuits, tune to a noisy spot on the dial, then flip in the circuit and judge how effectively the noise level is cut back, without eliminating the station

[\(Please turn to page 226\)](#)

KNOW YOUR RECEIVER FEATURES			
<b>R.F. STAGE</b>	Radio frequency amplifier located ahead of other receiver stages. If you want really long-range reception make sure your receiver includes this circuit. Best sets have 2-stage circuit (preselector)	<b>VARIABLE SELECTIVITY</b>	Electronic circuit that adjusts bandwidth of i.f. stages enabling reception of weaker more distant stations. Look for range of adjustment and crystal filters. See diagram on page 118
<b>S-METER</b>	Signal-strength meter. Look for large calibrated dials and a long scale. Vital if you intend to obtain QSL cards. Large dial eases tuning and taking accurate signal-strength readings for QSL's	<b>ANL (AUTOMATIC NOISE LIMITER)</b>	Circuit designed to reduce background noises of all types. A real help if you live in an area where a lot of electronic static is present. Look for a sensitivity control if circuit is not automatic
<b>TUNING RATIO</b>	Ratio of distance tuning control knob turns to distance station selector dial actually moves. Larger the ratio, the more selective your tuning. See the diagram on page 118 for greater detail	<b>ANTENNA TRIMMER</b>	Matches receiver input to antenna for best performance. Look for front panel control. It often helps to readjust trimmer after tuning station. Brings the desired station up out of the clutter
<b>BFO (BEAT FREQUENCY OSCILLATOR)</b>	Absolute must if you intend to listen to Morse code broadcasts. Keeps tone of signal constant making code reading easier. Look for a variable pitch control so you can select the tone you want	<b>HEADPHONE JACK</b>	A must for listening to distant stations. Phones eliminate otherwise distracting local noises. Look for front panel jack. Other locations are not as convenient. Found on almost all receivers

# Laughing Tables

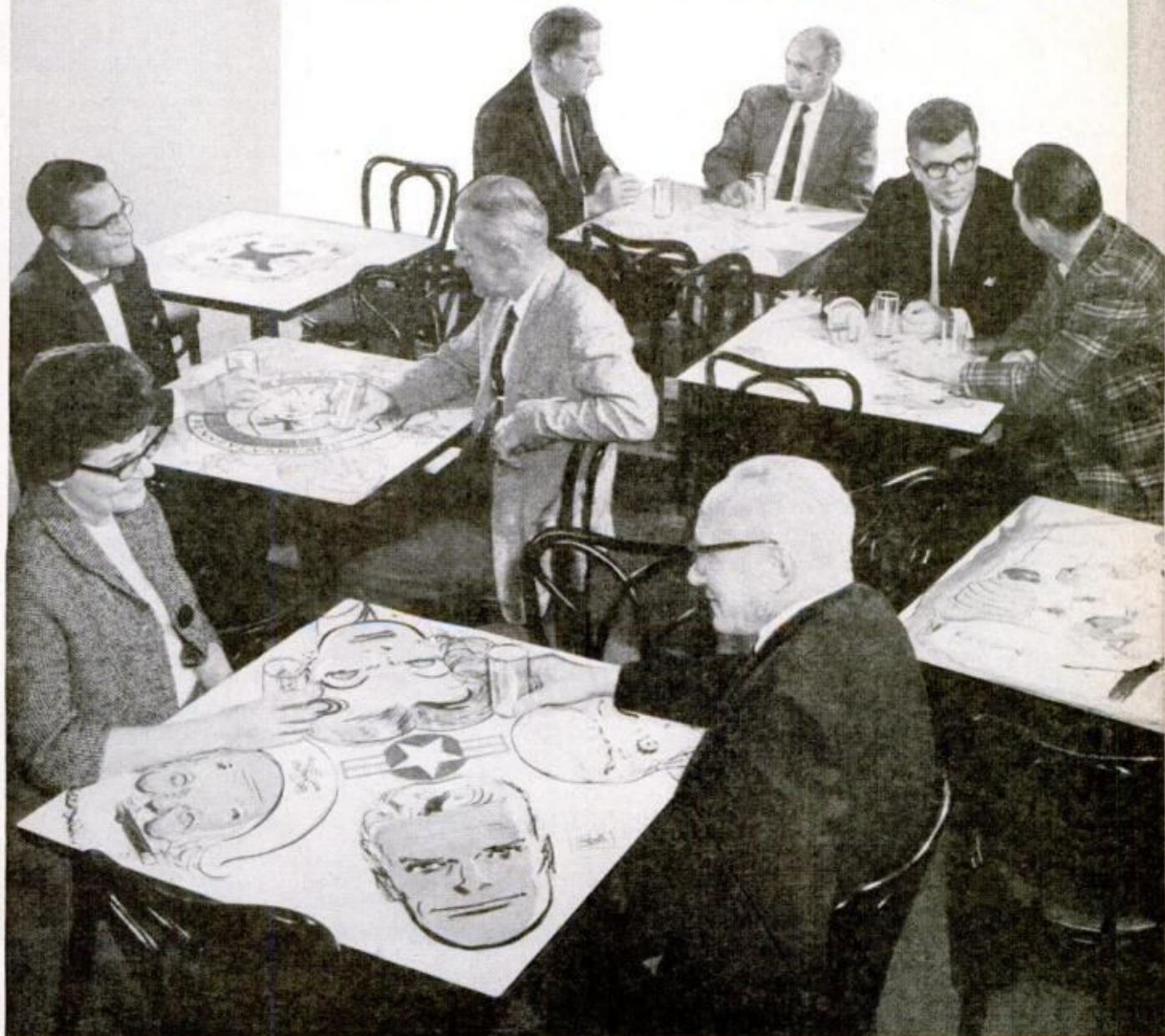
*Sealed in plastic tabletops, dozens of characters from famous comic strips clown for Fred Waring's friends in a unique "Cartoon Room"*

**W**ALKING DOWN the long corridor to the taproom beneath the lobby of Fred Waring's hostelry at Shawnee, Pennsylvania, is a pastime designed to provide chuckles.

Actually, it's like wading through the family room on a Sunday afternoon, after the kids have dismembered and abandoned the comic sections from every newspaper in the neighborhood. Original drawings of familiar funny faces peer, leer and grin from the walls.

In the taproom itself, bristle-headed little *Nancy*, the *Katzenjammers*, *Mr. and Mrs.*, the *Little King* and scores of

**FAMILIAR FACES** from the nation's most famous comic strips, gaze at customers from table tops in the Cartoon Room of Fred Waring's famous Inn



other comic strip characters, lie uniquely imbedded in plastic on every table top, as well as in an array of plastic panels on the stage. Legends in the balloons sing the praises—and kid the golf game—of the Inn's famous host. "The Waring Keep-Your-Head-Down Machine" is the label on Rube Goldberg's sketch of a system involving bees, buckets, balloons and dropping people—"Such a good friend for such a long time," Steve Canyon comments.—"Wow! What did I just hit?" asks Mutt, fanning a ball; "Shawnee on the Delaware," explains Jeff.

All the fun began about 20 years ago when Fred Waring brought a group of song pluggers and cartoonists to Shawnee for a get-together. Since then, on what has now become an annual pilgrimage, nearly every American cartoonist whose work appears in print regularly, anywhere, has wound up chipping and putting on the banks of the Delaware. Nearly all have left behind an original painting of their comic characters—in jest or jibe—to their buddy, "Fred."

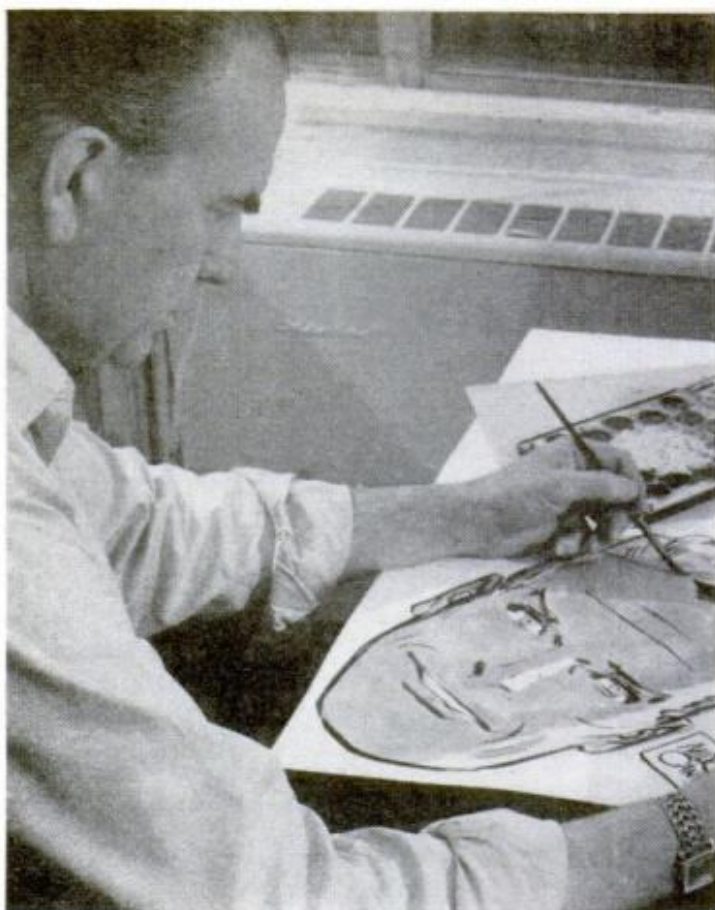
Trickiest of all the cartoons on view are those that form the tops of the nearly 100 (to date) tables in "The Cartoon Room." How do you protect a three-foot-square painting on a table top—in a public dining room—from vanishing under gravy stains? You invent a way.

Fred Waring's name was not associated with a "Blendor" for nothing. Among members of his troupe of "Pennsylvanians," he is notorious for spattering unique practical ideas in all directions all the time. His home, as well as the Inn at Shawnee, are a-bristle with Waring inventions and designs. Creations run from sliding shoji-screen "draperies" in his bedroom and an A-frame tree house for his young son (you'll see it soon in *Popular Mechanics*), to the vari-colored giant polka-dotted carpeting in the hotel's lobby.

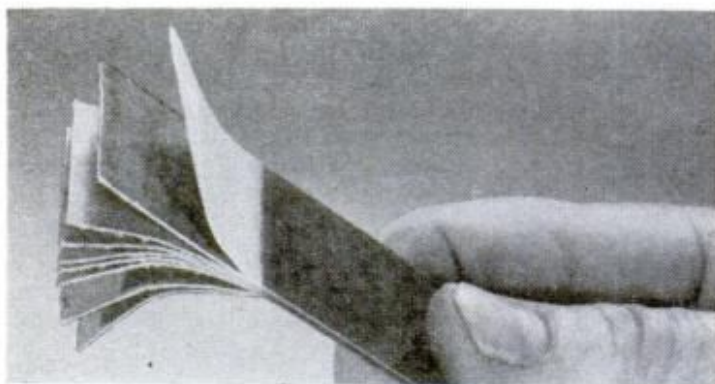
Making table tops out of original cartoons presented no outstanding problem to Waring. "I figured," he says, "that if the makers of kitchen countertop material could seal multi-colored patterns in their tough plastic laminates, they should be able to process king size comic strip subjects the same way."

Out went the query from Waring Enterprises. At Parkwood Industries in Wakefield, Mass., the answer was: "Why not?"

(Please turn to page 214)



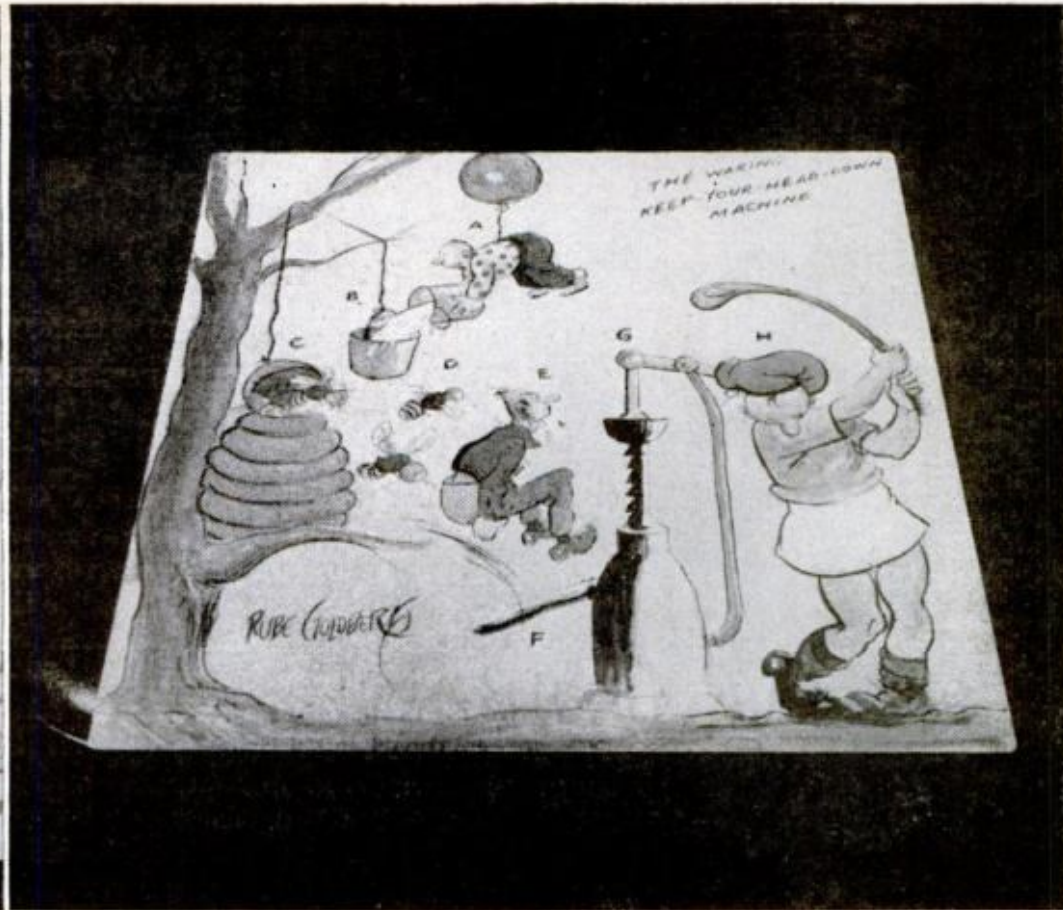
**MILT CANIFF** sketches outline of a table top Steve Canyon for the Waring collection. Drawing is made on treated paper with special ink for laminating



**PLASTIC SANDWICH** is made up of seven layers of kraft paper soaked in phenolic resin. Next comes cartoon design sheet, topped by melamine resin sheet

**CARTOON DESIGN** sheet for table tops at Shawnee is covered with melamine impregnated paper that will become hard, transparent plastic surface in hot press





**MUTT AND JEFF** table top in the Cartoon room carries funny legends kidding the golf buffs among the song pluggers and cartoonists who convene at Shawnee

**RUBE GOLDBERG'S** "Keep-Your-Head-Down" machine for golfer Waring involves complicated mechanism using bees, balloons, pedal tripper and head spanker



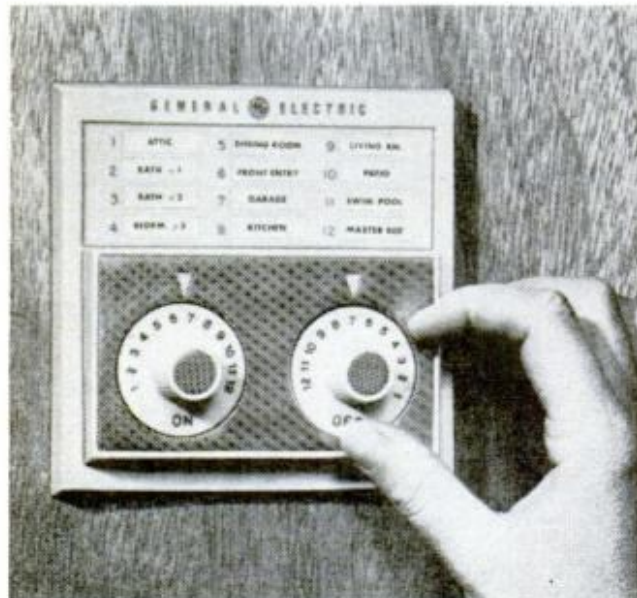


**BOUDOIR CHAIR** becomes ironing and beauty center when water repellent cover is unbuttoned. Ironing board lifts out of back of chair; steam iron and hairdryer are under chair seat. Also included in this space-saver unit: cord and plug connections for electrical outlets. Price: \$129.95. Castro Convertible, New York, New York

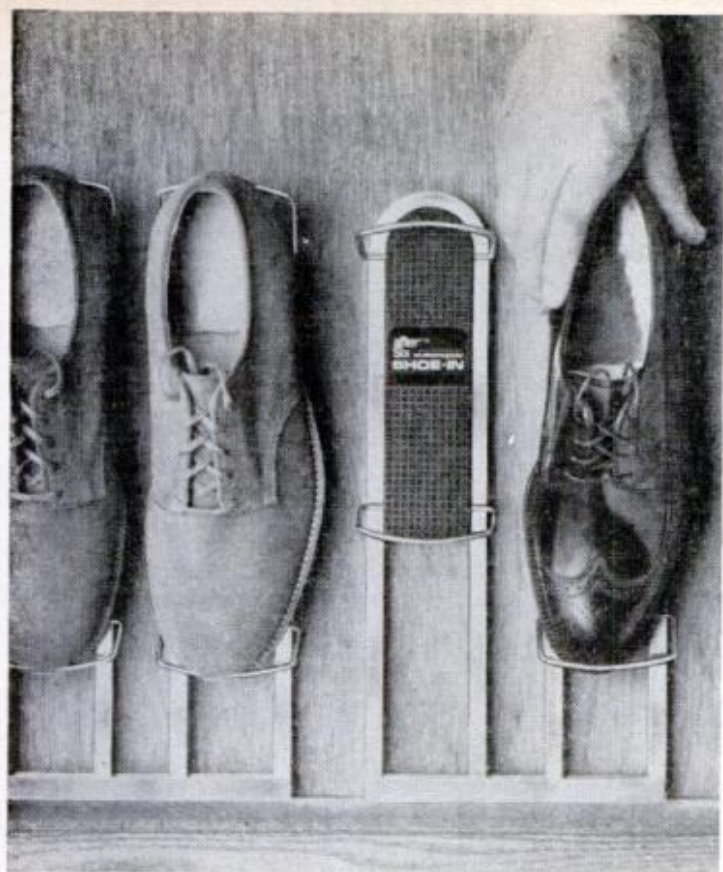
## New for Your Home

**MASTER SWICTH** runs 12 lights by remote control on low-voltage system. Lights, whether indoors or out, are turned on or off at once, or individually as dialed; directory shows which ones are on. Made by General Electric Co.

**WARMING TRAY** with built-in cold spot operates electrically. Fiberglass, portable waterproof unit weighs under 3 lbs., works for hot and cold foods simultaneously. Price: \$20; by Kimberly Products, Phoenix, Arizona



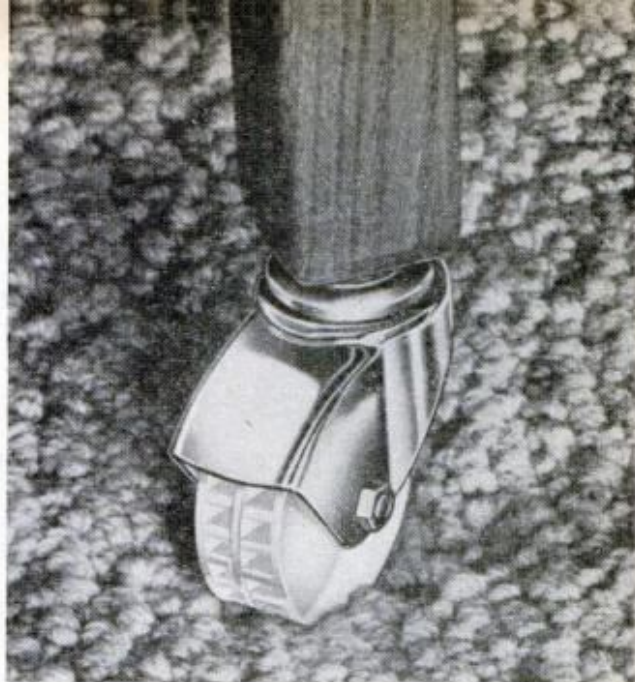




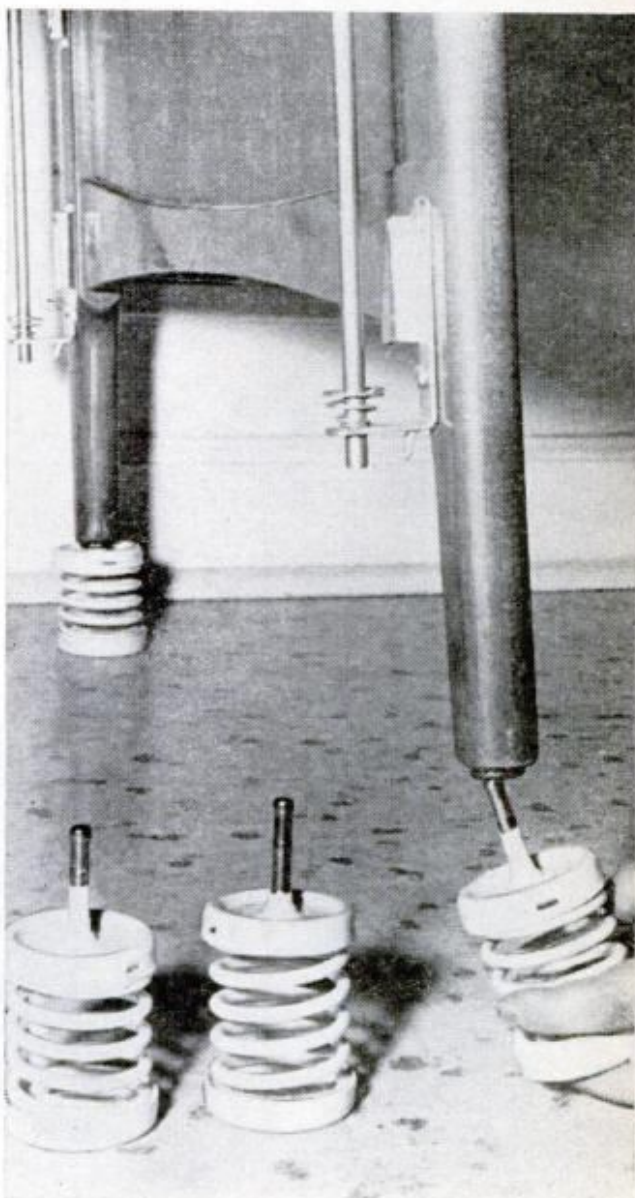
**SHOE RACK** adjusts automatically to all sizes and types of shoes, keeps soles flat. Of aluminum and black plastic, 7 by 14-inch unit screws or tapes to closet door. Available at \$5.95 from Hammacher Schlemmer, New York, N.Y.

**CRIB CASTERS** substitute springs for rollers or wheels, let child rock himself to sleep. Simply pry out regular casters, snap on noiseless and non-toxic ones. Price: \$3.95 a set. Syro Industries, 1427-29 S. Halsted, Chicago, Ill.

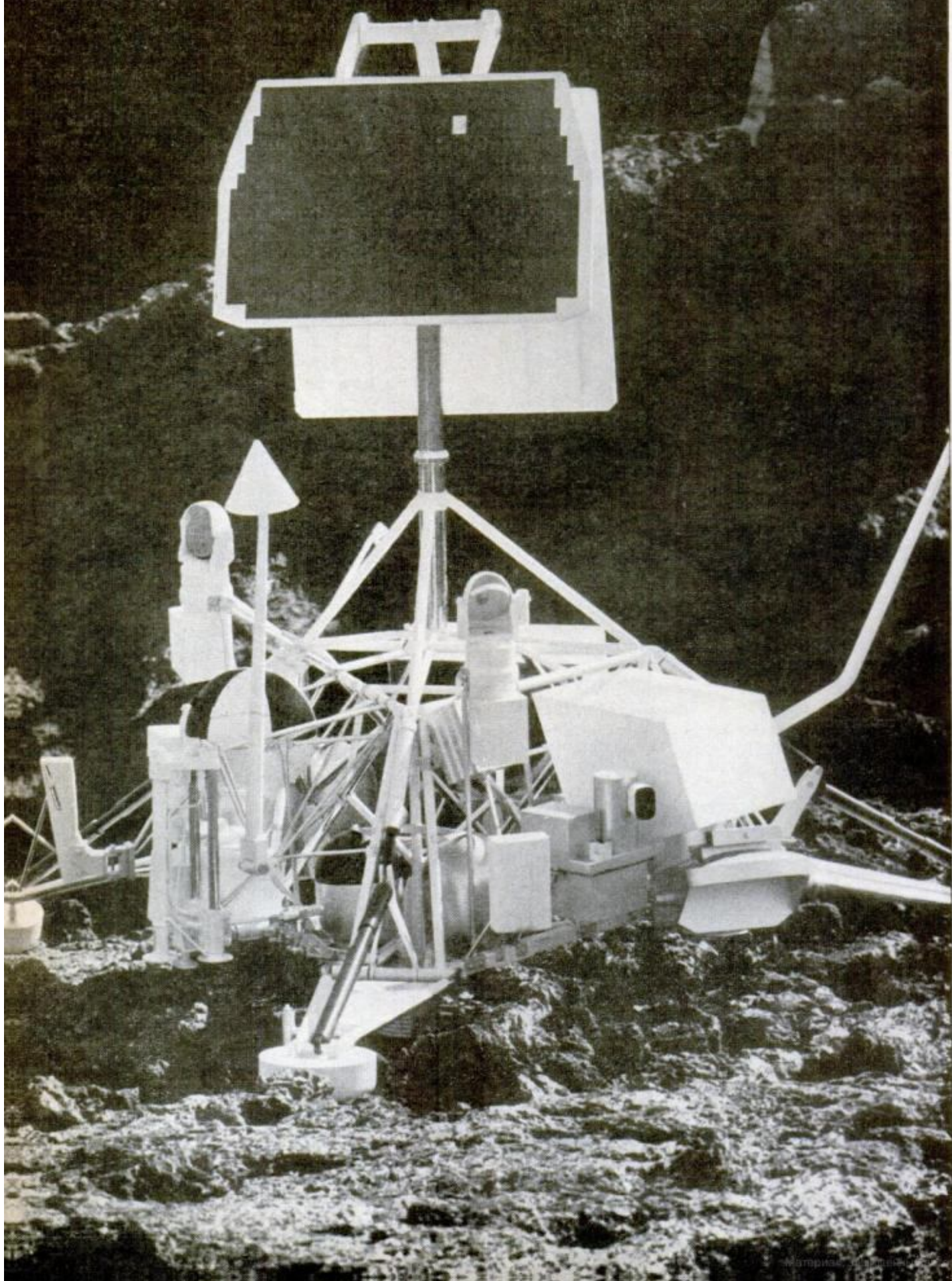
**CLUSTER TABLE** separates into six serving units that stack for storage. As cocktail table, it's 36 inches across. Stainproof, in teak or walnut patterns, set is \$32.50. Ultra Decor Products, 600 W. Main, Canfield, Ohio



**CASTERS** rest in, not on, carpet. For heavy, often-moved furniture, the differential swivel action resists pulling or twisting of pile. Molded nylon wheels cost \$6.45 for four. U.S. Caster Corp., 1630 Oakland, Kansas City, Missouri



ITS THREE FEET planted on rugged test terrain, with pantograph arm extended, TV humming and high-gain antenna oriented toward distant target, this is how Surveyor might look after making a soft landing on the moon



# Our First Moon Scout Heads for the Pad

*This year a talented robot will try to "check out" the moon. Called "Surveyor," he's got three legs, electronic eyes and chemical senses*

**By Thomas E. Stimson, Jr.**

**B**EFORE WE TRY to place human explorers on the moon, we are going to send up mechanical men who will land on their three feet, look around and tell us what they see.

After one of them has touched down, he'll report what the lunar surface is like. He'll scratch the ground with one hand to learn whether it's hard or soft. He'll reach out with another hand to feel if micrometeorites are showering down.

This mechanical American will be pretty human in other ways, too. His eyelids will close during landing, to keep dust out of his television eyes. If he suffers too much from the searing heat of the lunar day, he'll adjust his interior temperature. He'll go to sleep when the sun goes down, shutting off all of his senses except his sense of feel for moonquakes, and use stored-up battery energy to avoid freezing to death.

As a photographer, this extraordinary American will take stereo pictures and transmit them back to earth so we can see what he sees, in three-dimensional color.

The name of this mechanical man is Surveyor. And, to carry the simile one step further, his father is Caltech's Jet Propulsion Laboratory and his mother is Hughes Aircraft Company. Both parents expect great things of their offspring.

The first Surveyor, in a planned series of at least seven attempts, will leave for the moon later this year. The project is the last exploratory step before Apollo, the manned spacecraft that is scheduled for a moon landing in the early '70s.

Surveyor's role is to provide us with answers to questions such as these:

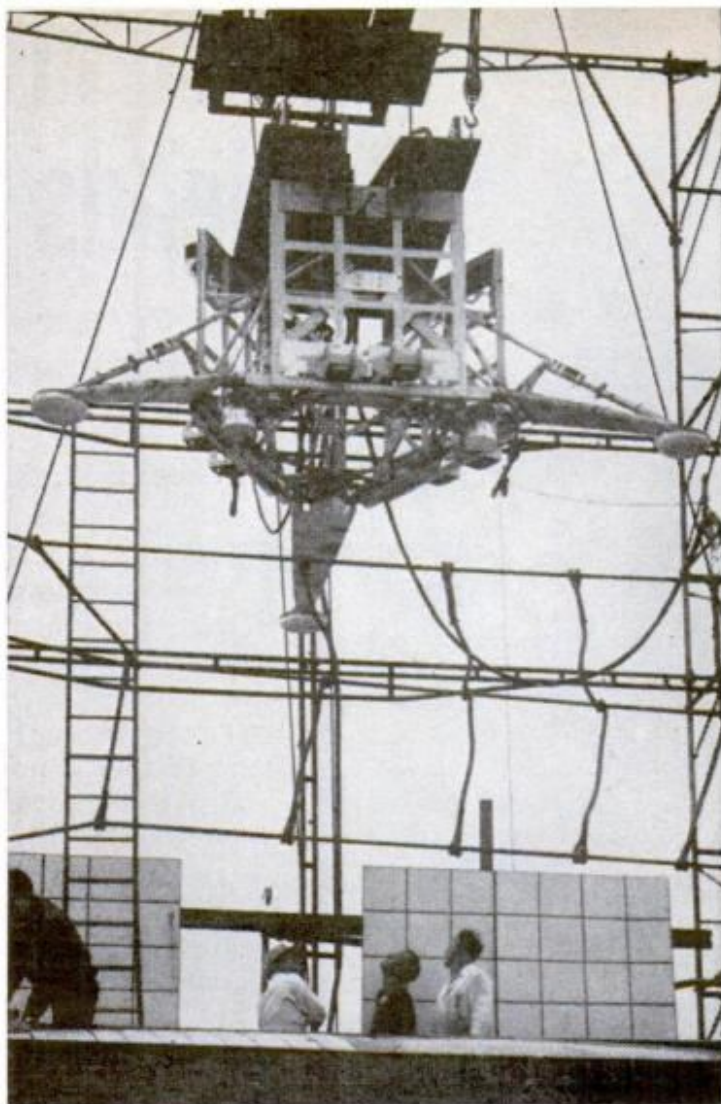
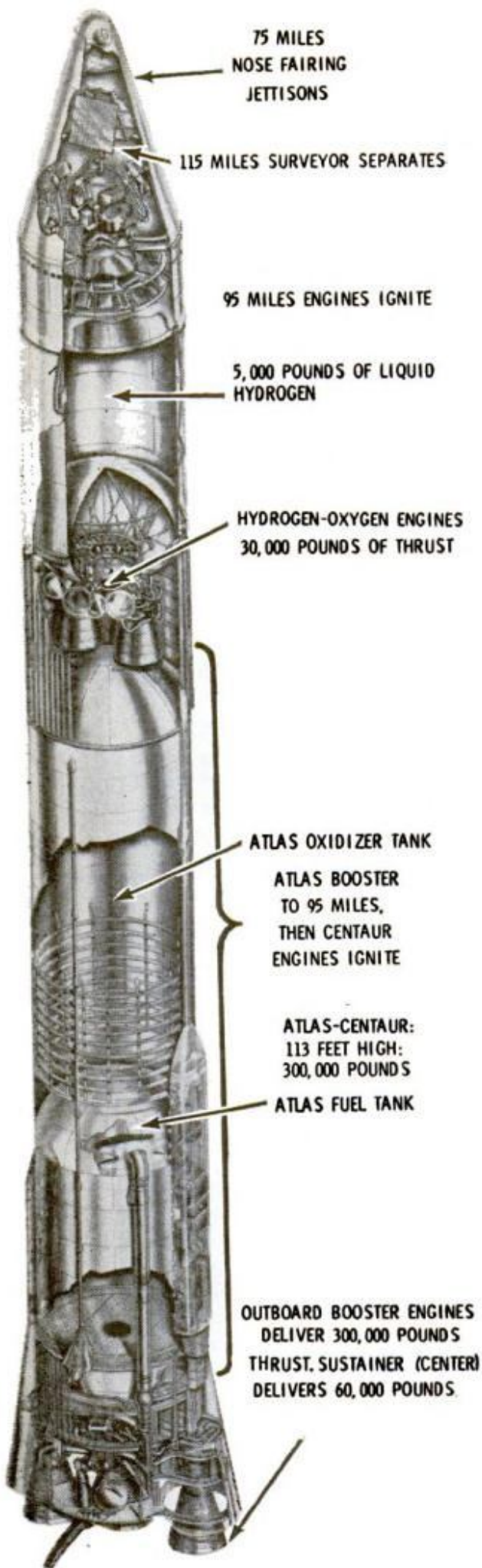
- *Is the moon covered with a layer of dust? If so, how deep is it?* (Despite radar information and close-up photos taken by Ranger VII, this question continues to generate controversy. Several scientists connected with the Ranger project maintain that the lunar surface is essentially firm. Other scientists with equally good credentials say just the opposite: they think the dust is deep enough to swallow up a space vehicle.)

- *Will moon dust clog mechanical parts or even turn an Apollo spaceman into a walking dust ball?* (There's some evidence that dry dust in a high vacuum tends to collect and cling to any surface.)

- *Are tiny meteorites constantly raining down on the moon?* (With no atmosphere to slow them down, the high speed particles could slice through a space suit or even the spaceman himself.)

But the first four Surveyors won't come up with all the





**LANDING** strength is tested by dropping Surveyor from various heights. Tether arrangement is used to duplicate the one-sixth earth gravity of moon

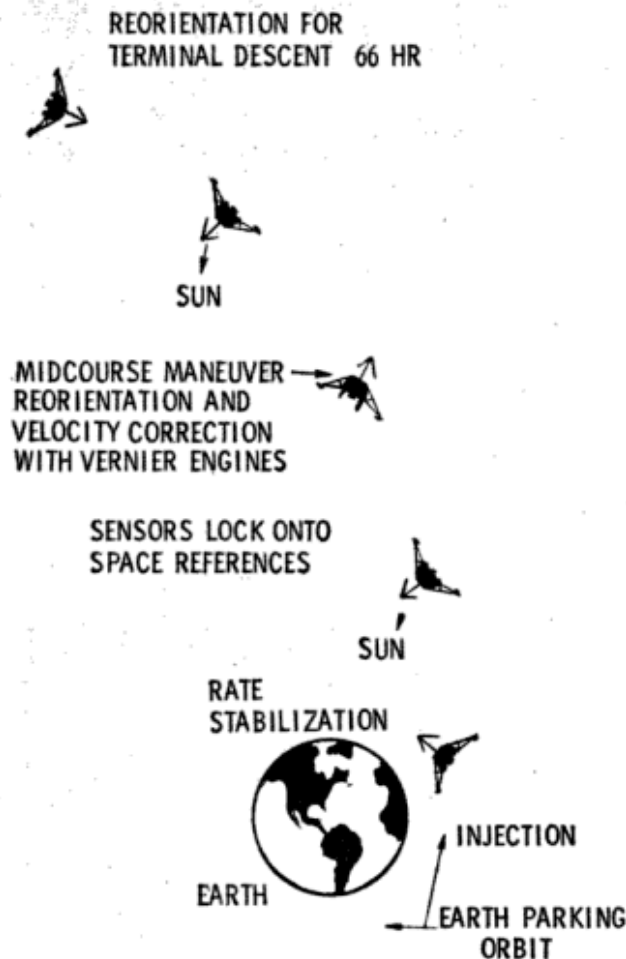
answers. Instead of carrying the full "lunar laboratory," they'll be outfitted mainly with flight instruments designed to report the accuracy of the approach to the moon, how successful the landing is and, if something goes wrong, exactly what the nature of the trouble is.

Eugene Giberson, Surveyor project manager for JPL, explains that without these pioneer flights there would be no way of correcting a malfunction. So, first the vehicle will be proved out, then the full laboratory will be transported.

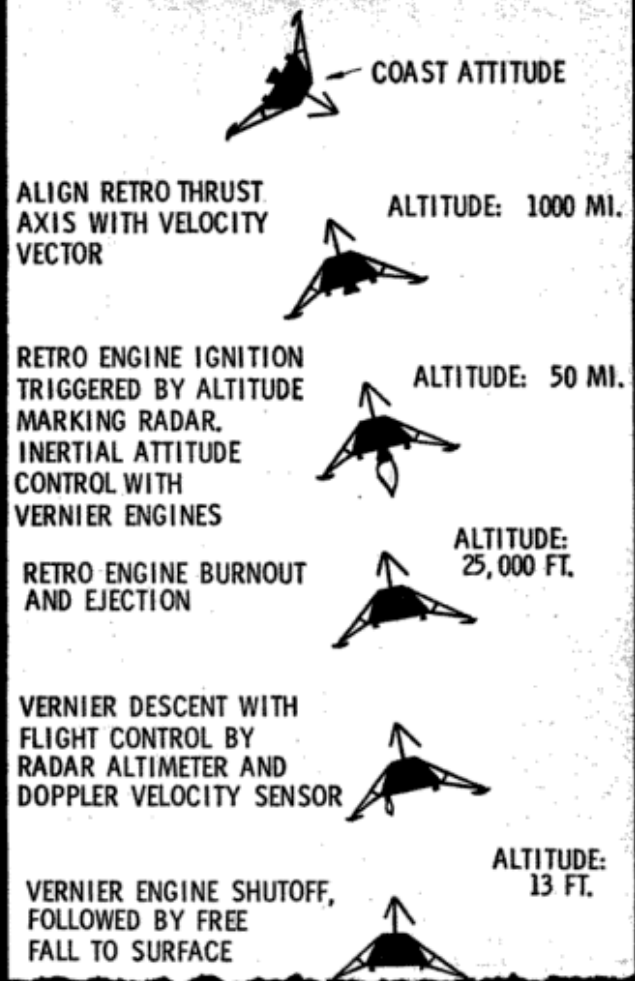
Giberson compares the job of making a soft landing on the moon to performing a launch at Cape Kennedy in reverse. That is, the vehicle approaches at high speed, at an angle. Then it must tilt tail-first toward the surface, slow itself down while maintaining perfect balance, then drop in

**ANATOMY** of an Atlas-Centaur. Drawing shows Surveyor cocooned inside nose fairing atop Centaur upper stage, first rocket to use liquid hydrogen fuel

## SURVEYOR TRANSIT TRAJECTORY



## SURVEYOR TERMINAL DESCENT



**AFTER 66-HOUR TRIP** (left panel), Surveyor will get command from earth to turn and point big retrorocket straight down (right panel). Sixty miles above target, rocket will ignite to slow craft from 6000 to about 400 m.p.h.

at almost zero speed into the preselected site. And, adds Giberson, Surveyor must do all of this by itself after having spent 66 hours in the hostile environment of space.

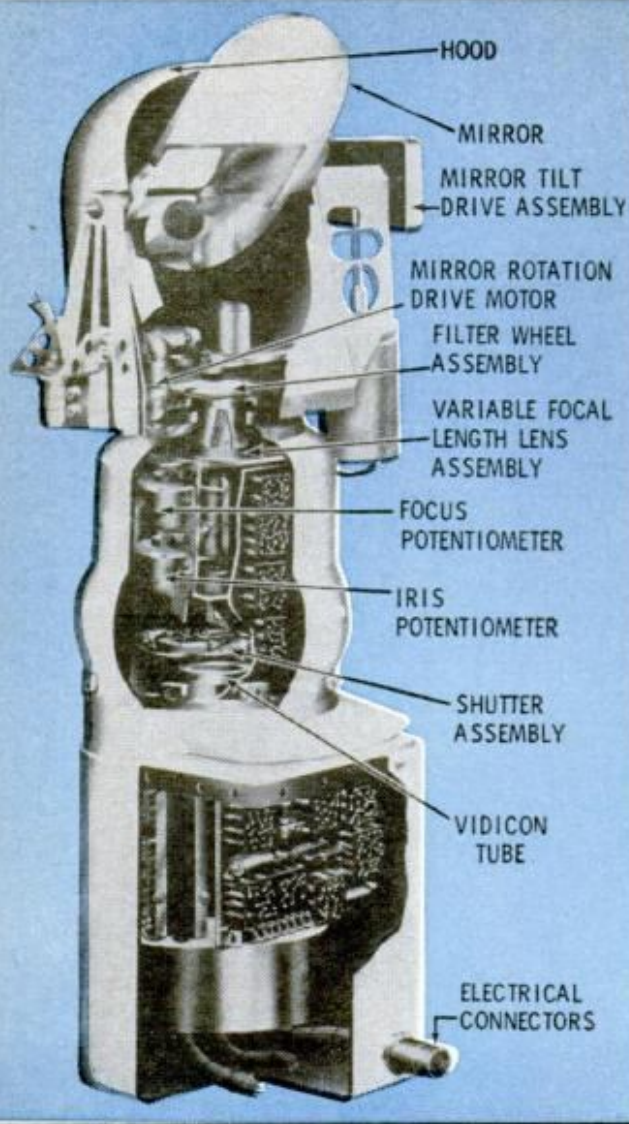
Even the blast-off from earth will be more critical than were the earlier moon shots. Ranger VII was first put into parking orbit around the earth, then was fired toward the moon at exactly the right time. This called for relighting the rocket's second stage while in orbit, a tricky operation by remote radio command.

To avoid possible failure, the first Surveyors will be fired at the moon by direct ascent. Each will travel toward a point in space that will be occupied by the moon at the moment the vehicle gets there. The period of time in which the rocket can be launched (the "launch window") is no more than an hour per day at best, on no more than four or five days per month.

When Surveyor closes to within 1000

miles of the moon the craft will turn (on command from earth) so that its big retrorocket points straight down. At 60 miles altitude the rocket will ignite and push backward with enough thrust to slow Surveyor from its earlier 6000-mile-per-hour speed to less than 400 m.p.h. Explosive bolts that hold the retro case (now burned out) will then free the case and allow it to drop away.

Now RADVS goes to work. (Pronounced "radviz," the initials stand for Radar Altitude Doppler Velocity Sensor.) One RADVS beam projects straight down to measure the altitude and the vertical drop speed. Three other beams, at angles, will measure the craft's speed and direction of travel across the moon's surface. RADVS automatically operates three small vernier gas jets that will cut horizontal travel to zero, at the same time reducing the drop velocity to 12 feet per second. The jets shut off at 15 feet altitude to avoid stir-



**CUTAWAY** shows one of Surveyor's two TV "eyes." They are designed to take close-ups, scan the horizon and produce stereo pairs for viewers on earth

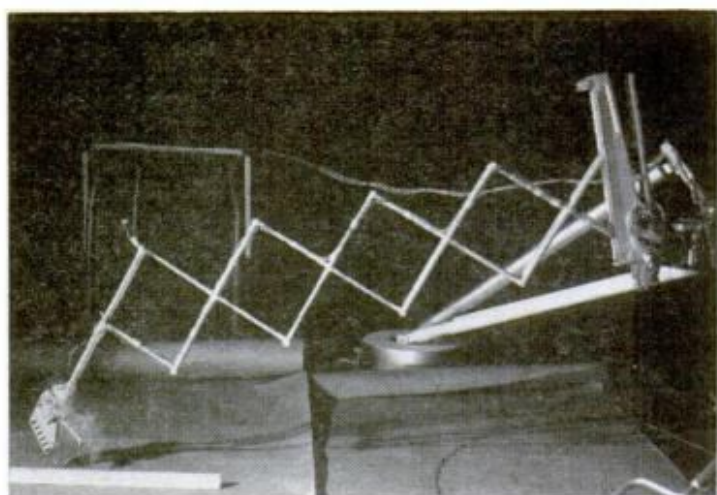
ring up moon dust, and Surveyor impacts at parachute speed.

Being realistic, Giberson expects there may be failures. "If only one of the first four craft makes a successful soft landing, that will be a spectacular achievement," he says.

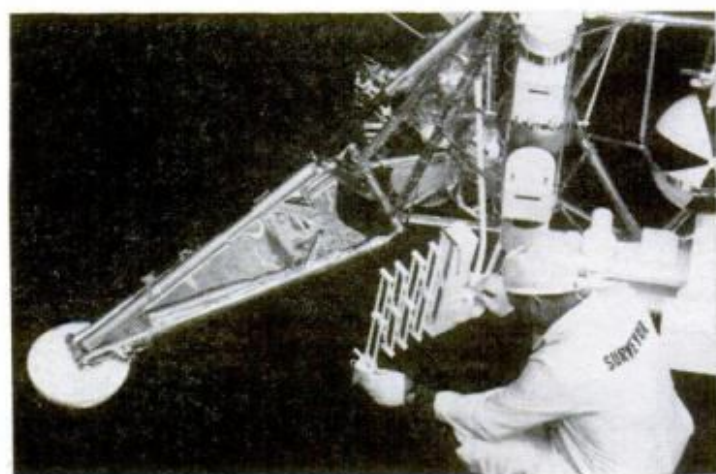
Surveyor is eight feet tall and its hinged, shock-absorbing legs spread out to a diameter of 13 feet. It is designed to land softly on slopes of up to 15 degrees and has actually landed safely, in rehearsals on earth, on 30-degree slopes.

The first thing Surveyor will do after landing is a little "housekeeping." It will tilt its solar panel to the sun to begin acquiring more electric energy. Then it will orient its high gain antenna toward earth for maximum radio strength.

These chores attended to, it will begin accepting and decoding radio commands from earth: "Take a good look at yourself



**PANTOGRAPH** arm has a reach of four feet, swings right or left on command and is spring-loaded. Its purpose: to help define nature of moon's surface



**TECHNICIAN** tests arm. It can whack at the lunar crust like a pick and is strong enough to break a half-inch concrete slab or dig hole 20 inches deep

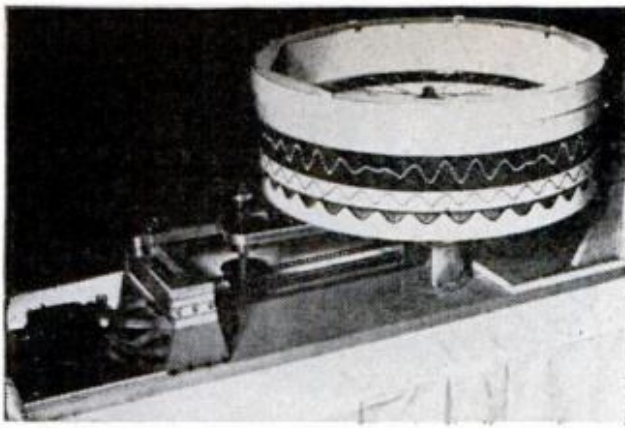
with the wide angle TV vidicon so we can see if you received any landing damage. Now, look down at your legs so we can see whether they are buried in dust."

### One Job After Another

Meanwhile, on a different frequency, Surveyor will be transmitting a telemeter report from its 24 touchdown sensors, on such things as time of contact of each foot pad and the force with which each one struck, and whether any sliding or rolling occurred after impact.

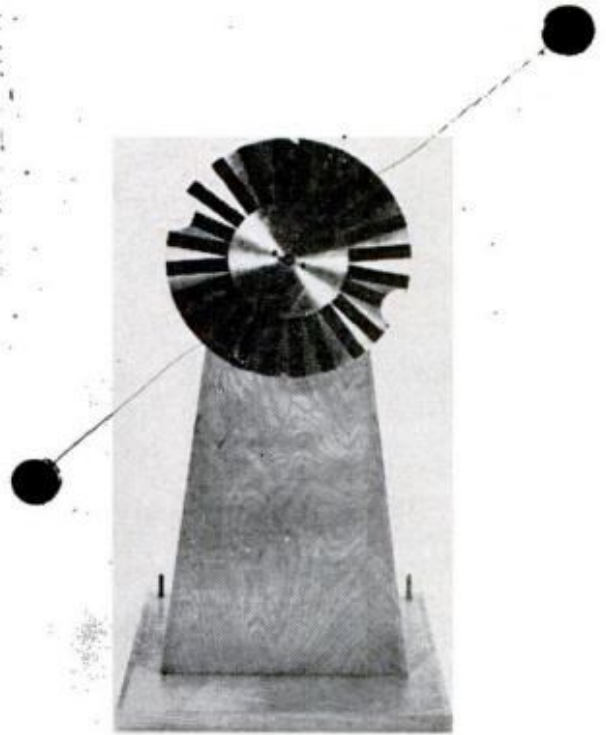
From the start, Surveyor has been an exciting challenge to its designers at Hughes Aircraft. To develop a machine that can determine the nature and strength of the lunar surface, provide information for maps, determine seismic activity and even if the moon has a liquid core, analyze the chemical composition of the surface,

[\(Please turn to page 212\)](#)



### Odd Teaching Machines

Bicycle chains and an array of knitting needles are basic components of machine (above) that demonstrates aspects of "two continuous wave trains." "De-spin" mechanism (right) comes to sudden stop when weights, restrained by cables, fly out and carry away angular momentum. The devices won awards in competition among physicists for new demonstration gear.



### Mechanical Baby-Sitter

Goro, a Japanese robot, will follow directions spoken into a microphone, and can repeat the voice of the speaker. He walks forward and backward and can move in any direction. The inventor, Jiro Sagami, claims that Goro can take care of children under a mother's direction.



### Tanned to a Turn

Britons may soon be able to get a two-to-five-minute dose of artificial sun from a coin-operated machine called the Solarota. Rays from a five-foot ultraviolet tube play on the customer, who stands on a slowly revolving turntable. The maker plans to sell machines to beauty salons.



# The Way-Out World of What the New Safety Standards Mean

**F**OR THE FIRST TIME in its 70-year history, the U. S. rubber industry has adopted safety standards for tires. All tires made after January 1, 1965, must pass three performance tests:

1. Strength. A  $\frac{3}{4}$ -inch round steel plunger with a hemispherical end is shoved into the tread of a normally inflated tire. The tire must withstand a specified pressure—different for each tire size—without breaking. This checks a tire's resistance to blowout when it slams against the curb or into a stone or similar object on the road.

2. Endurance. A tire is run at 50 m.p.h. against a steel wheel for four hours at 100 percent of the test load specified for its particular size, for six hours at 120 percent load, and for twenty-four hours at 140 percent load. The tire must show no signs of broken cords or of tread, cord, or bead separation. If it passes this test, the tire should be OK for long-trip driving without excessive heat buildup or strain.

3. High-speed performance. The tire is run at 50 m.p.h. under the standard load, this time for two hours. After cooling off, it is cranked up to 75 m.p.h. for another half hour, and finally to 85 for a final half hour. A tire that gets by here is presumed safe at any normal turnpike speed.

On January 1, 1966, a final provision becomes effective. At that time, the actual size and the nominal size—the size shown on the sidewall—will have to be closer together than they are now. Under the new standard, for example, a tire marked 7.00 will have to be at least 6.7 inches in cross section; one marked 7.50, no smaller than 7.2 inches.

As far as it goes, the new code is fine. The big weakness comes not in what it says, but in what it does not say. There is no provision for enforcement. Any manufacturer who doesn't want to comply doesn't have to.

"I don't think any reputable manufacturer would jeopardize his market by undercutting the standard," says Firestone senior engineer Jim Corey. Most manufacturers agree . . . but not all. Harry C.

McCreary, long-time battler for industry standards, isn't so sure. Says the McCreary Tire Company chief: "The competitive situation being what is in in the tire business, I am extremely pessimistic that any minimum standards would ever be adopted voluntarily."

State Senator Edward J. Speno, who introduced tire safety legislation in New York last year, agrees. Voluntary standards, he told *Popular Mechanics*, just won't do. "We will not accept industry self-discipline as the answer for what we feel is a need for legislation," he says. "We're going to press for new laws."

Even if all tire manufacturers stick to the new rules, Speno notes, an overloaded tire still can be as dangerous as a hand grenade with the pin pulled. Yet the new regulations set no maximum loading figures.

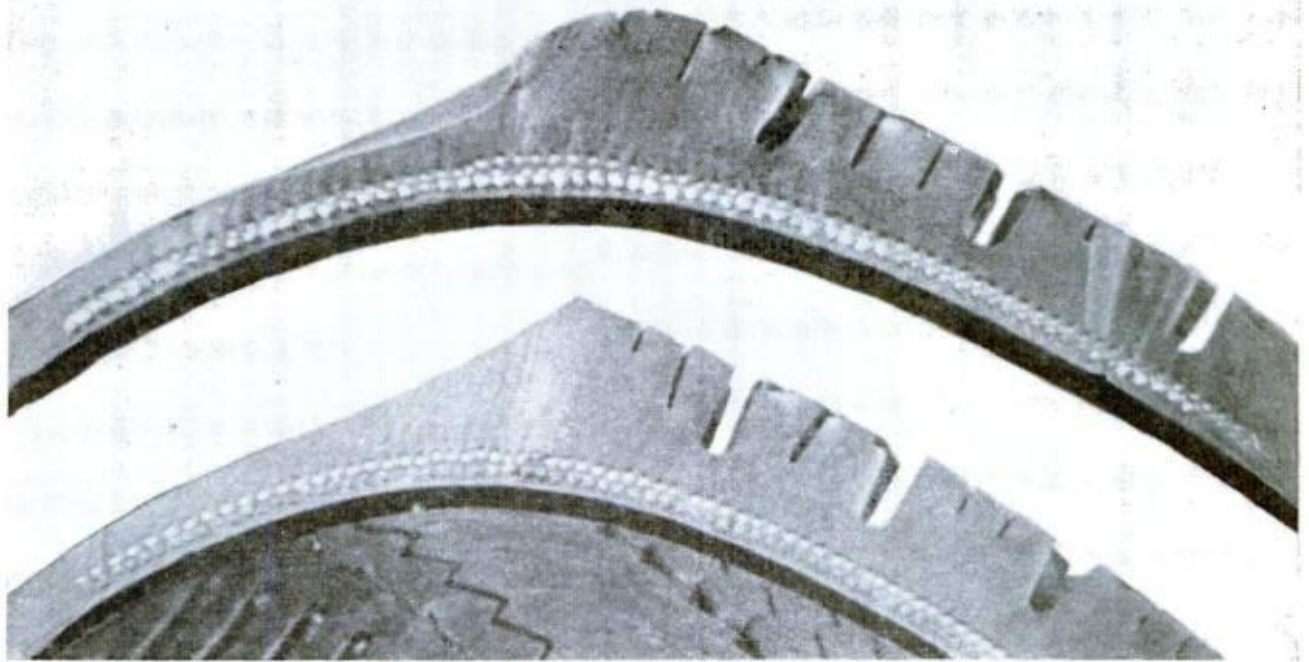
Tire loading has been giving some safety experts sleepless nights for a long time—particularly as it applies to station wagons. With two or three passengers and a little baggage, wagons are safe on original-equipment tires. But wagons can be—and are—seriously overloaded at times. Most owners think they'll carry anything you can jam into—or on top of—them. They won't. If loading figures were made a part of tire standards, the customer would be warned. (The test loads used to check endurance are set by a trade group. They're used for design purposes but aren't recommended maximums.)

The tire industry, however, isn't likely to set such loading standards. Car manufacturers now decide which tire goes on which vehicle. And Akron isn't going to knock the car makers. Said one tire man: "Overloading is a pretty touchy subject with us. If we criticize Detroit, we're biting the hand that feeds us."

With all the shortcomings of the new code, it's still a valuable first step. And the door is open for further improvements. "Perhaps in the future these yardsticks will be increased in length and standards set higher," says M. A. Wilson, Goodyear's manager of tire engineering.



# Automobile Tires



**ROUNDED TREAD SHOULDERS AVOID**, tire men say, what they call the "trolley track effect," so wheels can approach obstacles better from an angle. But shape is only the most obvious characteristic of these complex rubber "shoes"

## Down-to-Earth Facts About Buying Tires

- *Premium or second line—how they differ in wear and tear*
- *Rayon versus nylon—which is stronger, which wears longer*
- *Pros and cons of glass fiber, radial ply and low profiles*

By C. P. Gilmore

**T**IRE BUYING has always been a tricky business. One tire sells for \$8.88, another for \$48.88. What does the extra cash buy, and how much of it? Whatever it is, is it worth the price to you?

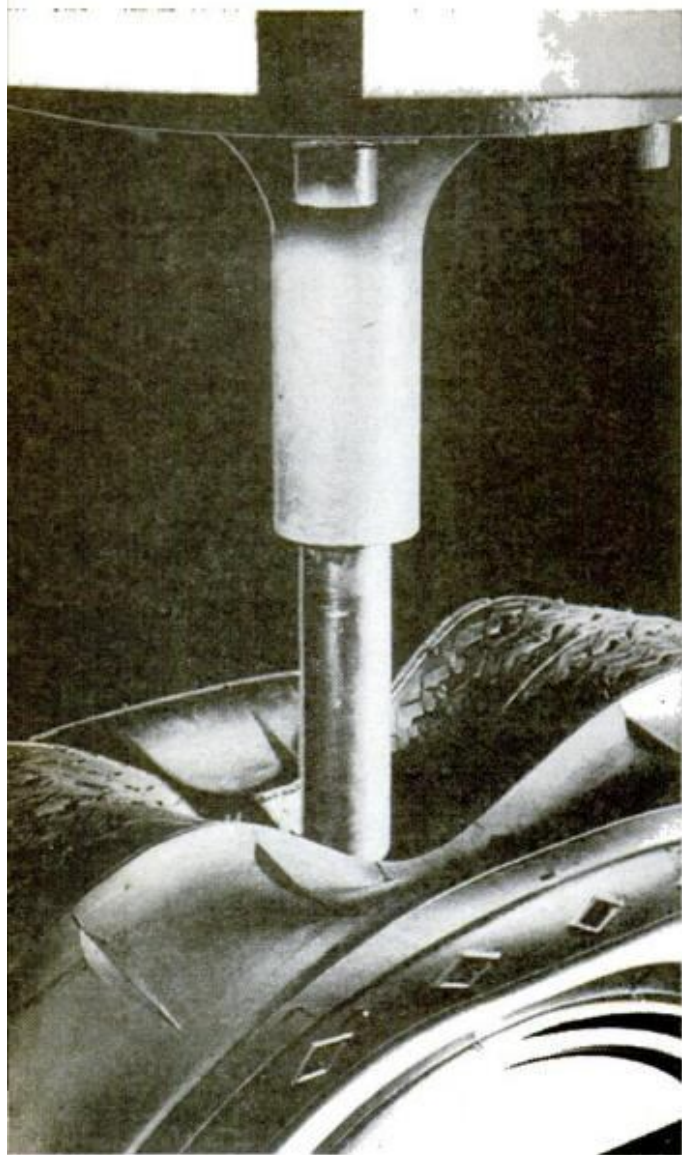
The new safety standards (see p. 132) make the job a little easier. Now you know that a reasonable amount of safety is built into every tire, even the cheapest. But picking the right tire for your kind of driving—and getting a dollar's worth of value for every buck you spend—is as tough as ever.

It's tough because tires—while they may look simple—are really complicated machines. And both the materials used (the rubbers, the additives, the fabric) and the

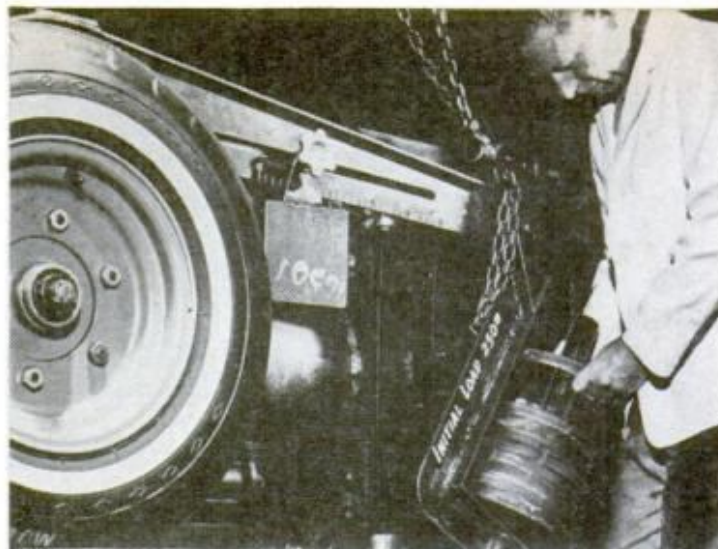
design (the way they're put together) affect the performance and value you get from your car's new shoes. Without knowing something about what goes into them—and why—it's impossible to know what you'll get out of them.

First, the materials: The chief tire ingredient is rubber, accounting for more than half the tire by weight. No single rubber is ideal from every standpoint—traction, wear, aging, ride, price—so most tires contain a blend, each rubber with its own advantages and disadvantages.

Natural rubber was the principal ingredient for years. Today it's been largely replaced by synthetics like SBR—styrene butadiene rubber—the first artificial rub-



**PLUNGER RAMS INTO TREAD AREA** of inflated tires. This is part of the test procedure Akron has agreed on to help their tires meet basic safety demands



**WEIGHTS ADDED TO ARM** of tire test machine prepare the shoe for running with a given test load, at a known speed, for a given time in one of new tests

BREAK STRENGTH Rayon vs. Nylon			
	Second Line (Nylon)	First Line (Rayon)	Premium (Nylon)
Tire A	2517	2661	3124
Tire B	2345	1654	2551
Tire C	2870	2133	3019
Tire D	2749	2707	2996
Tire E	2714	2204	2829

**USUALLY, BUT NOT INVARIABLY,** nylon-cord tires have higher break strengths than those with rayon cord. Tires listed are from the Big Five manufacturers

ber to get wide use. Newer rubbers have certain improved characteristics, however. Polybutadiene, for example (Firestone's), gives both fine tread wear and a reasonably soft ride, but dump too much in the mix and traction and skid resistance drop sharply; 40 percent is the maximum you can use today, though experts hope to find ways to increase this and improve tread wear even more. Karl Brandau, Firestone rubber expert, estimates polybutadiene has boosted tread life alone by 20 per cent. (Each company, incidentally, has its own name for its polybutadiene compound. Firestone uses Sup-R-Tuf, for example; Goodyear, Tufsyn, Goodrich, SuperSyn.)

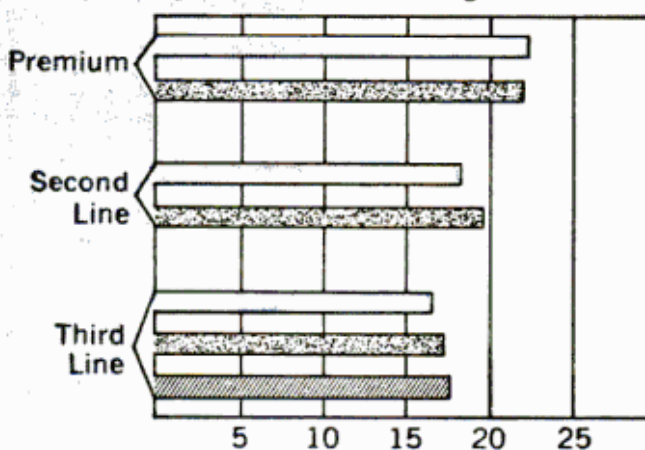
### Synthetically Natural?

Another synthetic, called polisoprene (Goodyear calls it Natsyn), is the closest thing to natural rubber from a test tube.

But it has better tread wear, more resilience, and improved heat durability over the natural product. Still another is Firestone's Duradene—chemists call it a stereo copolymer of styrene and butadiene—with fine wear, cool running and good wet-traction characteristics. It was used on A. J. Foyt's '64 Indianapolis winner. For the first time, a set of tires went the distance with rubber to spare.

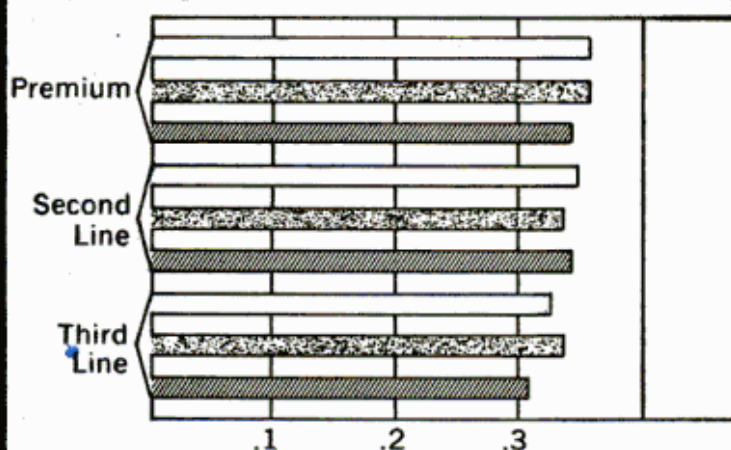
A day-after-tomorrow tire material is polyurethane. You may remember Goodyear's demonstrations a few years ago with the lit-up transparent tires. Neothane—Goodyear's name for it—is so tough that tires made from it don't even need cords. They can be molded like plastic buttons. But Neothane won't be in tire stores soon. Its biggest trouble is a weird one: It grows. The tire keeps stretching until the tire is too big for the wheel well, and may even

### HOW TIRE QUALITY VARIES Weight—Pounds



**TIRES' WEIGHT CAN BE** correlated in many cases with results that indicate their quality. In each chart, tires shown as "A" are from the same manufacturer

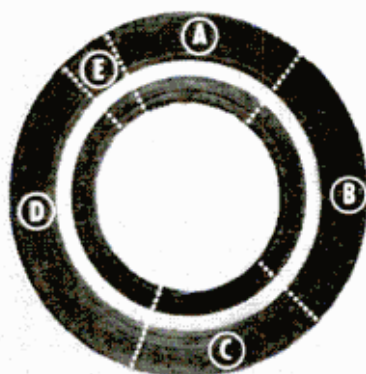
### Tread Thickness—Inches



**TREAD DEPTH FROM ONE** manufacturer may be ahead in one line of tires, behind a competitor in others. Premiums correspond to first-line tires with nylon

### WHAT'S IN A FIRST-LINE TIRE?

- A Polybutadiene** .....18.2%
- B Sbr** .....27.2%
- C Oil** .....18.2%
- D Carbon Black** .....31.8%
- E Other** .....4.6%

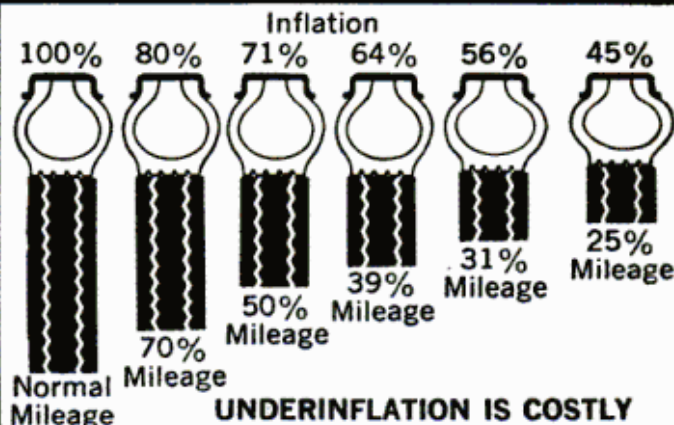


**PROPORTIONS VARY FROM ONE** tire builder to the next, but a typical rubber compound is shown here. Special rubbers like polysoprene may also be included

rub the fender on turns. A fabric carcass would hold it to size, but Neothane won't stick to present cords.

In addition to juggling rubber types, tire companies mix in additives like carbon black for abrasion resistance. The finer the particles, the better the tire wears. But also, the more it heats up in use. Engineers have to strike a compromise to get both good abrasion resistance and reasonable heat characteristics.

Generally, low-priced tires are made largely of lower-cost synthetics, such as SBR. For years, tire companies also held rubber costs down in low-priced lines by mixing in some reclaimed rubber. Now the trend is toward stretching the mix with oil instead. It reduces price as much as reclaim without lowering wear resistance, yet also improves ride and squeal resistance. More expensive tires have



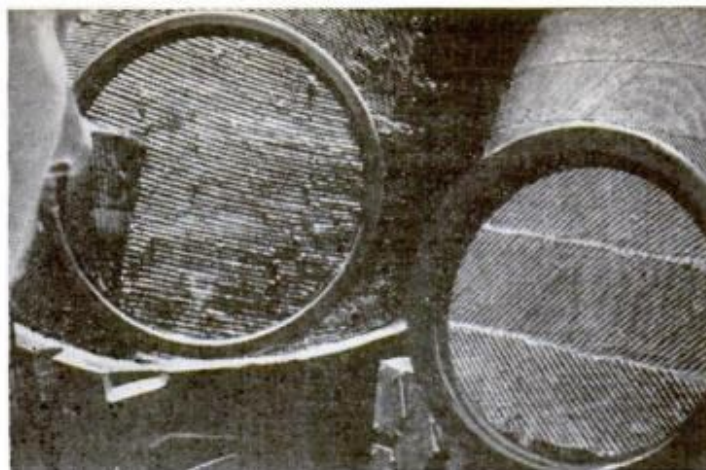
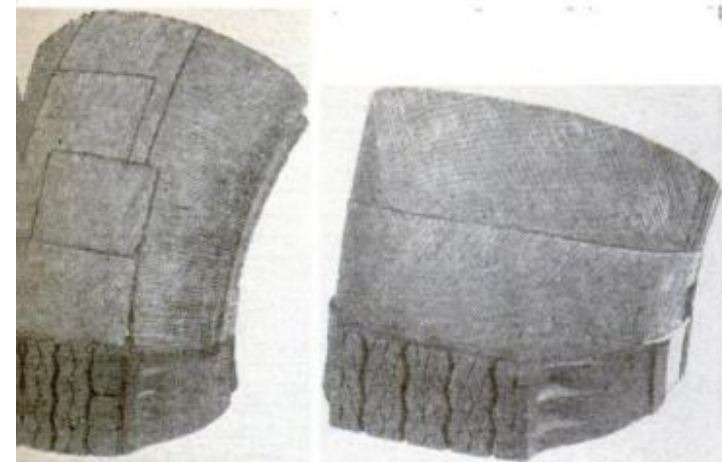
**UNDERINFLATION SLASHES** tire mileage. If yours need 26 pounds and are only 80 percent inflated (under 21 pounds) you're losing a third of the tire life

more of the special materials that give longer tread wear and other better performance characteristics.

As important as the rubber in a tire is the fabric. The cord carcass gives the tire its strength and basic shape. Rayon and nylon are, of course, used in almost all tires today. For new cars, Detroit insists on rayon (such as Tyrex). But car owners, usually buy nylon replacement tires.

### Nylon Versus Rayon

Car makers like rayon because it gives a quiet, velvety ride and shows off a new car to its best advantage. It also gives slightly better tread wear than nylon. "Nylon has a lower modulus; it's stretchier," says Dr. Edward T. Lessig of B. F. Goodrich's tire fabrics division. "This stretchiness lets the rubber scrub the road more and causes a little more wear, every-



**RADIAL TIRES' MAIN CORDS** RUN direct from bead to bead. Magnifying glasses compare truck radial cord (left) with those on bias-ply tire. Left comparison photo shows the multiple belt required for radials' tread stability

thing else being equal. It can vary, but rayon might give as much as 10 percent more tread wear."

Nylon's biggest sin, in the eyes of automotive engineers, is flat-spotting. After a car has been parked for a few hours, the side of the tire touching the ground becomes temporarily deformed. When the car starts, the flat spot thumps every time the wheel goes around. A few miles of driving, and the thumping disappears.

Replacement tire buyers, apparently, aren't bothered by the thump and aren't impressed by rayon's virtues. They're convinced that nylon is stronger, and thus a better buy. They're right about the strength. While either fabric is adequate for normal driving, nylon shoes are usually stronger than comparable rayons of the same blend (Fig. 1). And even if break strength were identical, nylon would still have an edge. "Since nylon is stretchy,"

says Dr. Lessig, "it can spread an impact shock wave out better than rayon. It's like catching a baseball; your hand gives to take up the shock. Nylon does the same thing."

B. M. Wolf, a Firestone textile expert, says, "Truckers are split. In operations that emphasize tread wear, they'll buy nothing but Tyrex rayon. But if they're worried about body and heat failures, they swear by nylon." Thus nylon is used in virtually all off-the-road and airplane tires, intercity busses, and race cars.

Nylon makers tried hard to get car makers to put nylon tires on new cars by designing a non-flat-spotting nylon called N-44. "It started out with a big bang," says Wolf, "but the bang has sort of fizzled. When N-44 is at its best, it is almost immune to flat spotting. Trouble is, it's not always at its best. When the moisture content rises slightly, it drops back almost to



**TWO-PLY TIRES USE** bigger, stronger cord for similar total strengths as old four-plys. In demonstration photo (right), new cord carries total car weight





**CLEAR, ATTENTION-GETTING** polyurethane tires were lighted from inside for promotion shots like this. Material, so tough it needs no cord of any kind, hasn't made the grade. Tires grow until they're too big for the wheel wells

the level of regular nylon."

While nylon and rayon battle for the tire market, other new cord materials are beginning to appear. Most promising is polyester, sold under trade names like Vytacord and Dacron. "This new material," says Goodyear's fabrics development manager, T. M. Kersker, "has the strength and durability of nylon with the smooth, easy ride of rayon." One polyester tire—Goodyear's premium-priced Double Eagle—is now on the market. Further use is held up primarily by high price.

#### **Problems with Glass Cords**

Meanwhile, at least one really far-out fabric—glass—is catching Akron's attention. Tire makers like it because, weight-for-weight, it's three times as strong as steel. But it also has problems.

"Glass is its own worst enemy," explains Goodrich's Dr. Lessig. "The fibers abrade

each other and break." Individual coating helps, but there is still another problem. While glass is extremely strong in tension, it is weak in compression. And in ordinary tires, the sidewalls go through both tension and compression. But radial-ply tires, whose cords stay under tension and don't compress, can use glass cords.

As important as the quality of materials used in a tire is the quantity. Generally a more expensive tire not only has better materials, but more of them. Tread rubber is thicker for increased mileage, and extra cord gives greater carcass strength for better impact resistance and blowout protection (see charts).

More expensive tires tend to be heavier, but tire building isn't a simple matter of the-more-the-better. Extra thickness, for example, may increase tread life, but it may also contribute to excessive heat

[\(Please turn to page 230\)](#)

## **TUNGSTEN-CARBIDE FOR ICE AND SNOW CONTROL**

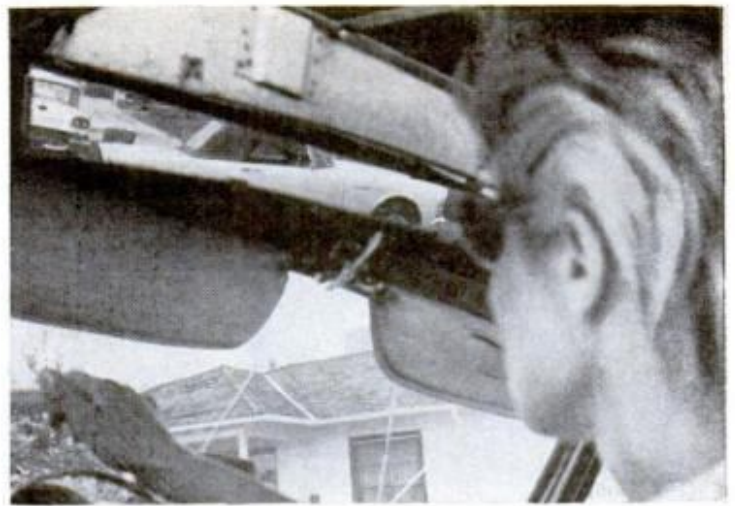
**SNOW TIRES** have been popular for years, but what do you do on ice where their bite is pretty anemic?

Some tire makers and recappers now mold holes in the tread so dealers can add tungsten-carbide studs to order—at about a dime apiece. They're sold complete, too.

In tests of conventional summer tires vs. studded tires, the summer tires pulled with 446 and 483 pounds of force before spinning. Tires with studs—from 36 to 108 per tire—reached 598 to 666 pounds on the average. Stopping distances, too, improved by about 50 percent with studs. Control felt excellent on the frozen sur-

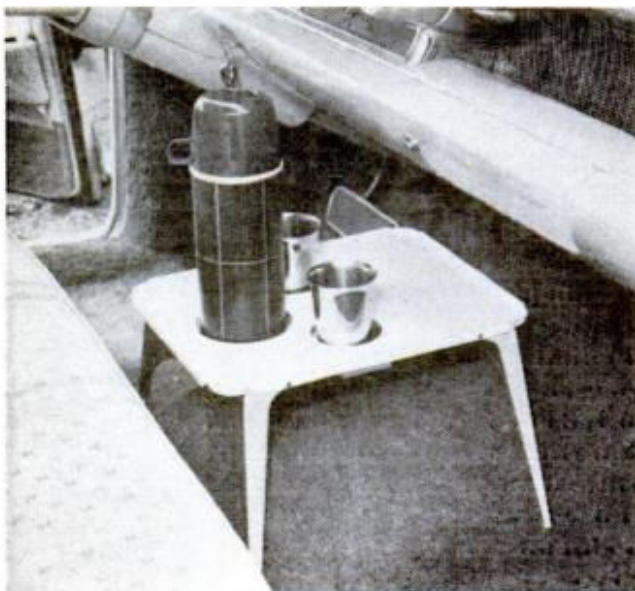
face of a New Hampshire lake. (Ice racers swear by the studs.)

But some state laws against steel-lugged tractors on public roads may prohibit studs, too. If they stick out more than a 32nd of an inch or so, PM found that hard stops can flip studs from their sockets. With studs normally installed, a 4000-mile cab fleet test showed that some tires lost about 20 percent of their studs. Others lost none. Some tests suggest that, on dry pavement, too many studs can reduce side-slip resistance; a PM editor reported his car felt as if it wanted to "skate" on dry concrete.



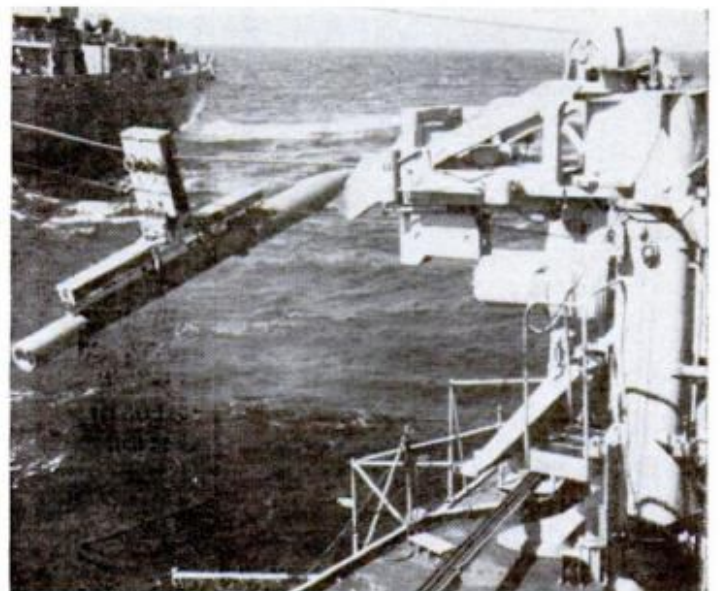
### Picnic Table for Car

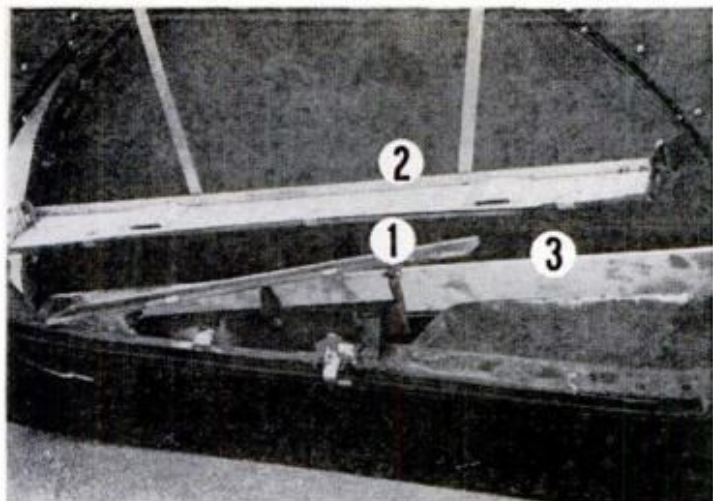
Straddling the driveshaft housing, a snack table holds food and beverages for front-seat occupants of a car. The table folds for storage when not in use. It sells for \$3.95 from Hamill & Assoc., P.O. Box 508, Treichlers, Pa.



### Missile Shuttle

Automatic and shockless transfer of delicately instrumented missiles and special weapons can now be done from ship to ship while under way. The equipment features spring-tension devices on king posts which compensate for pitch and roll.





## Wide-Screen Rear View

A piggyback rear-view mirror that sweeps 160 degrees and eliminates blind spots was built into the removable roof of a Mercedes 190SL by Karl Smith of Auberry, Calif. The front of the turret is black metal; the window is plexiglass. Inside are three mirrors (numbered at left in the upturned housing). The driver looks into No. 1, which reflects No. 2, which, in turn, reflects the scene in No. 3).

It's those freeways in southern California with their many lanes of traffic that gave Smith the idea.



## Tilting Floats

Adjustable pontoons now let choppers and other VTOLs land in rough seas.

The pontoons tilt from a horizontal position, for landing on hard surfaces, to a vertical position. The tilted pontoons give the craft more stability than if they were left in the normal horizontal position. For takeoff, the maneuver is reversed.

Developed jointly by the U.S. Navy's Bureau of Naval Weapons and the Gyrodyne Company of America, St. James, Long Island, N.Y., the pontoons could be adapted to any vertical-take-off aircraft.

## 150-MPH Sports Tourer Has American V8

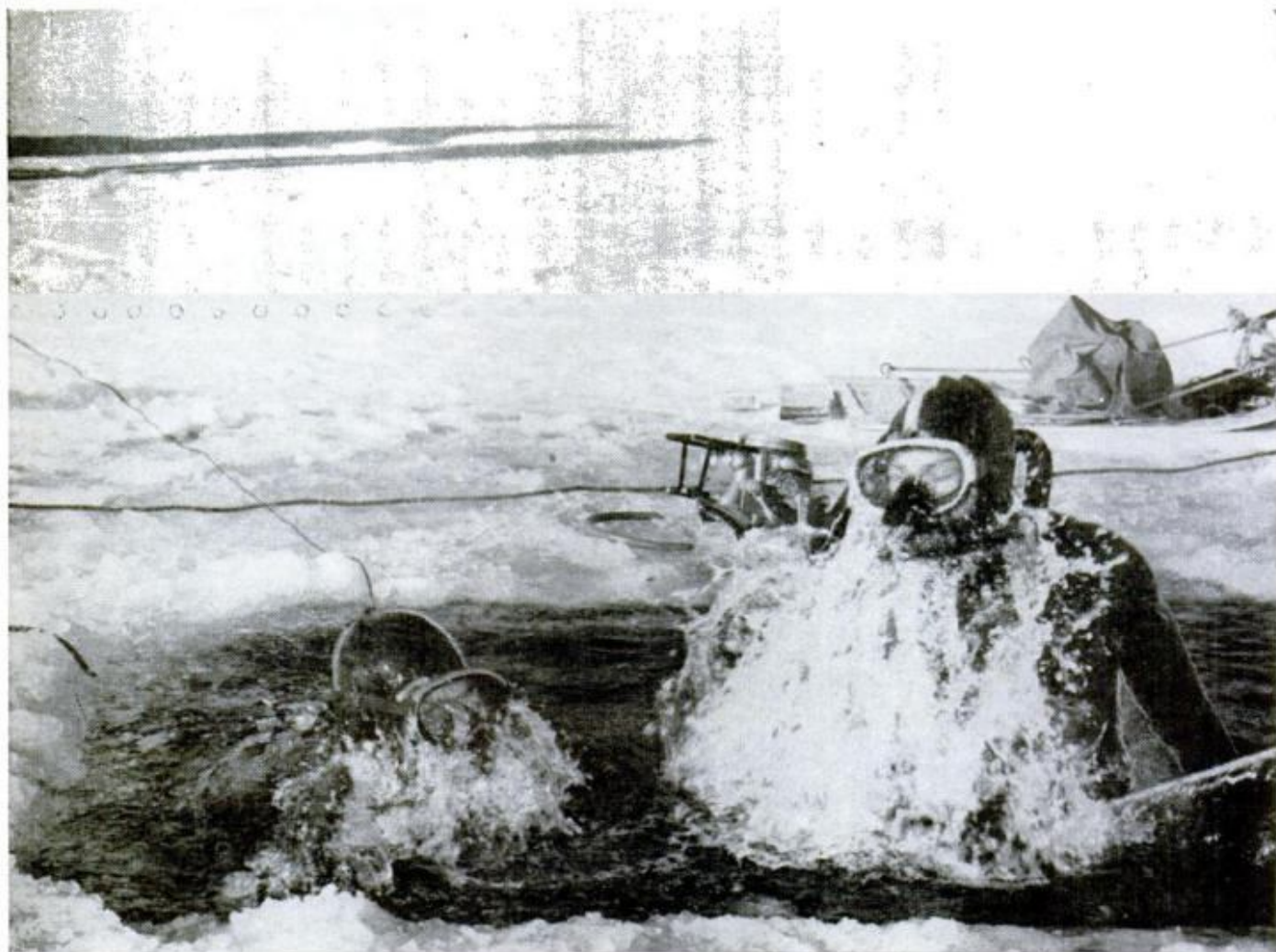
When Italians and Texans get together to build a car, the results are bound to be sleek and big. The steel body and tubular frame of the Vetta Ventura are made and assembled in Turin, then shipped to Vanguard Motors in Dallas, where a 300-cu.-

in., 250-hp. Buick V8 is dropped in.

The 2470-pound car reaches 60 in 6.8 seconds, it's claimed. Front disc brakes are standard. Base price is \$7000, with automatic shift, sunroof, racing wheels and air conditioning extra.



# Frigid Fun for Skin



**BURSTING** to the surface after a swim beneath the ice, a winter diver comes up for a rest. Another diver is waiting to take the rope and make his dive

**USING ICE CHISELS**, the divers chop a large rectangular hole in the ice. This is actually an easy job and even with thick ice it takes only a short time





# Divers



ALTHOUGH EASY TO CHOP, the block of ice would be difficult to remove. To solve this the divers push it down and slide it under the ice



*It's risky, and there's no good reason for it—but some people just have to behave like seals*

By Gene Parker

ASTINGING JANUARY WIND whipped across the frozen expanse of New York's Sacandoga Reservoir. Flinging granules of crusted snow like shot, the wind buffeted a group of ice fishermen who huddled over their stoves for protection and warmth. The temperature stood at 10 degrees.

Lifting their heads, eyes peering from muffled faces, the fishermen watched our group approach. They made no sign of welcome, but merely stared suspiciously as we passed within 20 yards.

A short distance from the fishermen we put down our scuba gear, etched a six-by-four-foot rectangle on the ice, and took up our long-handled ice chisels to chop the hole. When it was cut and the large floating chunk pushed under the ice, two of us slipped into our breathing equipment.

One of the fishermen stood when our intention became apparent. He took a few steps toward us, then stopped and just watched in disbelief. I buckled on my weight belt, then I took the end of a 100-foot line, looped my waist and knotted it with a bowline. The other end was tied to a short ice chisel driven into the ice. I spit into my face mask and rubbed the spittle around to keep it from fogging underwater, then I put it on. I slipped the mouthpiece into position and took several breaths for assurance that the regulator was functioning. Then, when my partner was ready, I jumped into the water. I could almost hear the fisherman gasp.

He should have known that it is actually warmer in the water. It can't go below 32 degrees or it would freeze solid.

Diving down, I veered to the right and swam down and away from the hole. I was bathed in the light that penetrated the thickness of ice. Looking up, the surface of the ice was like a luminescent white ceiling. Air from my regulator bubbled up and clung to the frozen ceiling like puddles of quicksilver.

Water seeped into my wet suit until there was a thin layer between my skin and the suit, a form-fitting casing of quarter-inch foam neoprene that's made

up of several pieces. There are the pants that fit to the ankles, a long-sleeved jacket that zips up the front. There is also a hood, booties and mittens. I use pants that extend to the armpits, giving me a double layer of neoprene over the vital organs which need more warmth than the limbs. The layer of water is quickly warmed by my body heat and I am completely insulated against the cold. It is as comfortable as diving in the summer.

I made a circuit around the fishing holes. The fishermen obviously weren't having much luck. There were no fish to be seen, and if there had been any in the area they would have been around to see what I was up to, satisfying a curiosity that—as skin divers know—is common to all fish. I signalled my tender with three tugs on the rope, and he pulled me to the hole.

"Tell them they're wasting their time," I said. "No fish in this area."

"They won't believe you," the rope tender said. "They're fishermen."

I laughed, then I adjusted the mouthpiece and dived again, the tender playing out the quarter-inch manila rope, keeping it just taut enough to give me leeway and also feel the tug of his signals. The tender has your life in his hands, and he must be alert to the possibilities of danger.

The wet suit eliminates the danger of freezing, but there are other hazards to ice diving that reserve it for the most experienced scuba divers. Claustrophobia is a hazard unique to ice diving, and it is terrifying to contemplate a diver losing contact and breathing the last of his air as he searches frantically for the exit. A frozen regulator could panic a diver who has never been under the ice.

Diving in pairs is a safety measure. If one diver should lose his rope he is instructed to stay in one place a few feet under the ice. His partner then swims out with additional rope and makes a long sweep of the area until he picks him up. And as an added precaution every ice diver should wear a compass and take good bearings before he goes down.

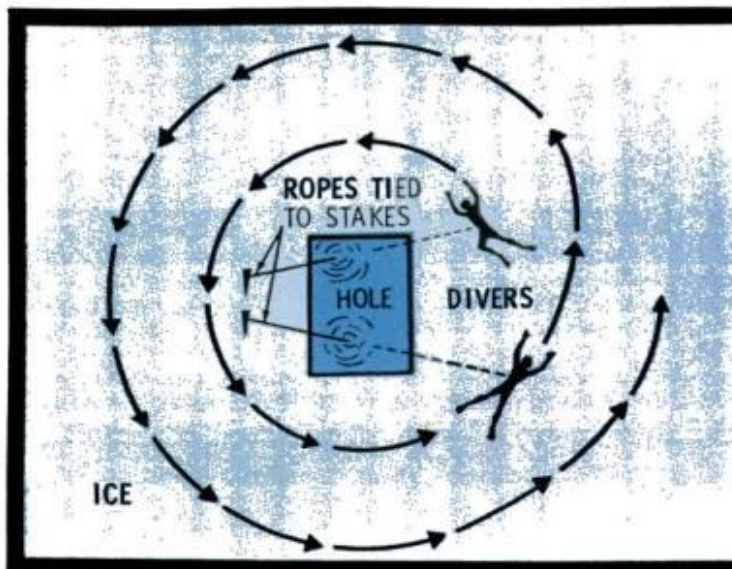
My time was up, so I signalled the tender and he pulled me in. When I climbed onto the ice several of the fishermen were standing around the hole. One of them dipped a hand into the water and pulled it out quickly. He took a hard look at me, then he turned and stomped off, muttering:

"Nuts, that's all. The place is crawling with nuts!" ★★★



**TAKING THE PLUNGE**, a winter diver leaps into the water. It is never below 32 degrees, and a layer of water under the wet suit acts as an insulation

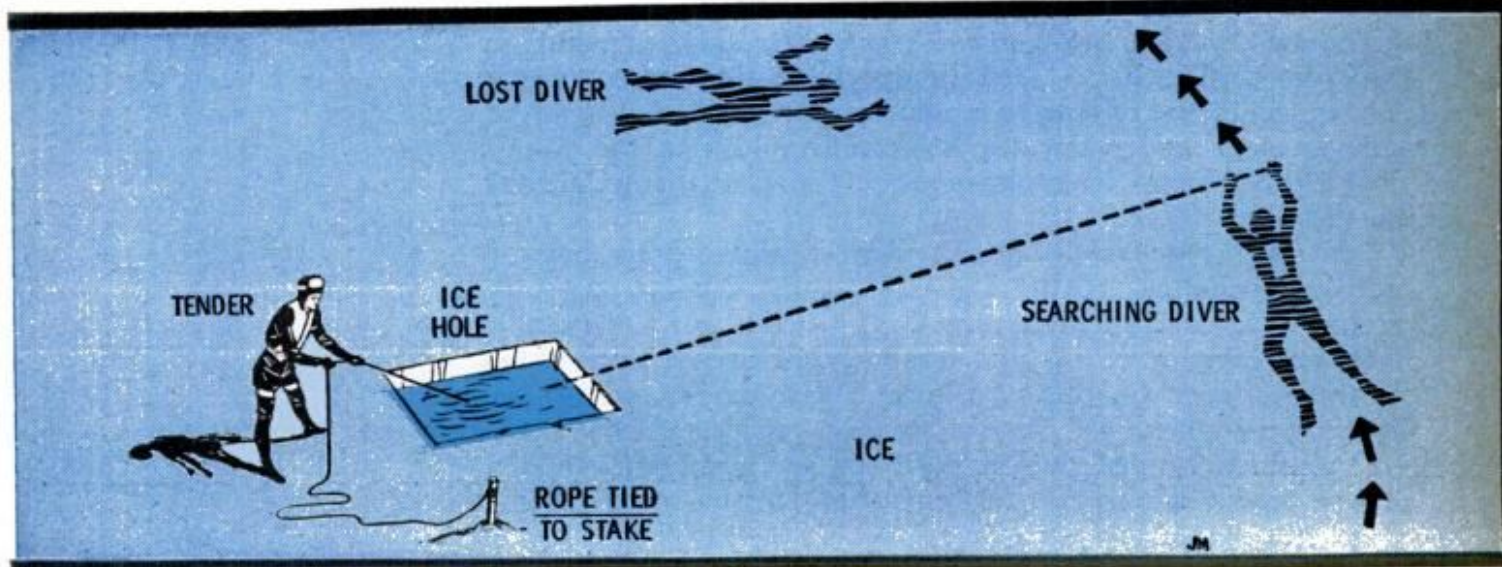
**SAFETY MEASURE** when first entering water is for both divers to make a small complete circle of the hole, gradually branching out to limit of the rope





**FROM BELOW**, the ceiling of ice is luminescent, the light pouring through from above to illuminate the water with an eerie radiance. The diver in this photo is looking up at the shadow of another diver standing on the ice

**IN AN EMERGENCY** when a diver has lost his rope and cannot get back to the hole, he stays in one place a few feet from the ice, and his partner swims in a wide circle with his rope stretched taut until he makes contact





**RECOIL** from .223-cal. cartridge fired by Stoner 63, an interchangeable small-arms system, is so slight that in this U.S. Marine demonstration the carbine is fired at full automatic with the butt held against the mouth

## New Weapons for ... **HOT LITTLE WARS**

*Treetop heliports, throw-away flame throwers, trucks that spew shrapnel like rolling Roman candles, dart-throwing hand grenades—they're all part of our new arsenal for fracas warfare*

**By Harold E. Jerome**

**A** FLIGHT OF HELICOPTERS loaded with crack Special Forces troops hovers over a dense jungle area concealing hostile guerrilla forces.

The whirlybirds nestle down near their quarry, right on the treetops, landing on little heliports of aluminum matting suspended in the foliage on nylon nets.

The troops and their gear descend rapidly to the jungle floor 60 feet below by brake-equipped lines that regulate the speed of the descent.

Some are armed with light shoulder-fired weapons that can spit out *flechettes* ("little arrows") against a point target, or grenades against an area target.

Others carry a pistol-type weapon that fires a tiny rocket projectile, large quantities of which can be carried by the individual soldier.

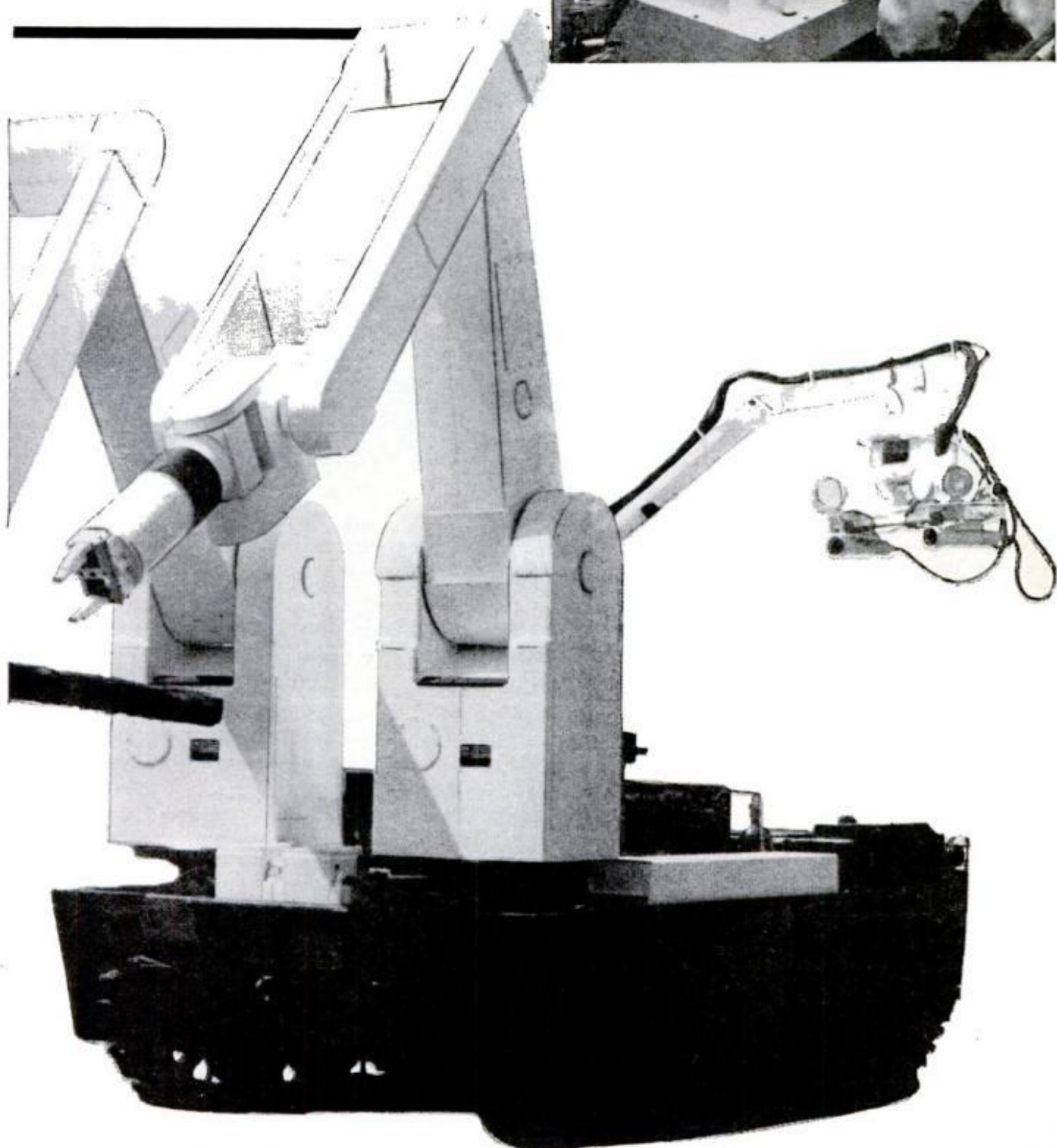
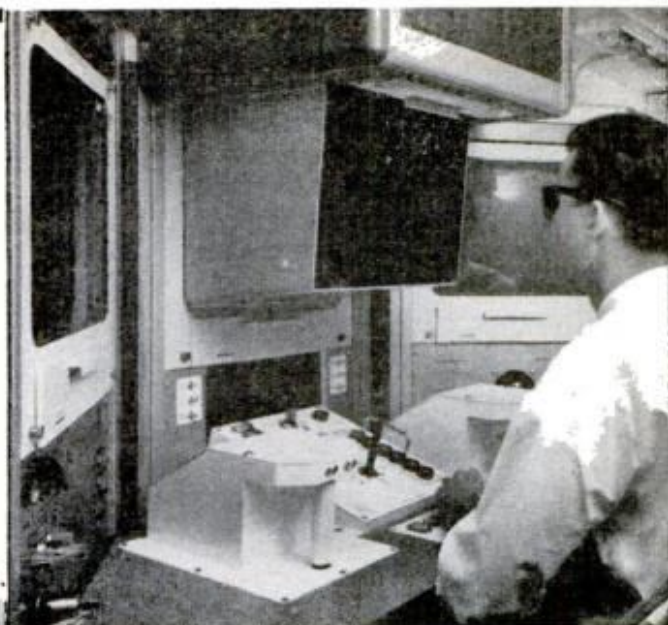
For attack against dug-in positions and armored vehicles, a few troopers carry light, one-shot "throw-away" flame throwers, with ranges up to 75 feet.

As the force starts to thread its way through the jungle,



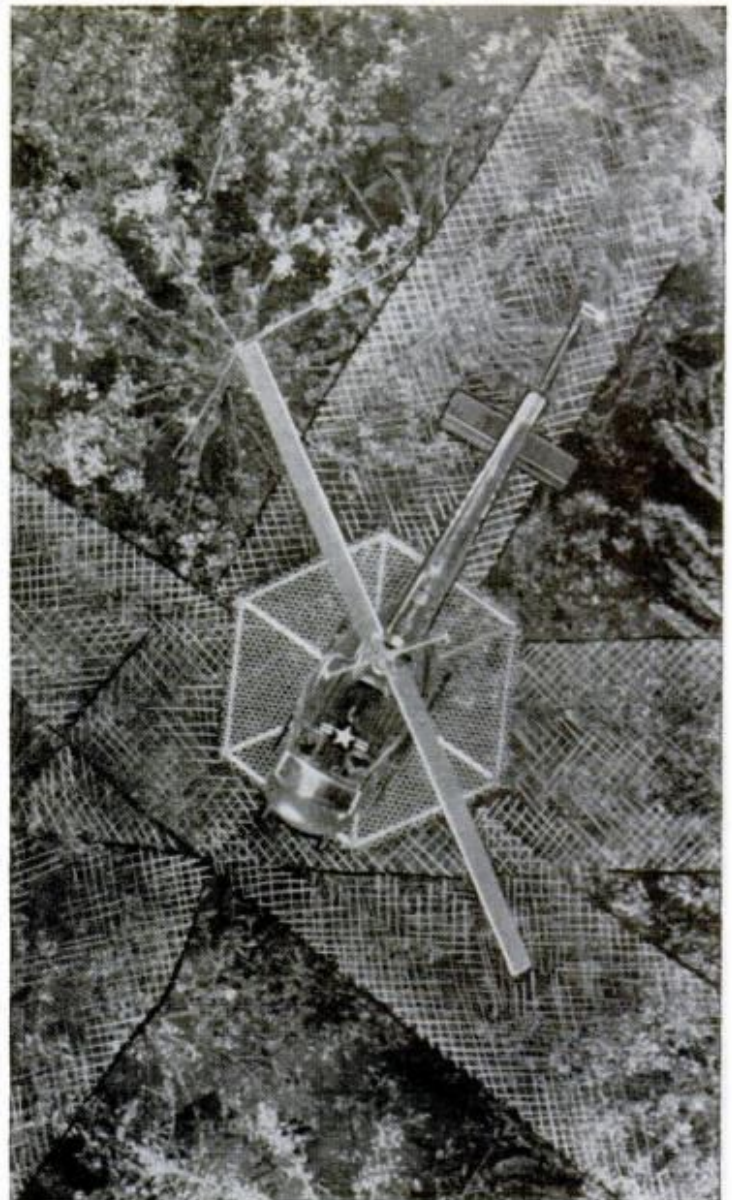
**OPERATOR** of a robot monster sits in a van miles away and directs its activities with an electronic console. A pair of TV "eyes" in the robot transmit pictures of the terrain to the monitoring screens in the moveable control center

**CAPABLE** of traveling at 40 m.p.h. over any terrain a tank can traverse, this robot can lift 600 pounds. It can destroy enemy weapons and equipment, and it can operate a variety of power tools for constructive work under fire





**INTENSIFYING** the light from moon and stars, a night sight allows soldiers to sight a weapon (top) or view a battlefield (bottom) despite total darkness



**SPREAD** over a treetop like a canopy, this metal platform is being tested as a makeshift landing pad for a helicopter in the most dense jungle cover

numerous ambush detection devices and techniques come into play. Some of these involve ingenious uses of chemical and electronic principles. Others are even more exotic. The jungle fighters also release specially trained birds that will fly ahead of the column and give warning of ambush.

In terrain more suited for motor transport, the force rides in trucks armed against ambush with rows of shrapnel-firing devices on each side of the vehicle, like ancient men-o'-war belching grape-shot from their gun-ports.

All of this is a fanciful scenario, of course. None of the equipment mentioned—except the helicopters—are ready for issue by the supply sergeant.

But every item is at this moment somewhere in the research and development

cycle—some little more than a gleam in a researcher's eye, others actually in the field-testing stage before being turned over to troops.

While the new emphasis given to guerrilla and counter-guerrilla warfare by the U.S. in the past three years—the so-called “lower end” of the warfare spectrum—has not gone unnoticed by any means, few people realize the amount of effort actually going into the development of this type of equipment today, overshadowed as it is by missiles, spacecraft, nuclear ships and supersonic aircraft.

But some idea can be gained from the fact that, for the 12 months ending in June, 1965, the Pentagon plans to spend more than \$103,000,000 with all military services and agencies for the development of counterinsurgency weapons and



**FIRED LIKE A MISSILE**, the deadly Redeye missile is attracted by intense heat. When it is aimed and fired at a jet plane, it picks up the plane's exhaust pipe and heads straight for it, exploding a warhead upon contact



**DESIGNED FOR GUERRILLA WARFARE**, this two-man boat is primarily used as a load carrying device. The two sides fold together like a suitcase. It is waterproof and can be carried or skidded across the terrain by two men

equipment, ranging from air-launched strafing rockets to collapsible canteens. This compares with less than \$10,000,000 in 1960 for the same categories.

Uncle Sam, in short, intends to be ready for the "dirty little war" type of conflict wherever the Communists challenge this nation's vital interests. Usually, this means helping a technically backward country fight off subversion supported from outside, as in South Vietnam. That country, in fact, has become a laboratory for developing counterinsurgency equipment and techniques.

The wave-upon-wave mass attacks of the Red Chinese during the Korean War made a long-lasting impression on U.S. Army thinking, and influenced subsequent weapons concepts significantly. Perhaps the single most comparable influence aris-

ing out of the Vietnam conflict is that of the enemy ambush. And in at least one instance, a weapon devised to meet the mass attacks of the Korean War is being modified for application to the vehicle ambush situation in counterinsurgency fighting.

To meet the thorny problem of the vehicle ambush, the Army first considered mounting a series of 48 sawed-off shotguns on the sides of the trucks in Vietnam. These would fire salvos of No. 4 magnum buckshot if the truck ran into an ambush, but this idea was abandoned. Among other things, the shotguns generated too much heat.

Then they thought of mounting Claymore mines on the trucks. The Claymore is a deadly little device that sits on a tri-

[\(Please turn to page 204\)](#)

# The Gun That Does Everything

The Stoner 63 Small Arms Weapons System features six different guns fabricated from one basic component group, with a variety of parts that are 85-percent interchangeable.

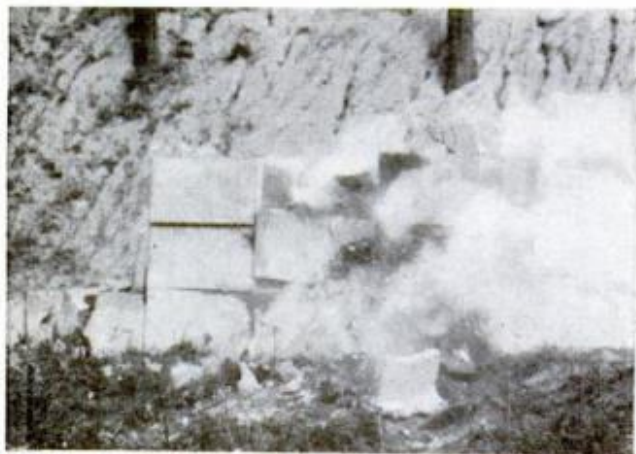
Designed by Eugene Stoner, inventor of the AR-15, and produced by Cadillac Gage Co., this new system is chambered for the .223-caliber cartridge. With the

exception of the barrels, the components are of steel stampings and can be produced in any machine shop without special tooling.

Any of the six weapons can be repaired or converted to another weapon in minutes in the field, using only a cartridge as a tool. The weapons are lightweight and are accurate and lethal up to 400 yards.



**ONE COMMON RECEIVER** and firing mechanism accommodates interchangeable parts for six weapons. A unique feature is that one barrel is removed by pressing a button and a new one slipped into place



**FIRING AT FULL AUTOMATIC**, a feature of every weapon in the Stoner 63 system, the .223-caliber bullet disintegrates on contact, creating a small explosion that will chop a concrete block wall to pieces

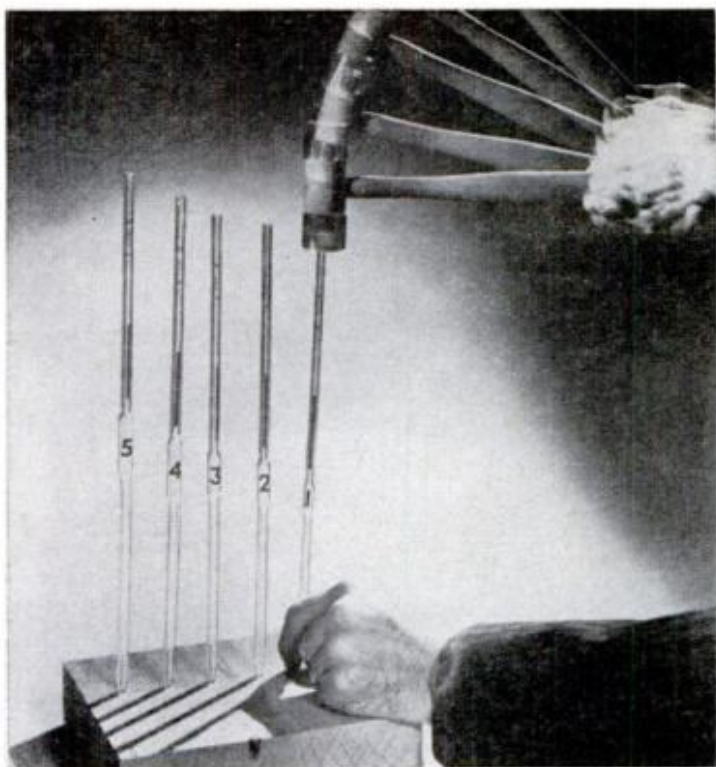


**EACH WEAPON** is capable of firing a rifle grenade when a blank cartridge is inserted into the breech. Although it would be unusual for a machine gun to fire a grenade (above) it could be used in emergency



**THE CARBINE** has a folding stock which makes it only 26 inches long. It can be strapped to the side for parachuting, and with its minimum recoil and the pistol grip, it can also be used as a machine pistol





### Tough as Nails

If you run out of nails, you might try pipets—if they're made of Corex glass. These new laboratory pipets can be driven into wood, as shown, without being damaged. They also have greater resistance to scratching and to the corrosive action of fluids than do standard pipets.

Their secret lies in a special process that chemically strengthens them, explains the maker, Corning Glass.



### Bedtime Picture Stories

Put a record on the turntable, the pick-up arm on the record, and the film strip into its slot. Turn on the switch, and you've got full-color pictures on the screen in time to music and words.

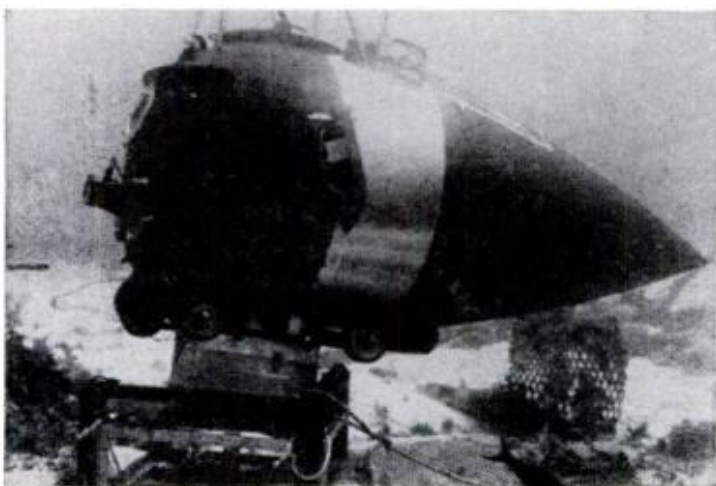
Show 'n Tell can be operated by its youthful viewers. Picturesound programs to play on the General Electric phonoviewer are 99 cents each, while the viewer itself costs \$29.95.

### One-Man Rescue Submarine

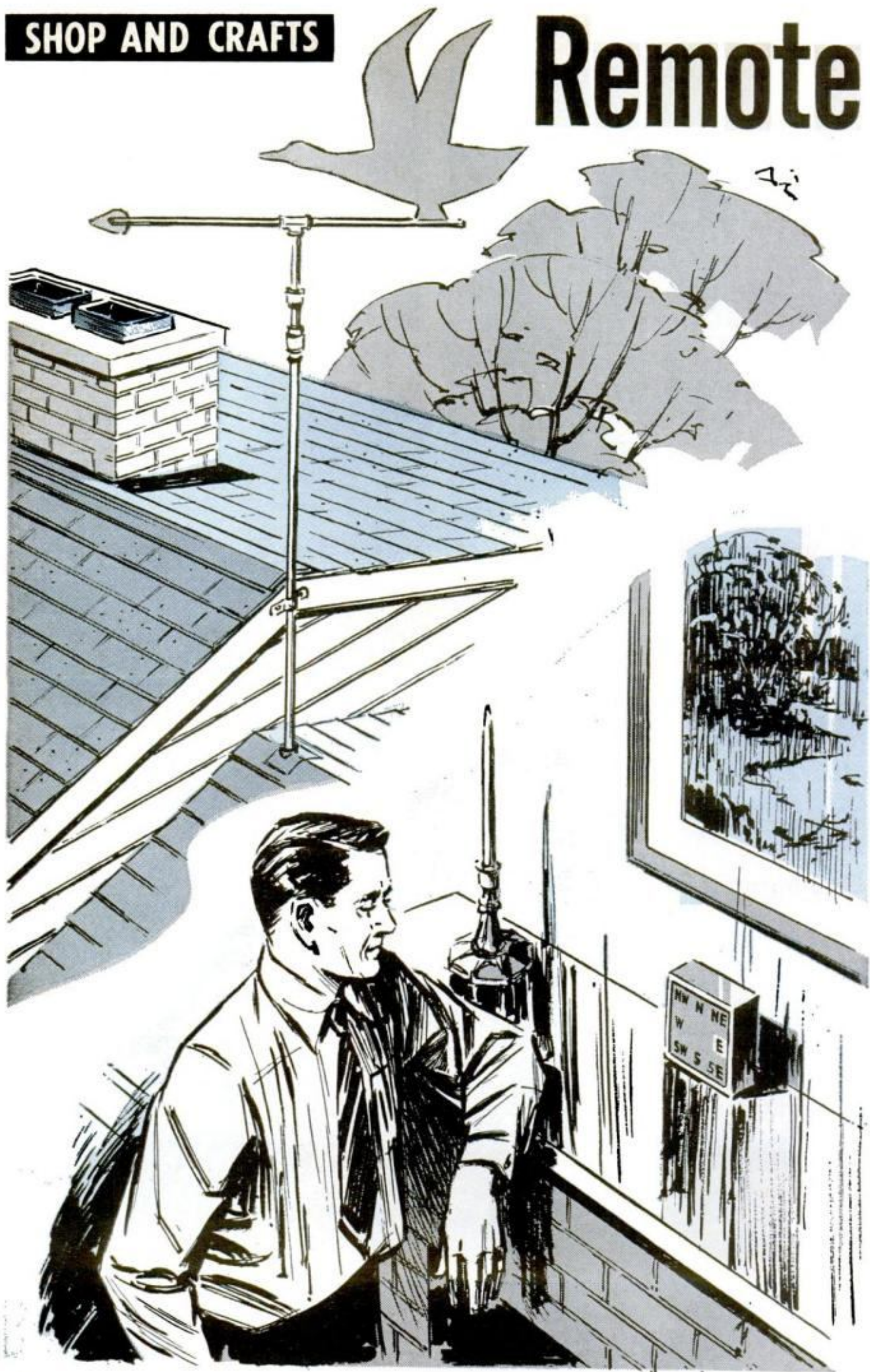
One man operates this undersea rescue submarine being developed by General Dynamics Boating Division. It is specifically designed to locate and rescue men from sunken submarines, but it can also be used for marine research work.

### Springy Seesaw

Four steel arms mounted on noncompressing springs make the Buck-A-Bout an exciting (and safe) four-passenger seesaw. Made by Game-Time, Inc. of Litchfield, Mich., this piece of playground equipment is priced from \$229 to \$378.



# Remote



# Wind Indicator

By Walter Gustafson

**I**F YOU'RE a weather enthusiast, here's the perfect accessory for your barometer and indoor/outdoor thermometer. It enables you to check the current wind direction at a glance, without leaving your living-room chair.

Basically, the indicator is a two-part assembly consisting of a vane on the roof which transmits wind direction through a stator-rotor assembly in the attic to a panel that can be mounted in any room. The low voltage used presents no electrical hazards, and the entire assembly can be put together in a few evenings from parts readily available at a plumbing shop or hardware store.

Begin construction with the upper unit. The rotating shaft which supports the vane should be made from a piece of  $\frac{3}{8}$ -in. rigid copper tubing, sometimes described as pipe. With this type of tubing, the nominal diameter and inside diameter are approximately the same.

The inner shaft is supported by two ball-bearing units, each having an outside diameter of  $1\frac{1}{8}$  in. and an inside diameter of  $\frac{1}{2}$  in. The first bearing is positioned on the  $\frac{3}{8}$ -in. pipe at a point about 12 in. from the end of the pipe. Then two short sleeves cut from a standard  $\frac{3}{8}$ -in. copper coupling are slipped over the pipe and soldered in place, one sleeve on each side of the bearing. Be sure each sleeve is snug up to the bearing. These sleeves lock the bearing in place on the shaft so that it cannot move up or down.

The long end of this pipe should now be passed through the larger pipe so that the bearing butts against the end of the 1-in. pipe. Secure the bearing in this position by sliding a  $1 \times \frac{3}{4}$ -in. reducer-coupling over the small pipe, over the bearing (the bearing will go inside the large end of the reducer-coupling) and on the pipe as far as it will go. Solder the coupling in this position.

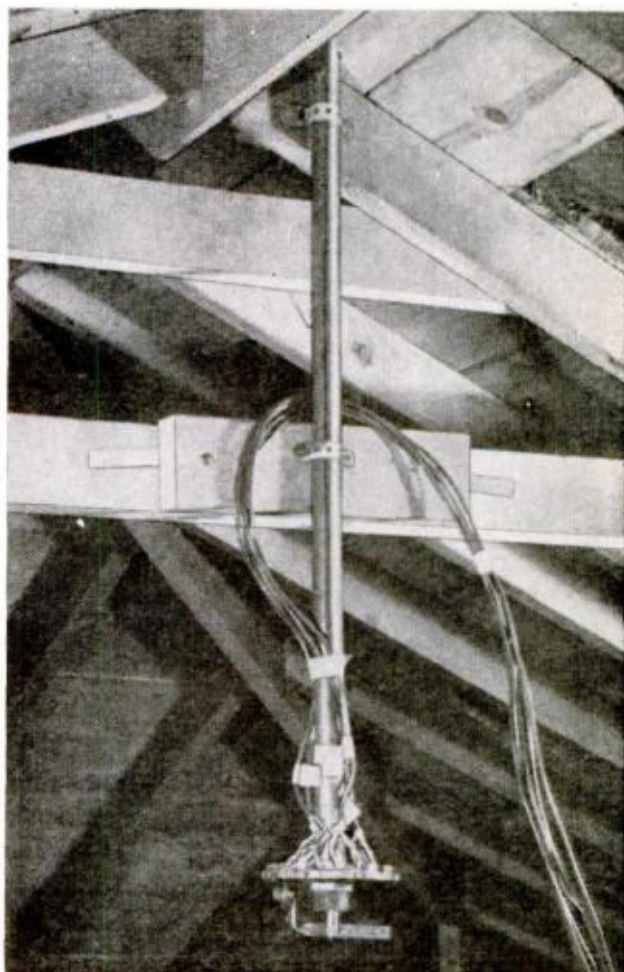
As this is the end that will be on the roof, it's necessary to prevent snow and rain from entering the open end of the pipe. This can be accomplished with a combination of reducer couplings. To make this assembly, proceed as follows.

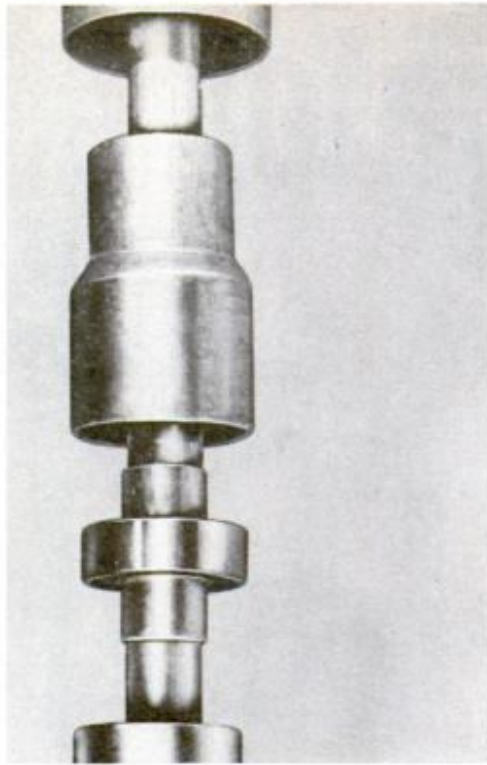
Start with a  $1\frac{1}{4} \times \frac{3}{4}$ -in. reducer-coupling. Cut a piece of  $\frac{3}{4}$ -in. pipe about  $1\frac{1}{2}$  in. long and solder this in the small end of the reducer. Now, solder a  $\frac{3}{4} \times \frac{3}{8}$ -in. reducer-coupling to the  $\frac{3}{4}$ -in. pipe



**ON THE ROOF**, an attractive silhouette wind vane swings into the wind, pivoting easily on the ball bearings located inside the weather-proof sleeve

**IN THE ATTIC**, a sensitive stator-rotor assembly attached to the bottom of the mast relays the wind direction to an indicator panel in your living room





**PROTECTIVE CAP** holding the upper ball bearing is made by assembling three copper reducer couplings

protruding from the larger coupling. With a round file, remove the flange from inside the  $\frac{3}{8}$ -in. end of the reducer-coupling. This flange acts as a stop when a pipe is inserted. After the flange is removed, the reducer will slide readily over the  $\frac{3}{8}$ -in. pipe.

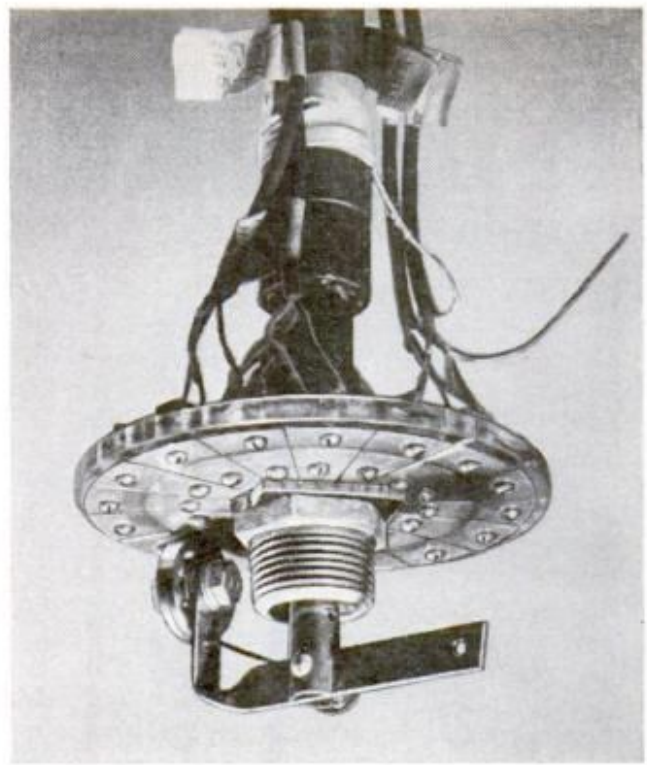
Slide the reducer-coupling combination you have just made on the  $\frac{3}{8}$ -in. pipe, the large end toward the 1-in. pipe and the coupling securing the bearing. Bring it down until the coupling overlaps the  $\frac{3}{4}$ -in. coupling by about 1 in. Finally, solder in place at the small end of the reducer.

A second bearing is now mounted on the other end of the assembly. Slide the bearing over the small pipe and secure it in position with sleeves, as you did the upper bearing. Then pass a 1-in. adapter coupling over the bearing and pipe and solder it in place. (This adapter must be of the type having one end for a sweat fitting and one end threaded.)

The stator is constructed of plexiglass and sheet copper. You will need a circular piece of plexiglass  $\frac{1}{4}$  in. thick and 5 in. in diameter. Drill a  $1\frac{5}{16}$ -in. hole in the center of the plexiglass.

Next, on a square sheet of copper (approximately 23 ga.) inscribe a  $4\frac{7}{8}$ -in. circle and divide this into eight equal pie-shaped segments. Cut a  $1\frac{3}{8}$ -in. hole in the center of the sheet of copper.

Before cutting the copper into segments, center the sheet carefully on the plexiglass and place both pieces together in a vise. Drill two  $\frac{1}{8}$ -in. holes through each



**SENSING UNIT** consists of an arm mounted on bottom of mast which rotates on segmented copper disc

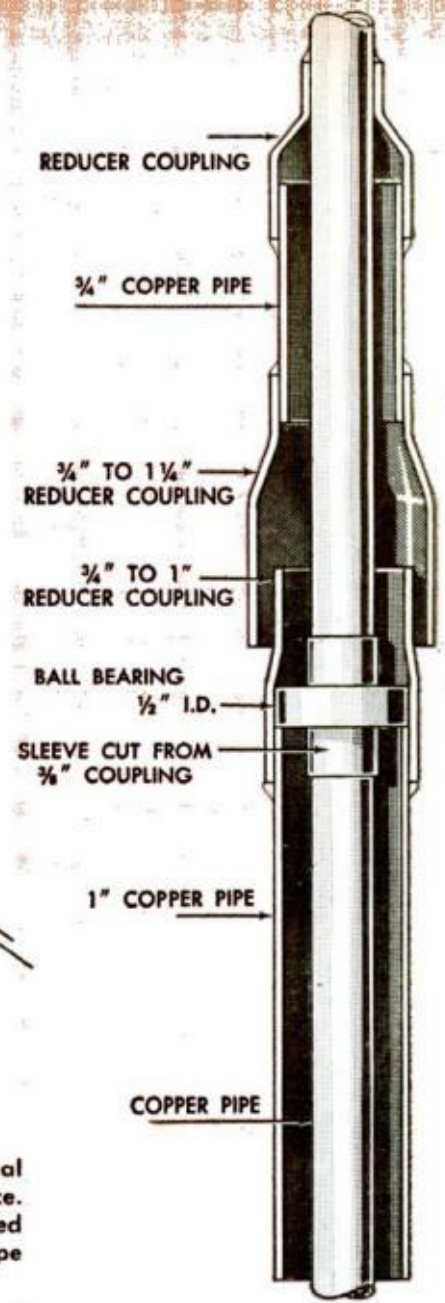
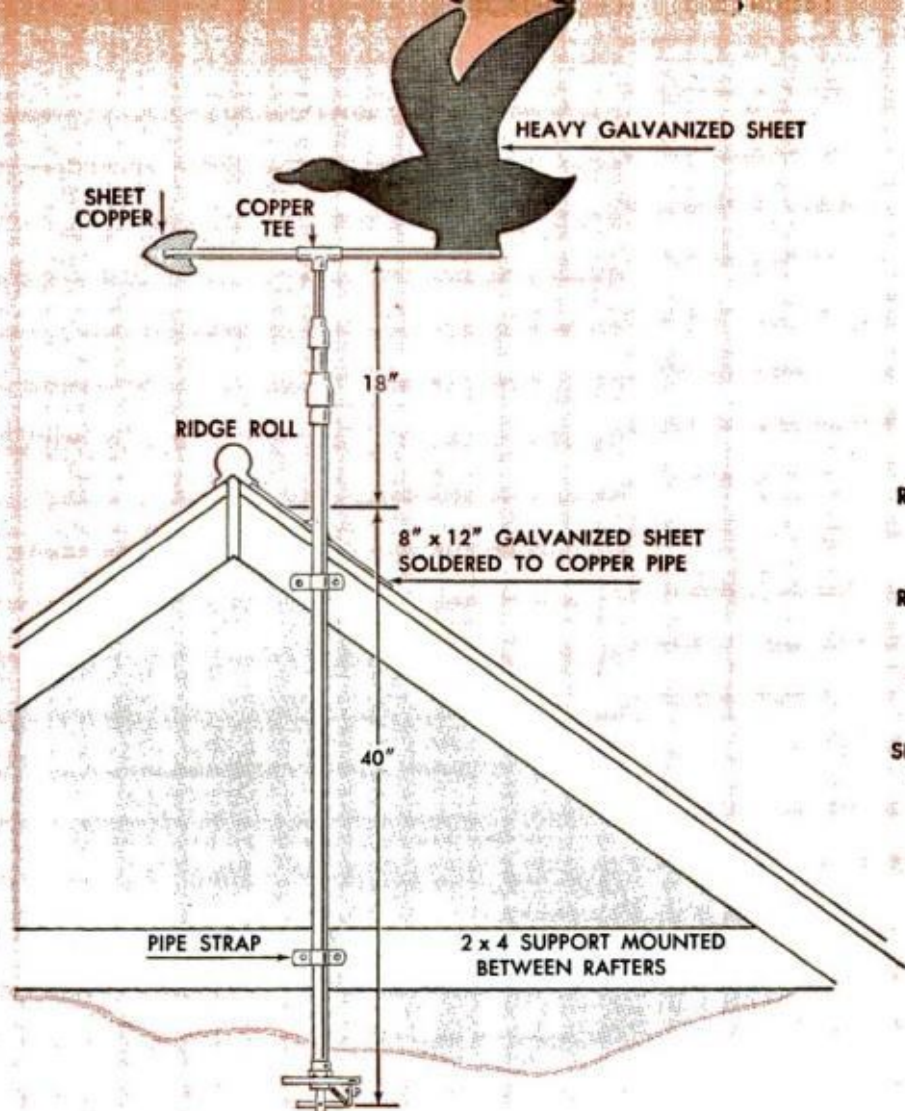
segment of copper and the plexiglass backing it. Keep the holes close to the outside circumference of the copper and close to the lines marking the segments. As these holes are drilled, secure the copper to the plexiglass using  $\frac{1}{8}$  x  $\frac{3}{4}$ -in. stove bolts.

After all the holes have been drilled, number each segment of the copper and mark corresponding numbers on the back of the plexiglass so that when the segments have been cut apart they can be replaced in exactly the same position.

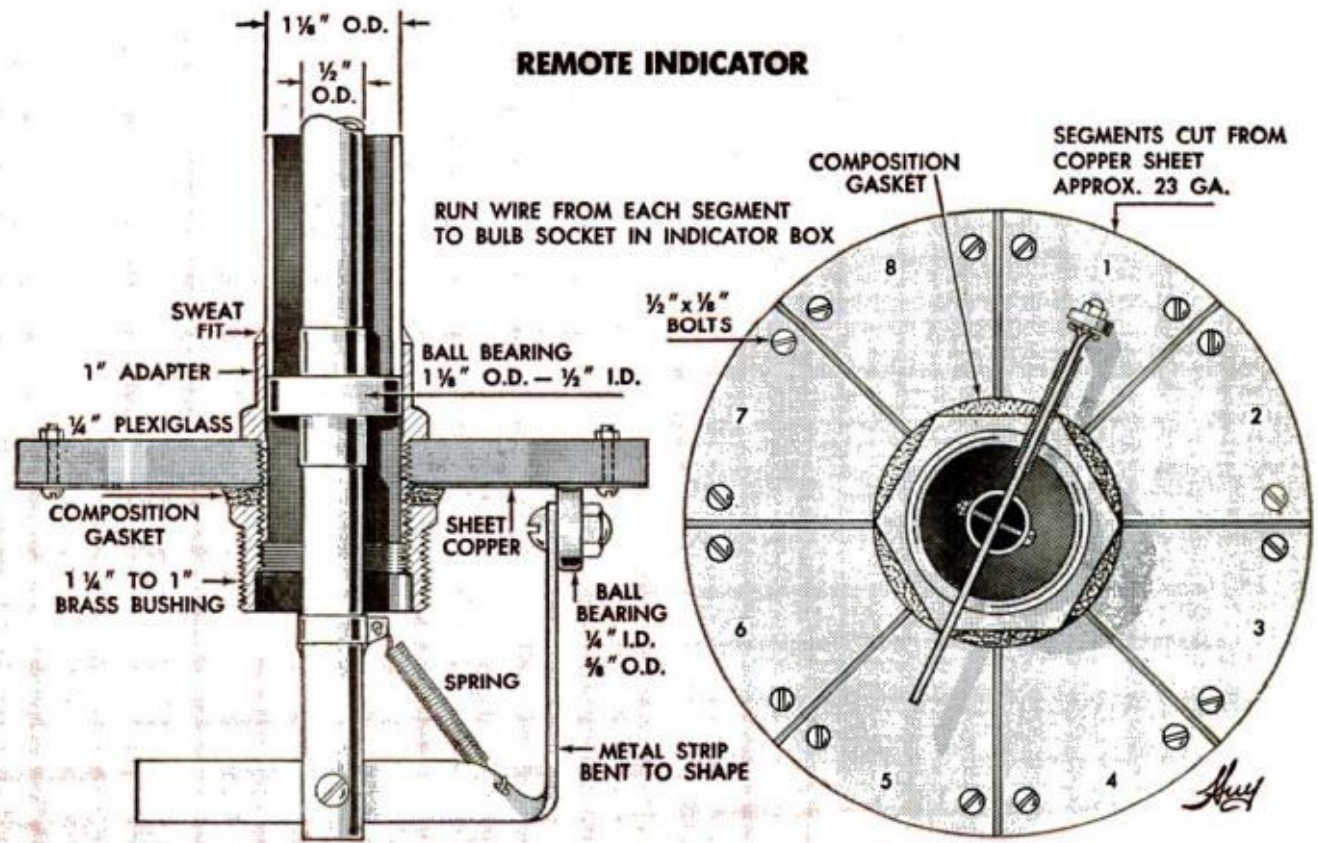
Remove the copper from the plexiglass, and with tin-shears, cut the disc into segments. File the sides of the segments, taking off about  $\frac{1}{32}$  in. from each edge. Then bolt the segments to the plexiglass according to their numbers and check to make sure that no two edges of the segments touch each other. You may have to do a little additional filing and fitting as you replace them. When completed there should be about  $\frac{1}{16}$  in. space between segments.

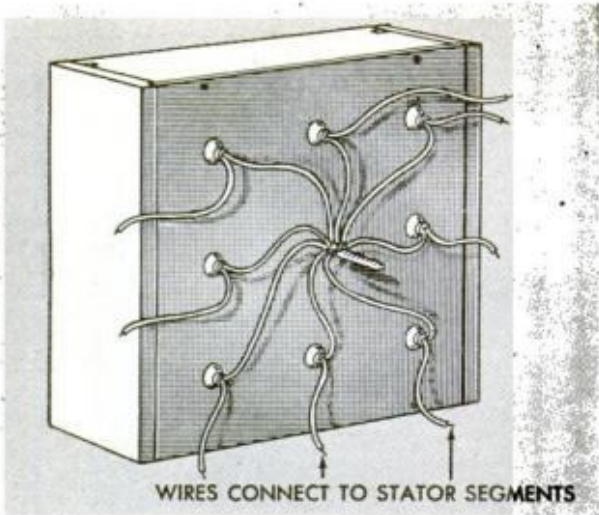
Next, place the plexiglass disc with its attached copper segments over the threaded end of the copper fitting. The copper segments should be on the "down" side, facing away from the long end of the pipes.

The large washer above the plexiglass serves to insulate the stator from the rest of the assembly, and also overlaps the inside circumference of the copper segments to hold them securely in place. You can buy the washer or make it. In either case it should have an outside diameter of  $1\frac{7}{8}$  in., an inside diameter of  $1\frac{5}{16}$  in., thickness



**DESIGN OF VANE** is purely a matter of personal taste, though the final result should offer sufficient surface to be deflected by a light breeze. After making a paper pattern of the design, cut the vane from galvanized sheet and solder it in a slot cut in the rear section of 1-in. copper pipe





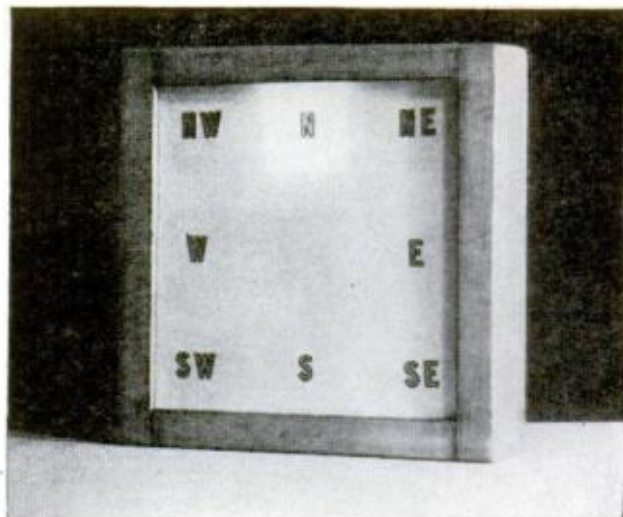
**EIGHT WIRES**, one from each socket, are twisted together and connected to transformer in the basement

of about  $\frac{1}{4}$  in. and be made from hard rubber, bakelite or some other nonconductor of electricity.

Pass the washer over the threaded end of the coupling, and using a  $1\frac{1}{4}$ -in. x 1-in. brass bushing as a nut, draw the washer right up to the plexiglass and copper stator assembly. Don't pull it up too tight or you may crack the plexiglass. It should be just tight enough to prevent the plexiglass unit from turning.

The most difficult and exacting part of the entire project is construction of the arm and rotor which will make contact with the copper segments and transmit the electrical signal down to the indicator panel in your home.

Still working on the end on which the



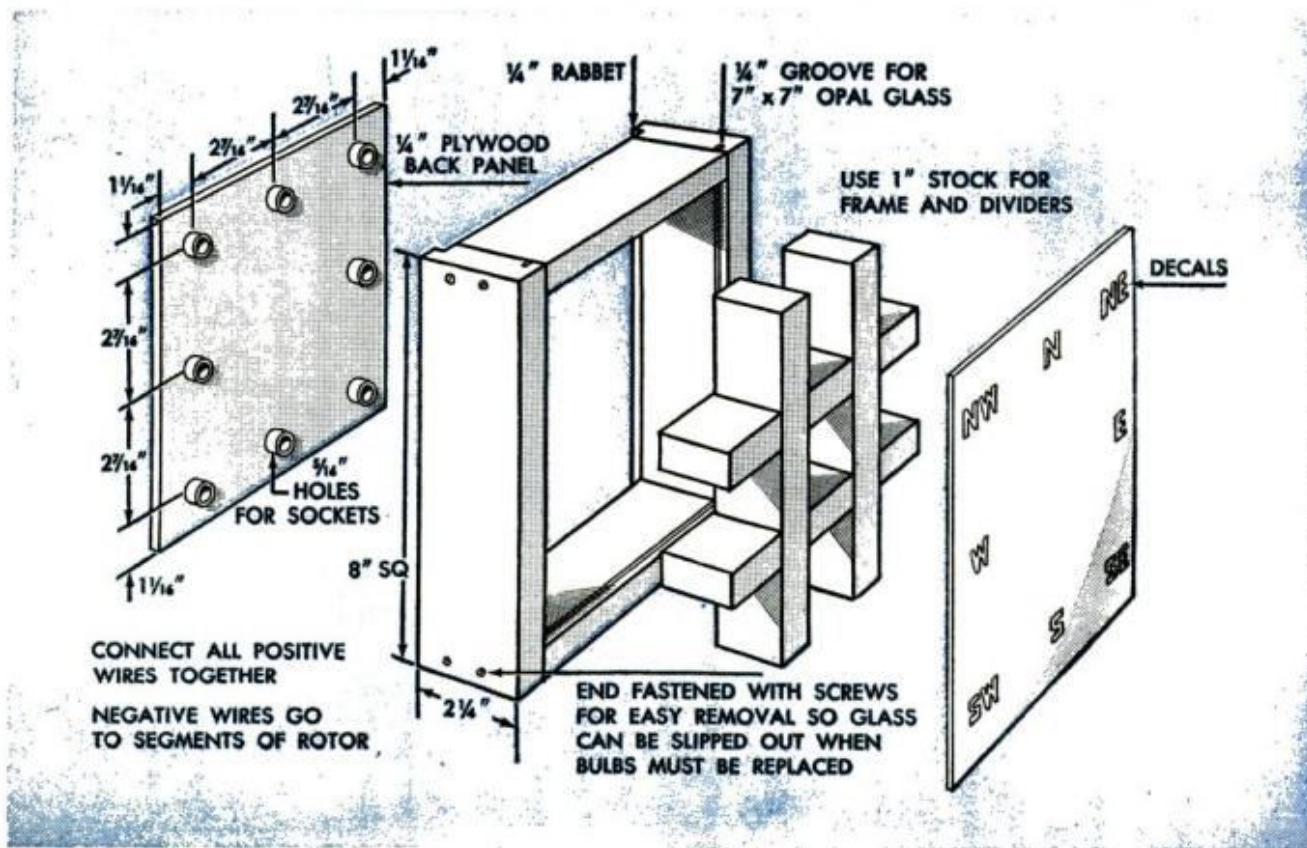
**WIRES FROM SOCKETS** are connected to segments of copper disc, activating light when connection is made

plexiglass unit is mounted, cut off the small-diameter pipe, leaving approximately 4 in. Then, with a hacksaw, cut a 3-in. longitudinal slit in the center of this pipe. Use a file to widen this slit to  $\frac{1}{8}$  in.

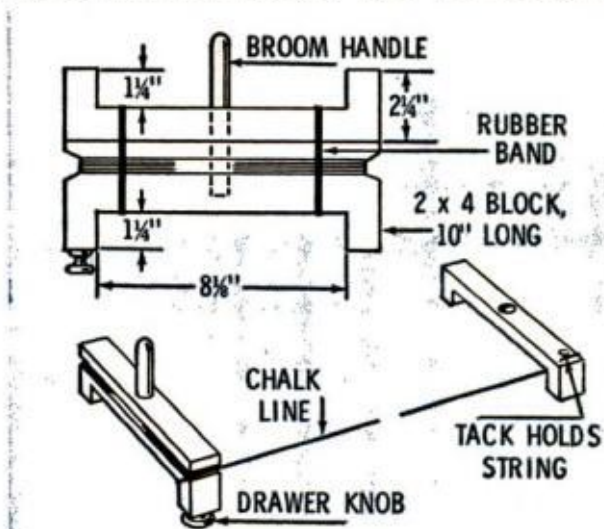
Make the rotor arm from a piece of strap iron or brass  $\frac{1}{8}$  x  $\frac{3}{8}$  in. x 8 in. Insert 3 in. of this strap in a vise, placing it so that the jaws of the vise grip the flat side of the strap. Be sure that it's exactly horizontal. Now, with a wrench or pliers, twist the free end one quarter turn. Then, without removing the piece from the vise, bend the long side toward you to make a 90-deg. bend.

Remove the arm from the vise, make a center-punch mark  $\frac{1}{4}$  in. from the end

[\(Please turn to page 206\)](#)



# Line Holders Clamp Themselves to Blocks

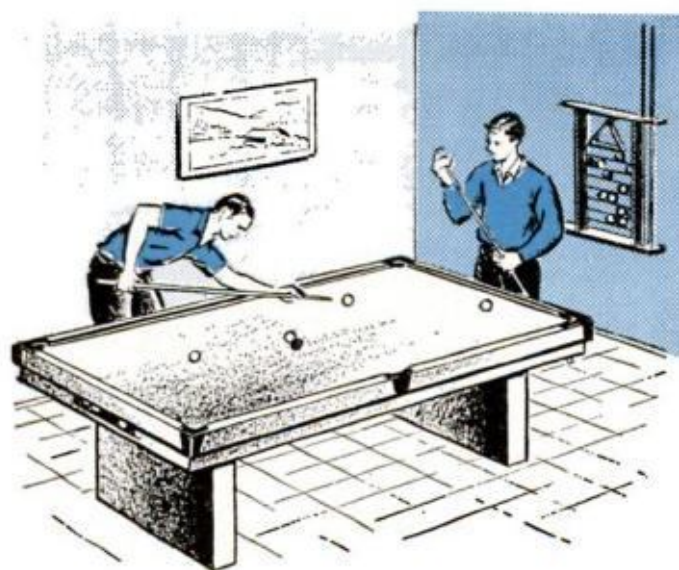


The clamping action of this combination line holder and reel results from the tension of the leveling string pulling on one end of each holder. The string, which is a standard mason's chalk line, is stored on the larger of the two holders which serves as a reel for winding in or playing out the string. Its broomstick handle permits nest-

ing the two holders when not in use, while a drawer knob provides a crank.

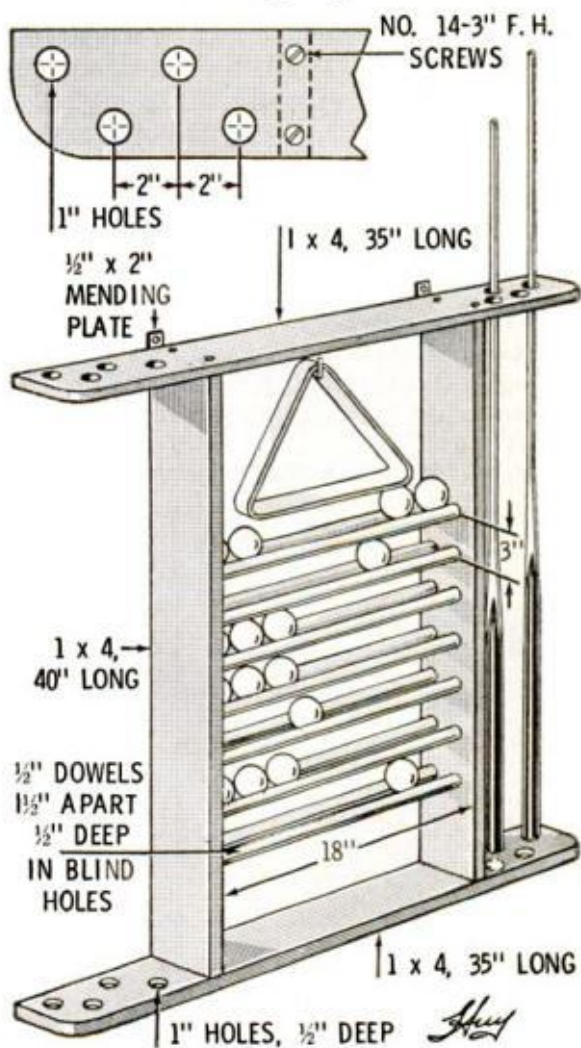
Cut the holders from lengths of 2x4. For standard 8-in. block, follow the dimensions shown in the details. For other sizes of block, make the distance between each holder's jaws 1/8 in. greater than the block thickness.—*Ralph S. Wilkes*

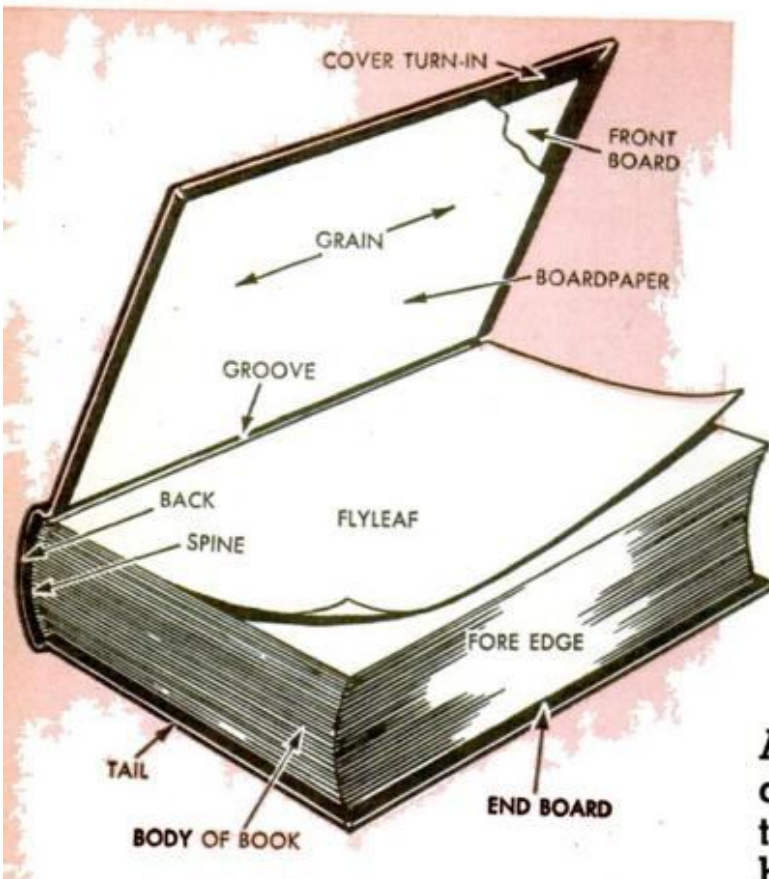
# Hanging Wall Rack Holds Your Pool Equipment



After buying a pool table for my family room I found that we needed a place to keep the rack and cues so I built the hanging wall rack detailed at the right. As you can see, the balls are cradled on pairs of 1/2-in. dowels, the ball rack hangs on a hook bent from a piece of coat hanger, and the cues stand in holes bored part way through the base. The cues are inserted in the rack by passing the tips up through the upper holes first. Mending plates are used to fasten the rack to the wall by letting them extend above the top member.

—*L. Dock*





# Rebinding Damaged Books

By Manly Banister

**A homemade book press, a few common tools, and you'll be able to handle anything from a torn hinge to a complete rebinding**

**N**OBODY WANTS to throw out a good book just because the binding is damaged. Chances are it's one of your favorites, for these always receive the most handling. Often, the damage can be repaired in a couple of minutes with a little glue or paste. Sometimes a complete tearing down and rebinding may be required. But in either case the investment in time and materials is negligible when balanced against the result.

You don't need a lot of expensive equipment to repair books. The most important piece of equipment is a book press, and the easy-to-build unit detailed on the opposite page is quite satisfactory for most

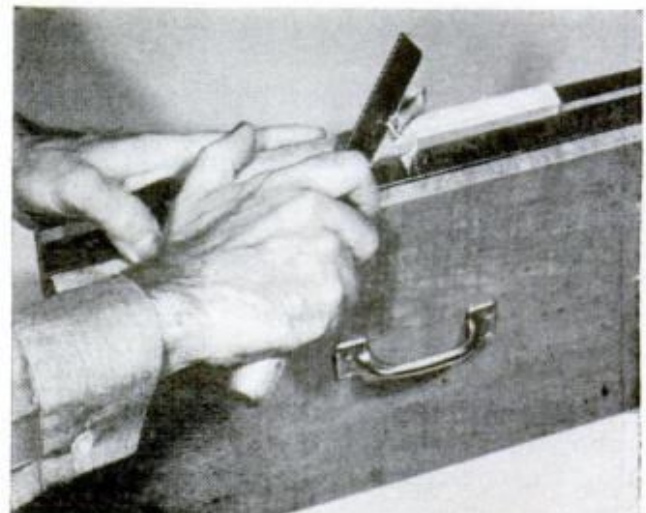
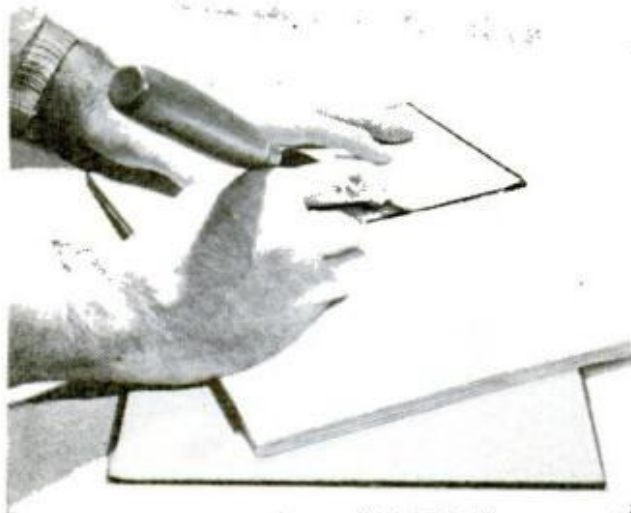
jobs. In addition, you'll need scissors; a ruler; a hammer or mallet; a bone "folder" (or make a wooden one by curving the ends of a flat stick and rounding the edges); a sharp knife, and a large needle.

Materials used in repairing books are also inexpensive. In addition to the paper, mesh-cloth "super," cover boards and book cloth, you'll have to buy a spool of #25 linen thread, a cake of beeswax (for waxing the thread), a small can of hide glue and a jar of library paste. All of these may be obtained at a bookbinder's supply house.

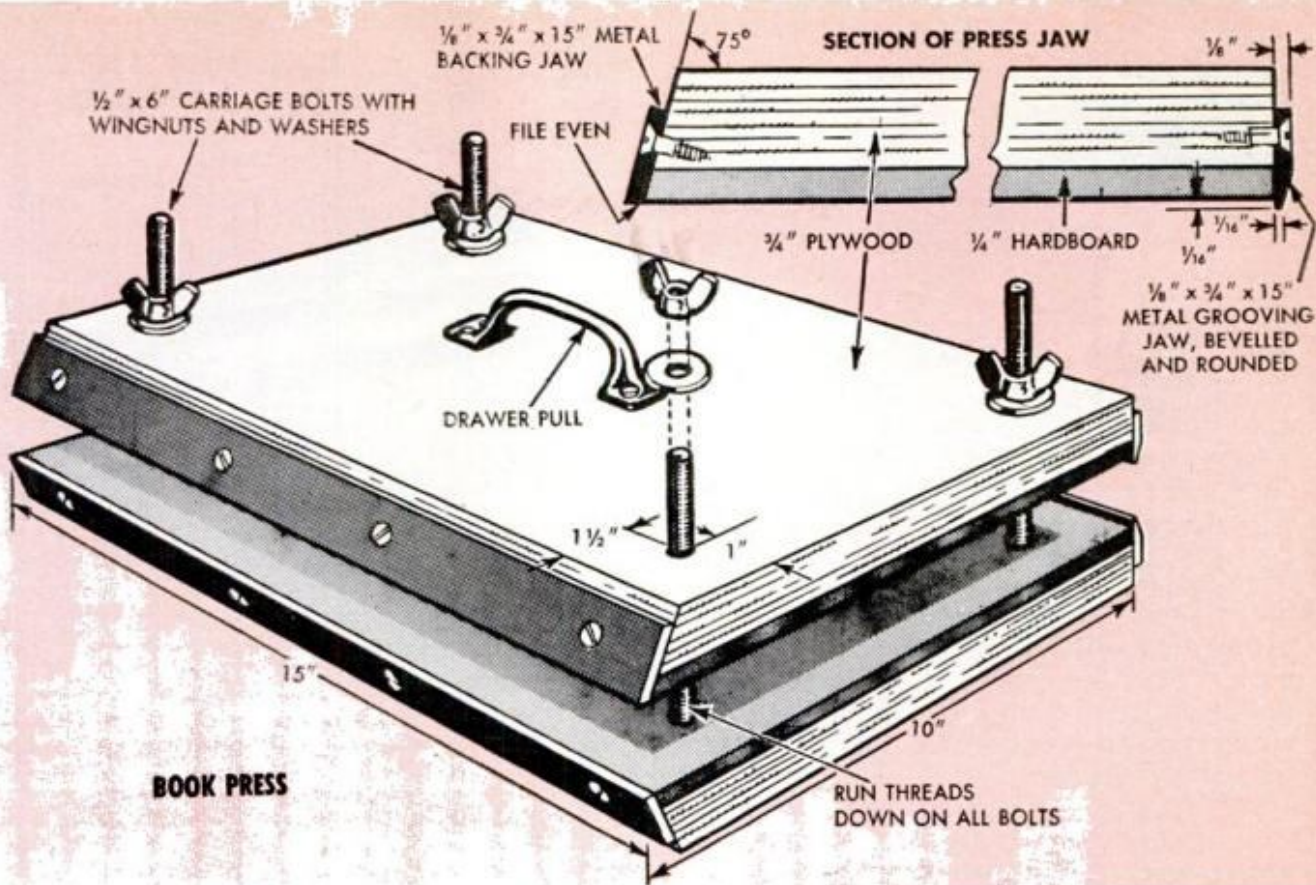
One thing to keep in mind when repairing books: Paper, like wood, has a grain

**1. WITH A SHARP KNIFE,** cut through the hinges on both sides to free the body of the book from covers

**2. CLAMP BOOK** in the backing jaws of the press and scrape off all the paper backing, super and glue



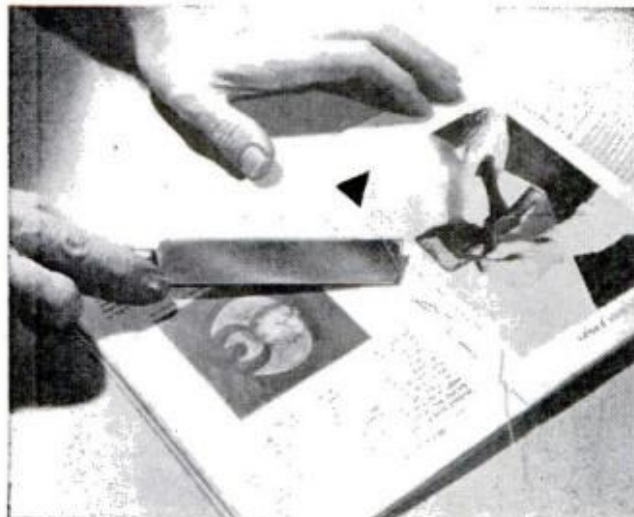




running in a given direction, and every piece of paper put into a book must have its grain running vertically, from the head to the tail of the book. Otherwise, it's bound to buckle and cause trouble. One simple way of determining the direction of the grain is to fold a sample sheet and wet the crease. If it dries smooth, the grain runs parallel to the fold. If the crease buckles, you've folded the paper across the grain.

The following steps, numbered to correspond with the illustrations, cover a complete rebinding. This will probably only be necessary if the book is in very bad shape, with the sewing loose and sections coming

**3. STARTING WITH** the first section, find the center and cut each stitch. Do the same to all the sections



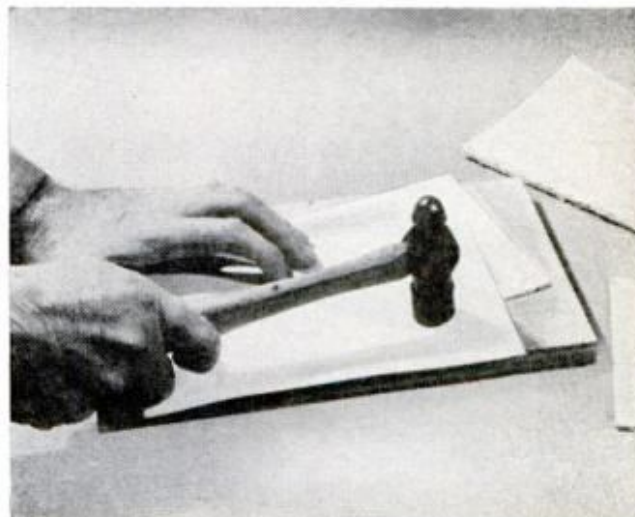
apart. To repair less severe damage—broken cover boards, torn flyleaves, etc.—simply follow the appropriate steps.

**STEP 1.** Cut the body of the book free of its cover by slashing through the hinges on both sides with a *sharp* knife. Tear off the flyleaves and throw them away.

**STEP 2.** Clamp the book in the angled backing jaws of the press and dampen the spine. (If old glue is really hardened, spread on a layer of library paste and let it stand a while.) Scrape off the paper backing, the mesh super and the glue, down to the folds of the sections.

**STEP 3.** The body of the book is composed of sections called "signatures" in

**4. SEPARATE BODY** into sections and flatten the groove in each. Cover with paper to prevent damage





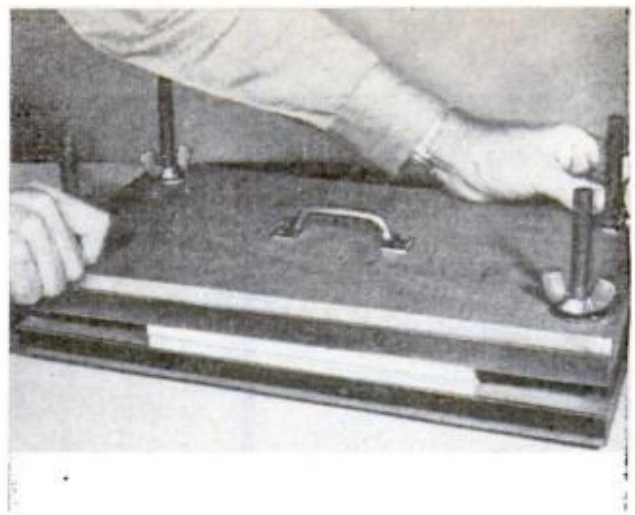
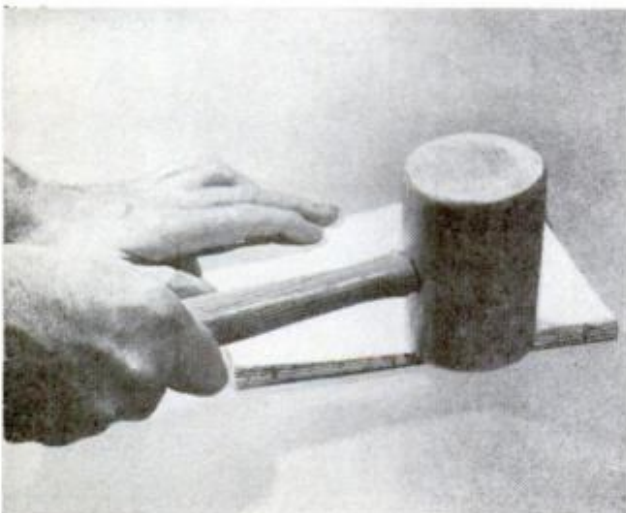
**5. IF OUTSIDE SHEET** of section is torn, repair it by pasting a 1/2-in. strip of bond paper over the tear

the trade—a series of sheets folded together, usually forming either 16 or 32 pages. Find the center of the first section, disclosing the sewing thread, and cut each stitch down the gutter. Do the same to the rest of the sections.

**STEP 4.** Carefully separate the sections. Note that each is creased close to the fold. This is the "groove," formed in the backing, and it must be hammered out. Protect the face of the section with a sheet of waste paper and hammer out the groove, one section at a time.

**STEP 5.** In separating sections, it often happens that the outside sheet of a section becomes torn. Before resewing the book, it is necessary to repair these sheets. Cut 1/2-in. strips of 11-lb. bond paper, or similar, as long as the page. Lay out the damaged sheet or sheets with the inside of the fold up. After applying paste to the strip, stick it over the torn fold, being careful not to stretch the paste-dampened strip. Then rub it down and put the sheet aside. When all such sheets have been repaired, gather them together with protective

**9. SEWING THICKENS** the spine, but pounding with a hammer or mallet will embed threads in the folds



**6. REASSEMBLE BODY,** stacking sections fold to fore edge in alternating groups. Keep in press overnight

sheets of waxed paper between, squeeze for a few minutes in the press, and lay them aside to dry.

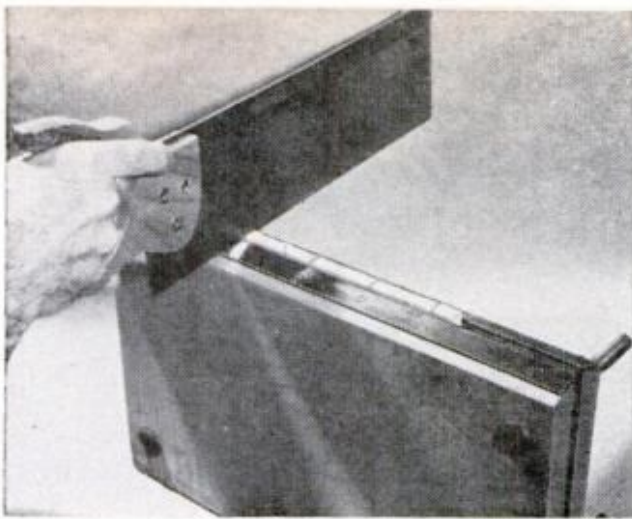
**STEP 6.** Reassemble the sections and stack them with the fold to the fore edge in alternating groups of two or three. Place a sheet of waxed paper or aluminum foil on each side and run the press wing-nuts down as tight as you can. Let the sections stand under pressure overnight.

**STEP 7.** Take the sections out of the press and assemble them in the proper order. (Take care you don't put a section in upside down!) Clamp them in the backing jaws of the press, leaving about 1/4-in. projecting. Make four or more unequally spaced marks across the back, and saw each mark with a *dull* saw about 3/16 in. deep (deep enough to cut through the innermost fold of each section). The head and tail sawcuts should be placed 3/4 in. from ends of spine.

**STEP 8.** Sewing by the lockstitch method has the advantage that no special equipment is needed. Lay the first section face down on the edge of the worktable.

**10. TO ATTACH** new endpapers, apply a 1/4-in. strip of paste down the folded edge of outside sections





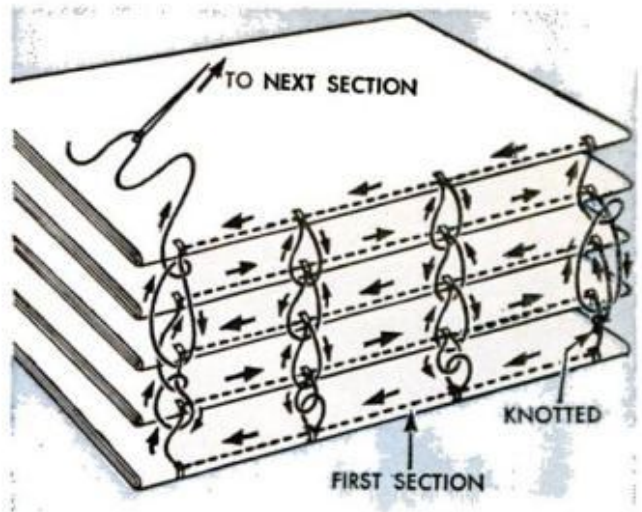
7. USE A DULL SAW to make four unequally spaced cuts about 3/32 in. deep in spine of collected sections

Thread the needle with a couple of feet of thread. Pass the needle into the tail saw cut at the head. Draw loops of thread out through the other sawcuts with a crochet hook or poke them out from inside with the eye end of the needle. Lay on the second section, pass needle in through sawcut at head and out through next sawcut down the back. Pass needle upward through the loop protruding from the section below and back into the same sawcut. Draw the loop firm (but not too tight) to form the lockstitch. Finish sewing section one to section two and tie the two threads together at the tail sawcut with a square knot.

Section three and all following are sewed in the same manner, except that there are no loops protruding. Pass the needle behind the stitch in the next lower section, then back into the section, out at the next saw cut, and so on.

At the end of each section, the section is anchored to the one below by means of the "kettle stitch." Pass the needle behind the thread below, then bring it around and

11. AFTER APPLYING flexible glue to spine, tap it into a rounded shape before the adhesive has set



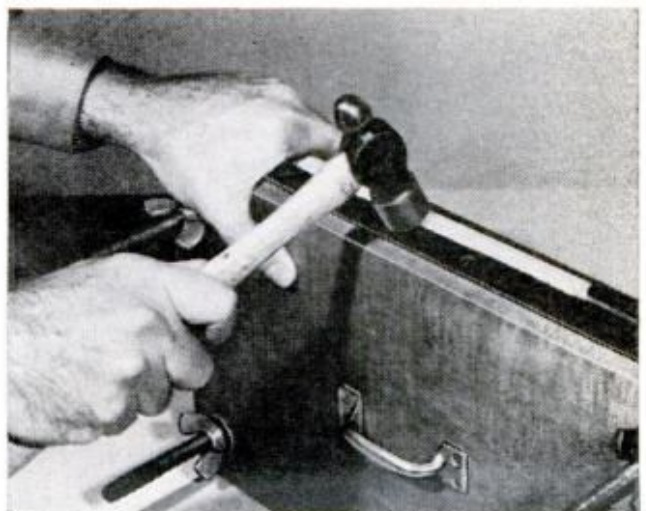
8. SEW SECTIONS together using the lockstitch shown above. This is described in detail in the article

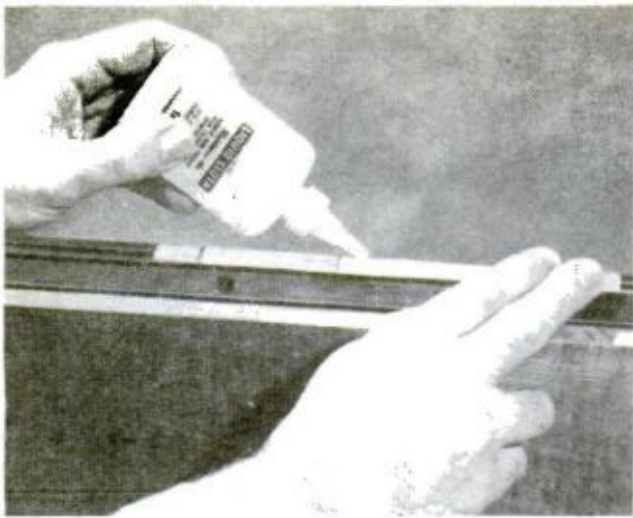
up through the loop of thread thus formed and draw it snug. When you come to the end of the thread, tie on another length so that the knot ends up inside a section. When the final section is sewed on, finish off with a couple of kettle stitches down the back and cut off the thread about an inch long. This will be glued down to the spine of the book.

**STEP 9.** Sewing leaves the spine thicker than the rest because of the bulk of the thread. "Knock down the swell" with a mallet or hammer, embedding the threads in the folds.

**STEP 10.** New endpapers may be made from regular endpaper stock (obtainable at any bookbinding supply house) or any other strong paper, even Kraft wrapping paper. The fold is made with the grain, and the folded sheet should be exactly the size of the body of the book. Protecting the face of the book with a sheet of paper, apply a 1/4-in. strip of paste down the folded edge. Then lay the endpaper over the body and rub it down. Turn the body over and attach the other endpaper in the

12. WITH BOOK clamped in angled backing jaws, turn edges of sections outward with glancing blows





**13. ONCE SHAPING** of spine is complete, apply a thin coat of flexible glue and rub it in well with fingers

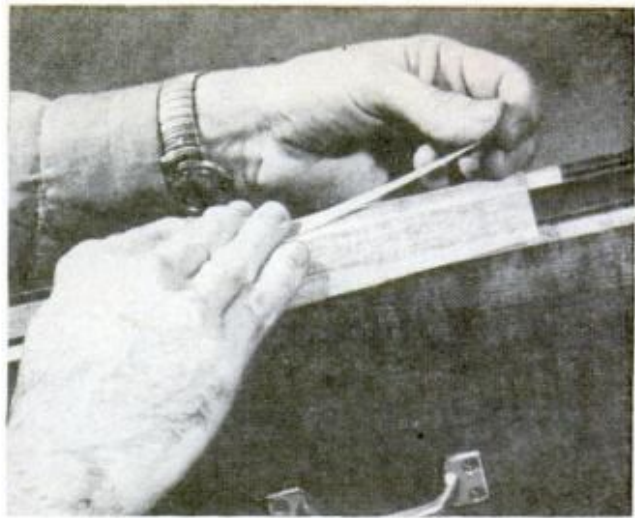
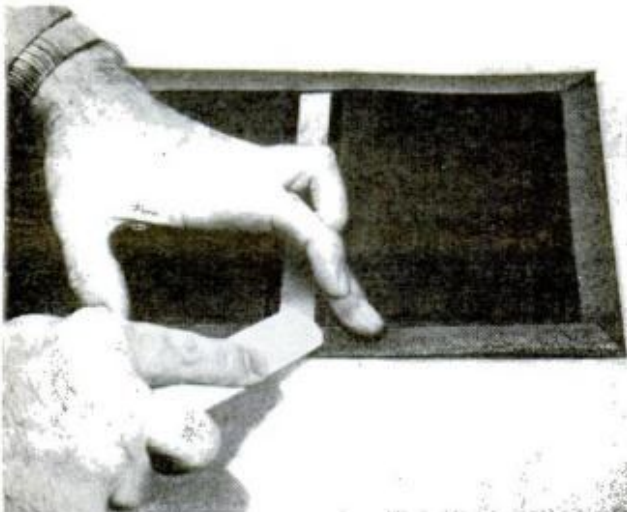
same way. Let it dry under a pressure.

**STEP 11.** Normally, the book won't need trimming. However, if the sections are badly uneven, have a printer trim about an eighth of an inch from all three open edges with a guillotine. Apply a thin coat of flexible glue or Liquid Cloth to the spine. (You can make flexible glue by adding 1½ teaspoonsful of glycerine to an ounce of liquid hide glue.)

Then, before the adhesive is wholly set, tap the spine into a rounded shape with the hammer. Push in the fore edge with your thumb while drawing the top sections toward you with the fingers.

**STEP 12.** To complete the backing, place the body in the angled backing jaws of the press, leaving  $\frac{3}{16}$  in. of the endpapers exposed on each side. The idea here is to turn over the sections from the middle toward each side, reforming the groove noted before you tore the book down. Draw the hammer toward you with each stroke, making glancing blows that tend to turn the fold-edges of the sections toward you. Work the full length of each

**17. REMOVE CASE** and turn excess cloth over edges all around, squeezing out excess glue with the folder



**14. CLOTH BACKING**, or "super," should be rubbed down into glue, then covered with a strip of paper

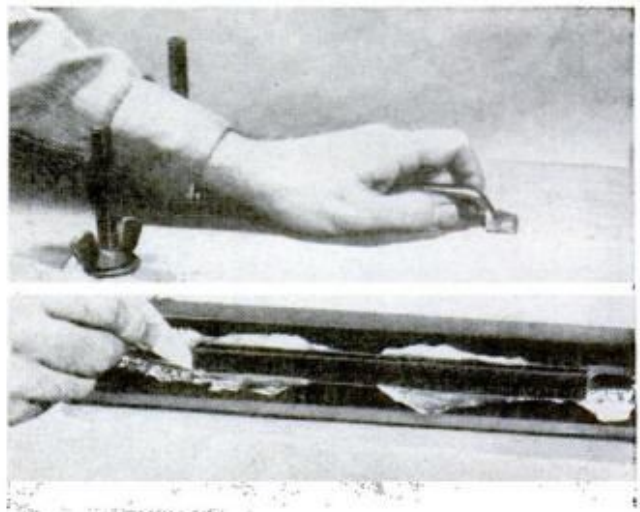
side of the book until a smooth, rounded spine is obtained, with edges bent over against the metal jaws of the press.

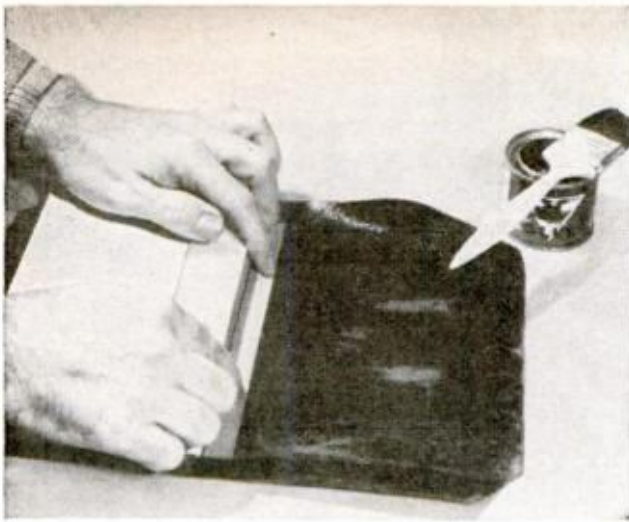
**STEP 13.** Apply a thin coat of flexible glue to the spine of the book and rub it in well with your fingers.

**STEP 14.** Prepare a piece of super (a mesh cloth) or crinoline, obtainable from a drygoods store. (Unbleached muslin can also be used, or canton flannel, stiffened by dipping in a starch solution. Iron the flannel when dry.) The super should be long enough to reach from tail kettle stitches to head kettle stitches and wide enough to overhang the book 1¼ in. on each side. Rub the cloth backing down into the glue. Now cut a strip of Kraft paper, or ordinary newspaper, as wide and as long as the book's spine, and glue it over the cloth.

**STEP 15.** To cover the book, you will need bookcloth or Fabrikoid, obtainable from a bookbinder's supply house. (For this you can substitute paper, leatherette, or even automobile upholstering plastic in sheet form. If the upholstering plastic

**18. REPLACE BODY** in case and clamp book in grooving jaws of press. Shape corners and let dry overnight





**15. WHEN BOOKCLOTH** has been cut, position body and boards on it and glue spine-size paper in place

has a cloth backing, remove the cloth.) Do not use ordinary cloth or anything else that will let the glue soak through and spoil the appearance of the book.

You can use the old boards or make new ones from mill board or heavy cardboard. Be sure to cut the boards with grain running from head to tail. Make them the same size as the old boards if the body wasn't trimmed; otherwise, make them as wide as the body and  $\frac{1}{4}$  in. longer. When  $\frac{1}{8}$  in. is left at the back edge for the groove, the boards will overhang the fore edge  $\frac{1}{8}$  in. all around.

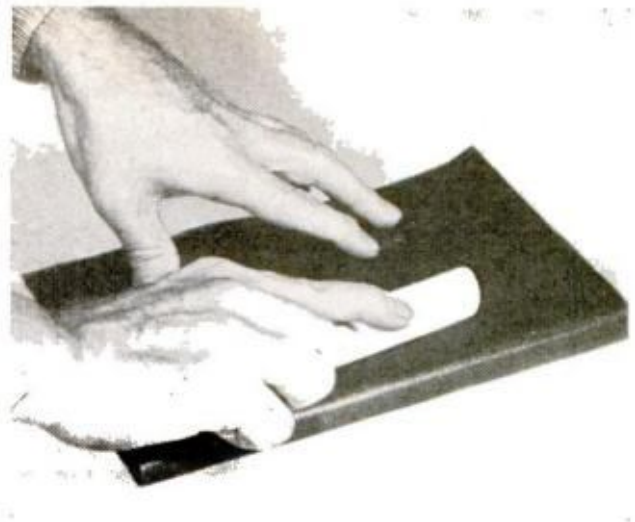
Cut the bookcloth to wrap completely around the book, plus  $\frac{3}{4}$  in. extra at each end and  $\frac{3}{4}$  in. along each side. Mark a rectangle the exact size that will be covered by the book on the inside face of the cloth, then coat it with thin runny glue. (If the glue is thick, thin it by heating in a pan of water.) Clip off all four corners of the cloth to within  $\frac{1}{8}$  in. of the corners of the rectangle.

Lay the end board on the glued cloth in exact position, then position the body of

**19. TRIM EXCESS** turn-in on boards (not spine) to leave about  $\frac{3}{8}$  in. around edges. Use a straightedge



FEBRUARY 1965



**16. WITH BODY** in position, glue bookcloth to boards, working out the excess glue by rubbing with folder

the book on the board. Cut a strip of Kraft paper as wide and as long as the book spine and glue it to the bookcloth, as shown in the photo.

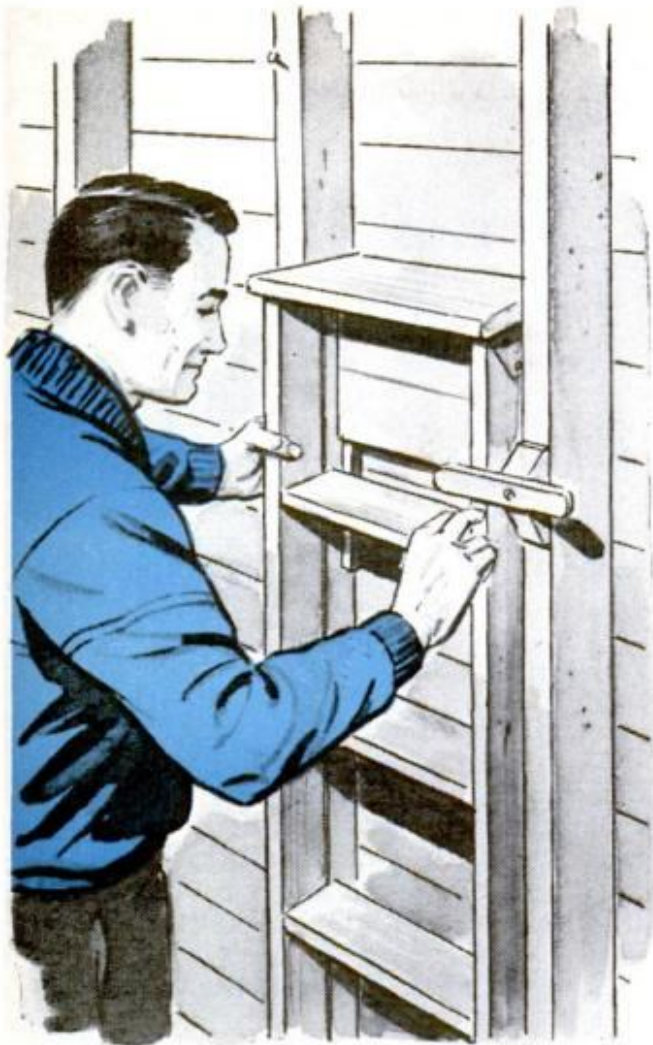
**STEP 16.** Don't hurry! Glue sets slowly. Check everything for squareness as you go along. Lay on the front board so that it overhangs evenly all around, leaving a  $\frac{1}{8}$ -in. groove between the back edge of the board and the turn-up on the book. Bring the cloth tightly over the back of the book, lay it down on the front board and rub it down with your folder. Use the rounded edge to rub in the groove. Work the folder from back edge toward fore edge and toward head and tail to work out any excess glue. (A sheet of waxed paper under the board will prevent glue from running on the edges of the book). Now, turn the book over and rub down the other side.

**STEP 17.** Remove the case (as the cover is called) from the body and lay it board-side up on the table. Turn the cloth over the edge all around and rub down the turn-in, squeezing out all excess glue,

[\(Please turn to page 222\)](#)

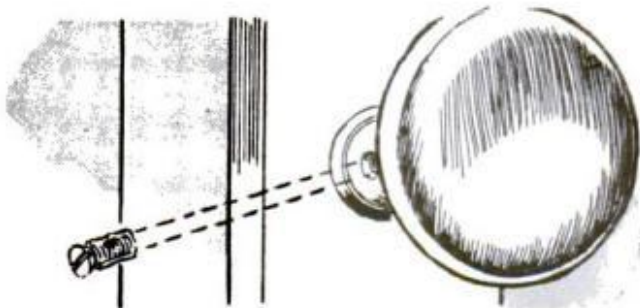
**20. GLUE BOARDPAPERS** to boards and place completed book in grooving jaws for final 24-hr. pressing



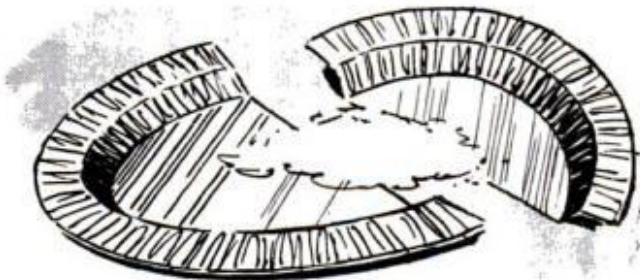


**TO STORE** a small ladder in the least possible space, stand it up straight against the wall between the studs in your garage. A long-arm turn button mounted on a projecting block will keep it from falling

# Solving HOME PROBLEMS

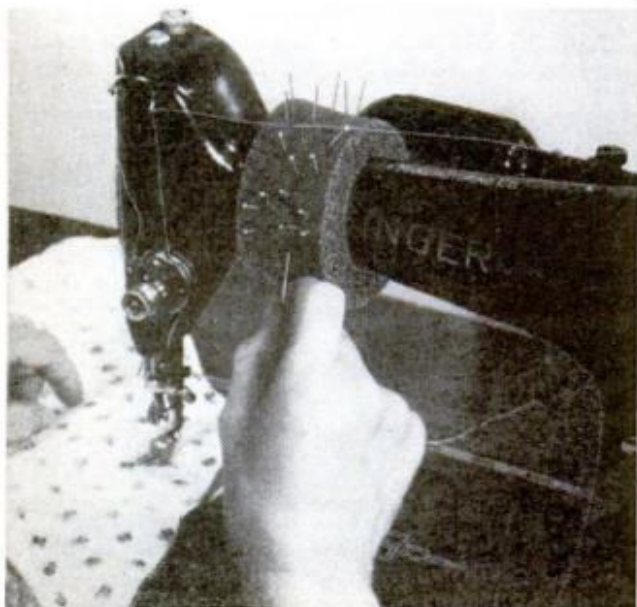


**WHEN THE SETSCREW** holding a doorknob works loose allowing the knob to come off, wrap the screw with a turn of cellophane tape before replacing it. The tape will tighten the grip between the threads

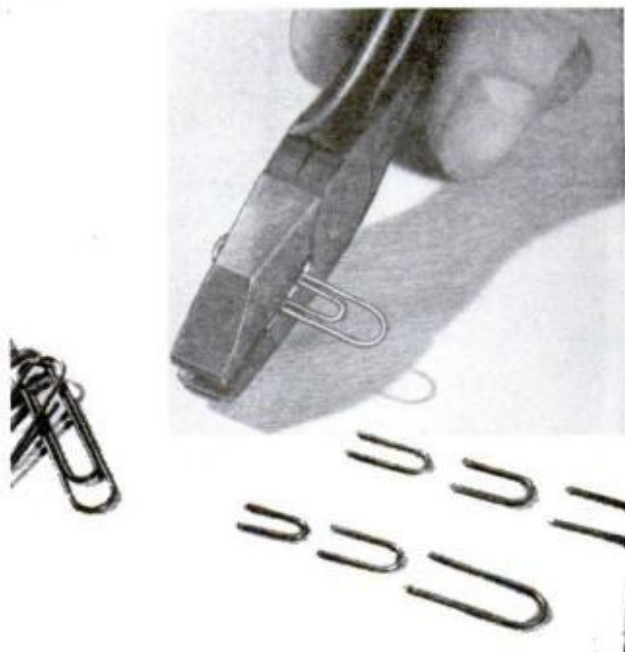


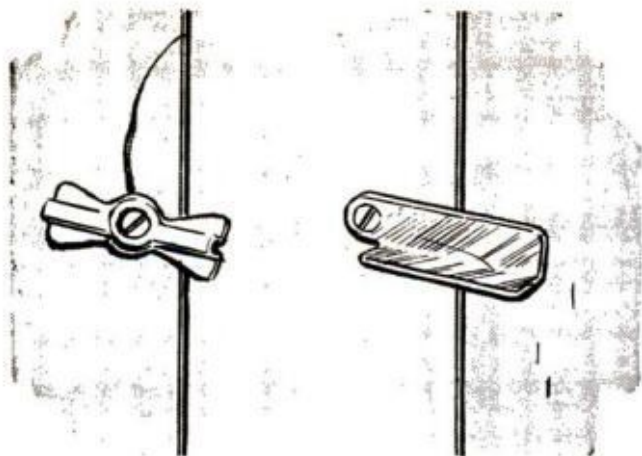
**DISPOSABLE DUSTPAN** is the perfect tool for cleaning up spilled food, paste or other moist materials. To make one, cut an aluminum-foil pie plate in two, leaving two thirds for pan and one third for scraper

**PIN-CUSHION COLLAR** on your wife's sewing machine is always handy and can't be misplaced. To make one, cut a strip of foam plastic and fasten it around the neck of the machine with glue or tape

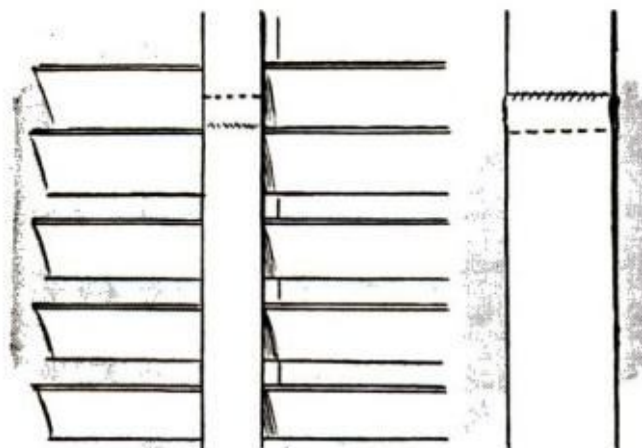


**IF YOU'RE FRESH OUT** of staples for framing a picture, you can make a few by snipping wire paper clips in half. Cut them at an angle to form bevel ends. They will serve in a pinch in soft-wood frames





**IN HAVING TO ATTACH** regular turn buttons close to the edge of a window frame, the screw is apt to split the wood. This won't happen when you use off-set buttons which you can make from aluminum angle

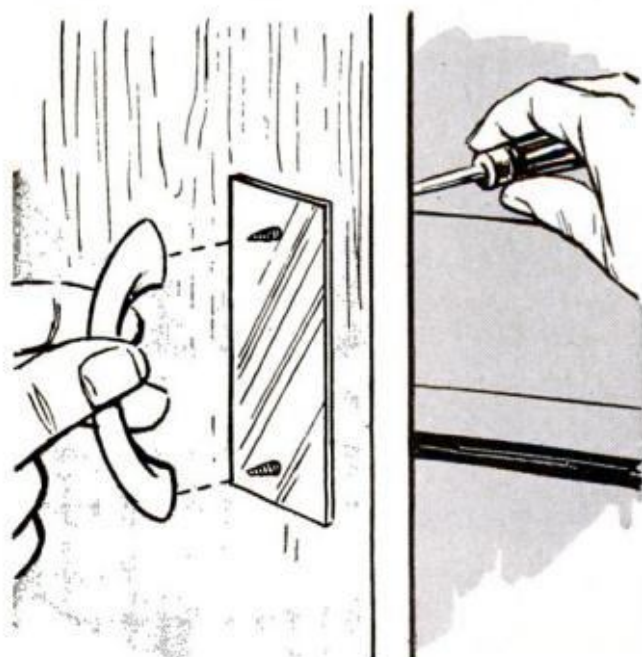


**BLIND TAPES** often stretch near the bottom so that the lower slats don't overlap properly. This can be remedied by sewing small tucks in the tapes where slats don't lap, thus pulling them up into place

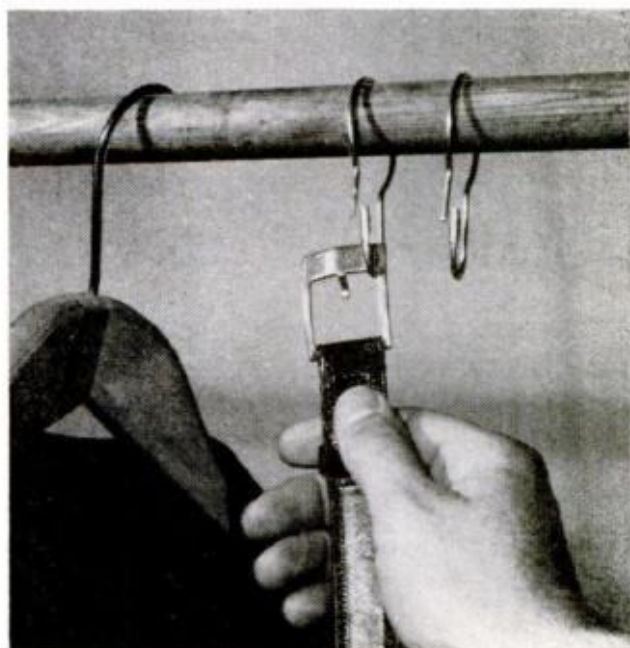


**IMPROVISED VASE** made by taping two paper cups together supports long-stemmed flowers in adequate supply of water. Simply cut bottom out of one cup, invert it over other and tape in place from the inside

**TO PROTECT FINISH** behind kitchen-cabinet pulls, place a sheet of thin plastic under the pull, drilling holes in it for pull screws. This almost-invisible shield protects the finish against wear and finger smudges



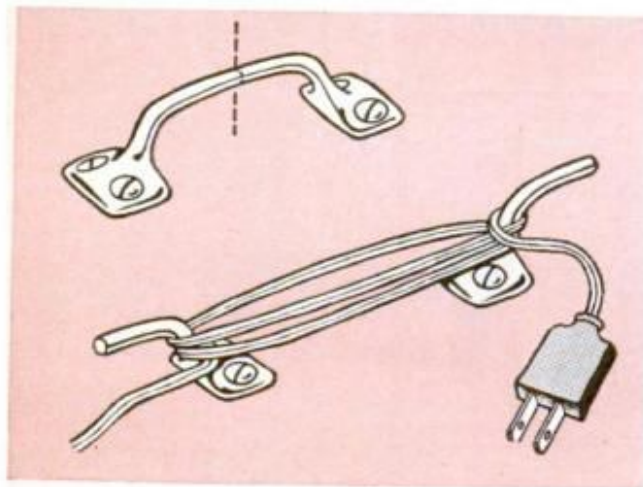
**SIMPLE BELT HOLDER** that slips right over your closet rod is just a shower-curtain hook. Bend the leg of the pin clasp back behind hook to make it easier to remove and replace belts. Make one for each belt





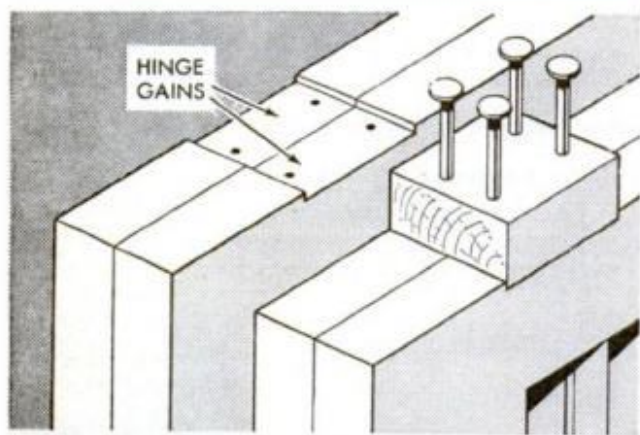
## Kerf Wedge Prevents Binding

When ripping long boards with a hand saw, you can prevent the saw from binding by slipping a small wedge into the kerf behind the blade to hold the two sides apart. The steel wedge used in setting a handle in a hammer head is ideal for this purpose, and if you do much ripping, it's a good idea to keep such a wedge handy in your tool box. To make it easier to remove from the kerf, drill a small hole through the wedge near the top and insert a key ring. The ring not only serves as a handle, but also makes it easier to spot the wedge if you drop it in the grass or otherwise misplace it. You can buy hammer-handle wedges at most hardware stores.—*G. E. Hendrickson*



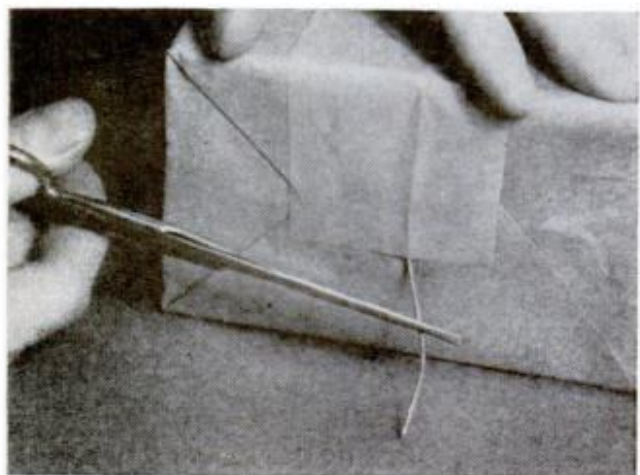
## Improved Cord Cleat

Many large portable appliances have no provisions for storing the cord. The simple cleat shown at left solves this problem with a minimum of work and expense. Just cut a window sash lift in half, smooth the cut ends by filing and bolt the two halves to the appliance to form a cleat. Such a cord holder is particularly well suited to portable fans, shop vacuum cleaners, etc., since it holds the cord neatly in place when the unit is being carried from place to place.—*E. Wiczorak*



## Marker Jig for Butt Hinges

Particularly useful in hinging louvered shutters for indoor window treatment, this jig was devised by a homeowner who found himself faced with such job involving 56 butt hinges. He cut a block of wood to fit the hinge gains of a pair of shutters and marked the location of the hinge screws on it, then drilled holes slightly undersize for nails which were driven through until the points protruded. A light tap on the nails marked all screw holes.

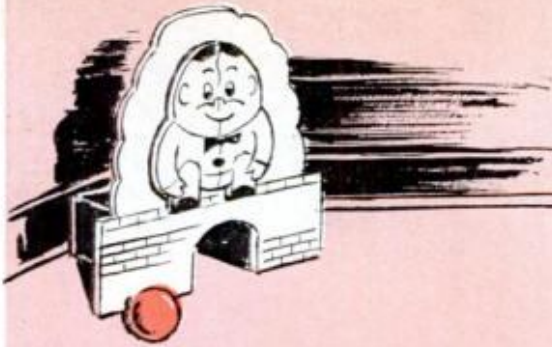


## Add a Ripcord to Package

When sealing a package with tape, you can make it easier for the recipient to open if you place a length of cord under the tape and leave an inch or so protruding from the end. Pulling up on the cord will rip the tape neatly down the middle, unsealing the package.—*William Swallow*

When applying wallboard with rubber-base adhesive, you can preserve a partially used can of adhesive for future use by pouring a layer of water over the remaining amount before closing the can.

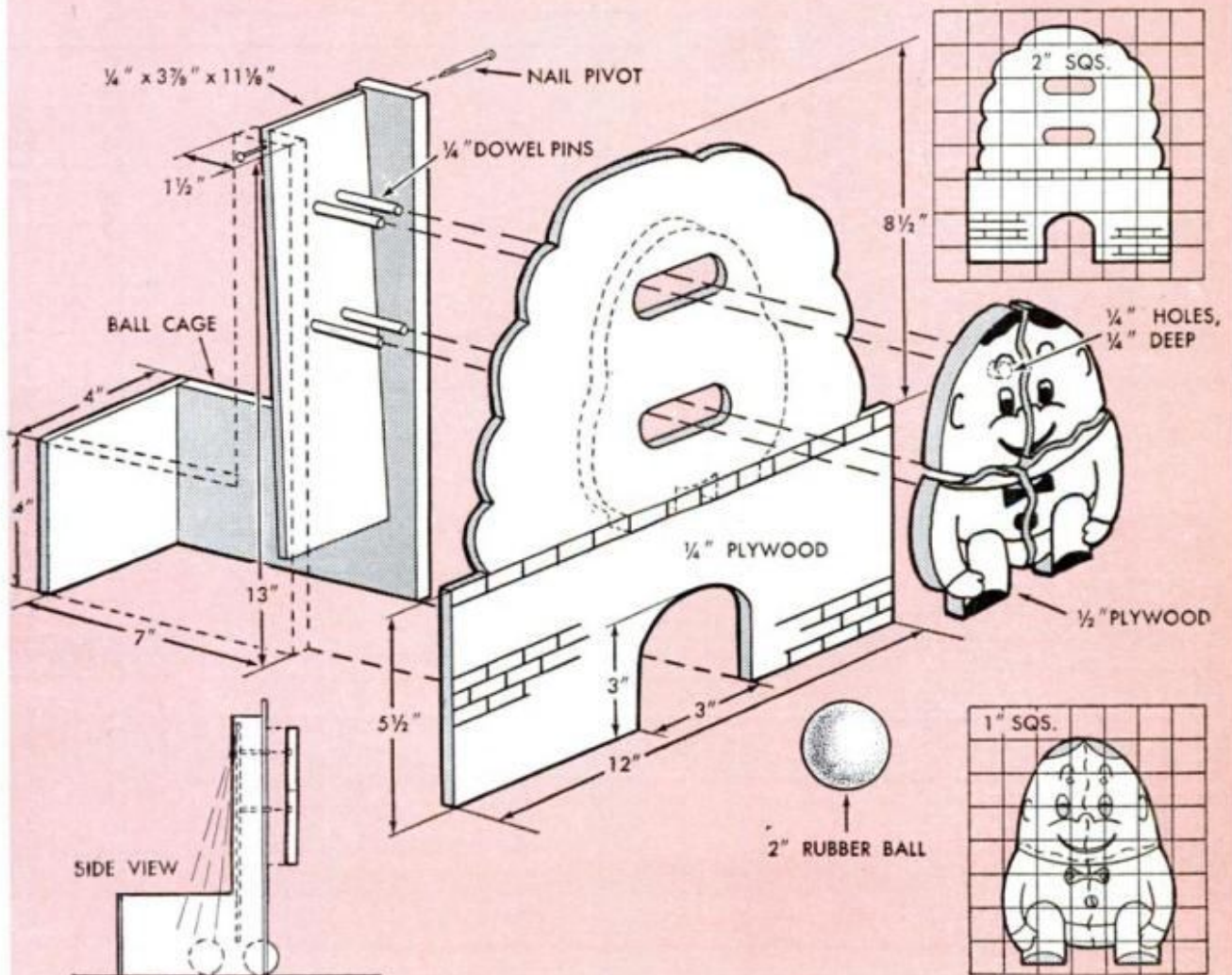




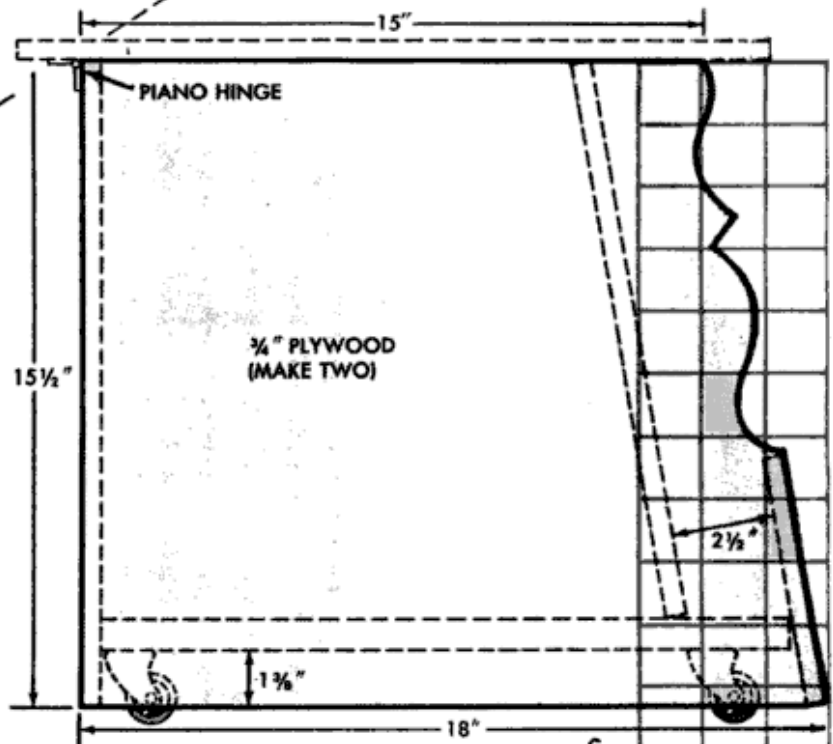
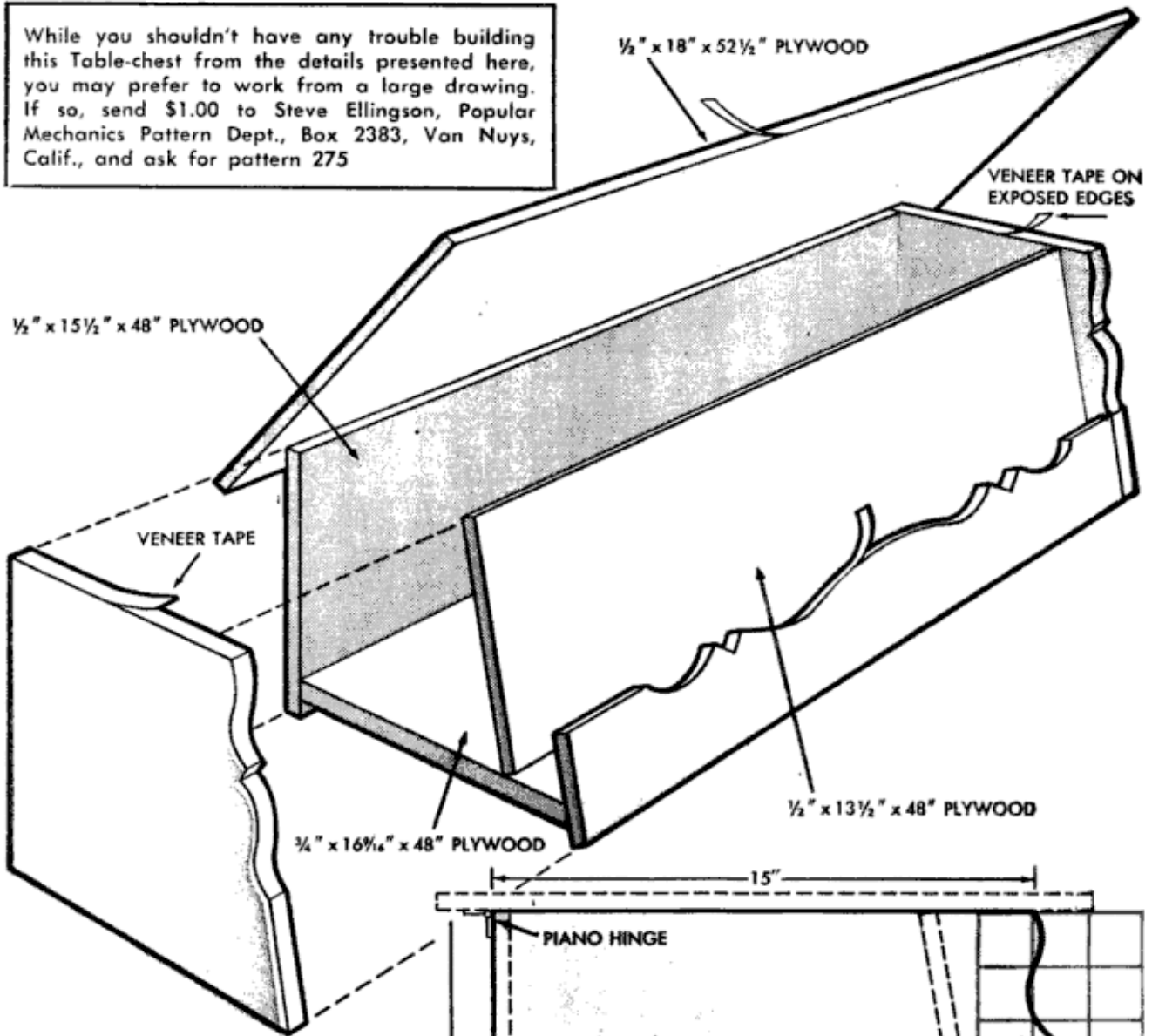
# HUMPTY DUMPTY

SURE TO DELIGHT your toddler, this easy-to-make toy re-enacts the famous nursery rhyme over and over again, complete with a shattering fall each time Humpty is knocked from the wall. The operating principle is simple. When the rubber ball passes through the gate beneath Humpty Dumpty's feet, it hits the trigger panel which is hung on nail pivots. The panel swings

back, carrying with it the four dowel-pin supports which hold Humpty Dumpty's four parts together on top of the wall. Result? A "great fall" which brings giggles of delight from the youngster who scores a bullseye. A blind hole is made in the back of the four parts of Humpty's body to correspond with the spacing of the four supporting dowels.—Merton H. Slutz

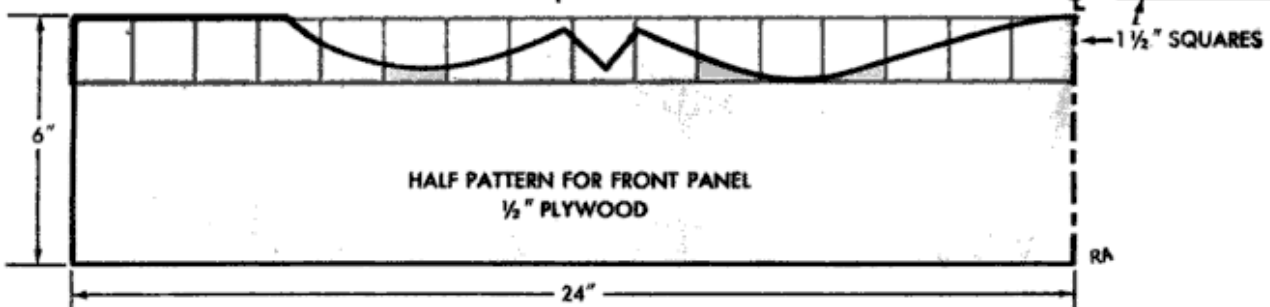


While you shouldn't have any trouble building this Table-chest from the details presented here, you may prefer to work from a large drawing. If so, send \$1.00 to Steve Ellingson, Popular Mechanics Pattern Dept., Box 2383, Van Nuys, Calif., and ask for pattern 275

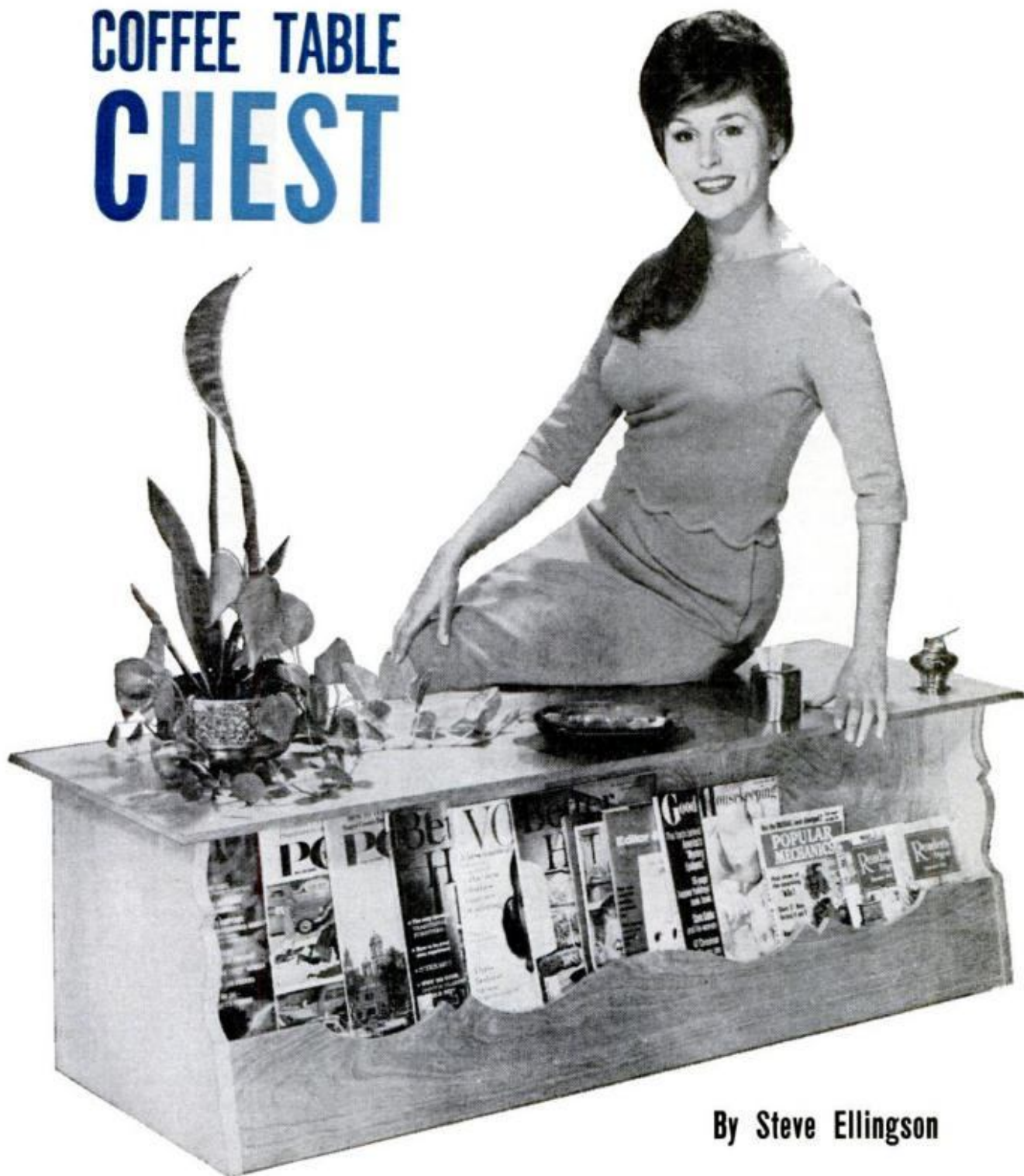


### MATERIALS LIST

- 1 pc.  $\frac{3}{4}$ " x 18" x 32" Hardwood-veneer plywood
- 1 pc.  $\frac{1}{2}$ " x 4' x 8' Hardwood-veneer plywood
- 1 pc.  $\frac{3}{4}$ " x 18" x 4' Fir plywood
- 2 pcs. Lid stops and screws
- 4 pcs. Flat-plate casters and screws
- 48" Piano hinge
- 32' 1" Veneer tape and contact cement
- Glue, sandpaper, 4d. finishing nails and finishing materials



# COFFEE TABLE CHEST



By Steve Ellingson

COMBINING traditional lines with modern space-conscious design, this easy-to-build table-chest combination is one of those rare pieces of furniture which can be used in almost any room of your house.

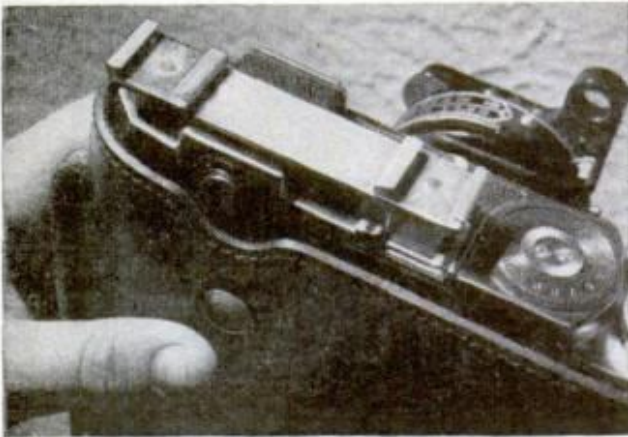
As a living-room coffee table, it not only provides a wide rack for displaying current issues of magazines, but also includes a roomy storage chest for holding bedding for that convertible sofa. And with magazines stored in the rack, the top is left uncluttered.

In the family room, the storage chest is the perfect place for games, puzzles and children's toys. In the den, it can be used for filing back issues of magazines you

want to save. In the bedroom, it becomes a blanket chest, with the magazine rack providing a place for that bedtime reading material which is normally stacked on the bedside table. Small flat-plate casters elevate the chest so that it just clears the floor, making it easy for your wife to move it about when cleaning.

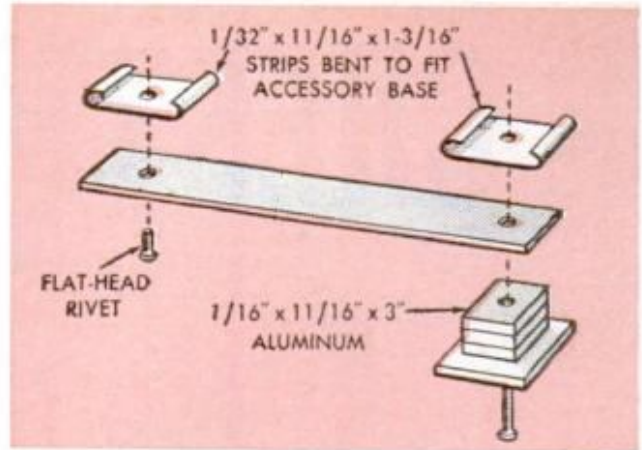
When applying the veneer tape, coat mating surfaces with contact cement and allow it to dry. Then place the tape over the exposed plywood edges, tap it with a hammer and block to assure a firm bond and use a sanding block wrapped with fine abrasive paper to cut it down flush with the surface.

## Dual Shoe Accessory Bracket Improves Your Camera



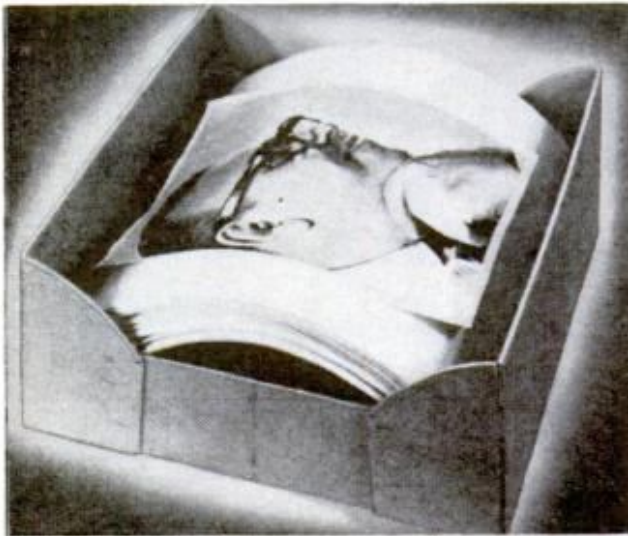
Two shoes are better than one on any camera. Suppose, for example, that you want to take some flash shots; with a dual shoe bracket it's possible to mount not only the flashgun but an accessory viewfinder as well.

The first step is to form an aluminum foot that will fit snugly into the camera's



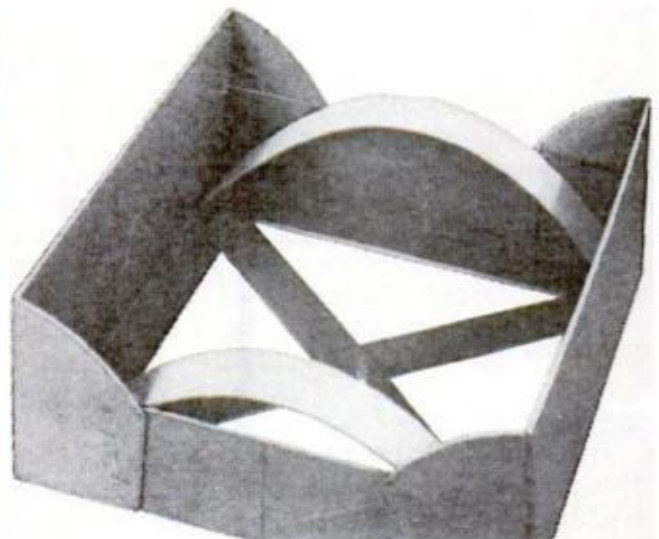
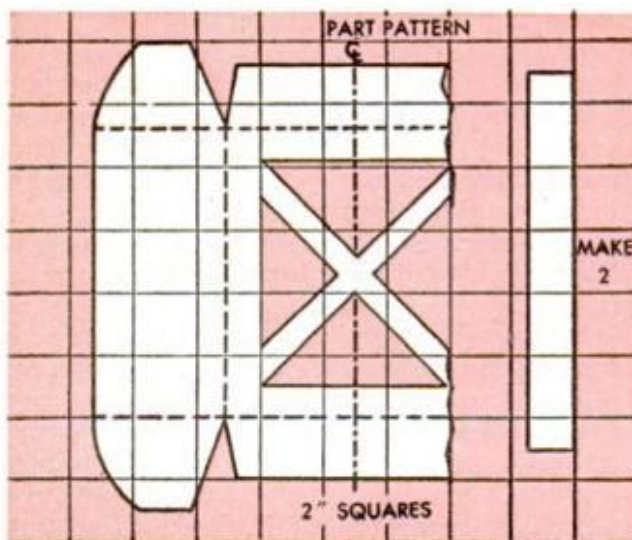
accessory shoe. If necessary,  $\frac{1}{16}$ -in.-thick aluminum spacer blocks may be stacked and riveted to the foot so that the base bar holding the two accessory shoes, will clear any projecting parts on the top of the camera. The shoes are fashioned to the proper shape from  $\frac{1}{32}$ -in. stock, using the foot as a bending form.—*J. Harley Hosack*

## Reverse-Curve Drying in Box Rack Produces Flat Mat Prints



Efficient drying of portraits and other mat (non-glossy) prints is a bugaboo in most home darkrooms. Simply sponging off excess water and spreading out the prints to air dry will almost invariably cause the paper to curl badly. Even when dried between blotters weighted down with books, the prints are likely to curl.

The solution to the problem involves no expense. It is a box-like affair made of cardboard with two curved strips that support a stack of 9 x 12-in. blotters. The cardboard can be cut and folded to shape in just a few minutes, following the grid pattern shown below. Prints are dried face up, so that the backward curve will counter-act their tendency to curl.—*Jack Eisner*



# FORD



- Front wheels operate independently, each on its own axle
- Front axles are forged steel I-beams—like big truck axles
- Forged radius rods secure axles to frame siderails
- Axles pivot in husky, long-life bushings

## New front-end durability in a revolutionary 2-axle suspension!

Two front axles—that's the big difference in Ford's new Twin-I-Beam suspension! And what a difference they make in pickup durability and ride! Each axle is an I-beam (like the I-beams big-truck axles use) that works independently to smooth the roughest road and give you a new feel of control! Moreover, a forged radius rod holds each axle in position to maintain better wheel alignment, extend tire life!

## New engine durability: biggest straight six, most powerful V-8!

Every engine for '65 is completely new! Standard is a 240 cu. in. economy Six with seven main bearings. Optional are a new 300 cu. in. Big Six—biggest Ford Six ever built—and a 352 cu. in. V-8, most powerful engine ever offered in any Ford pickup! Experience a wonderful difference in pickup response and ride—at your Ford Dealer's!

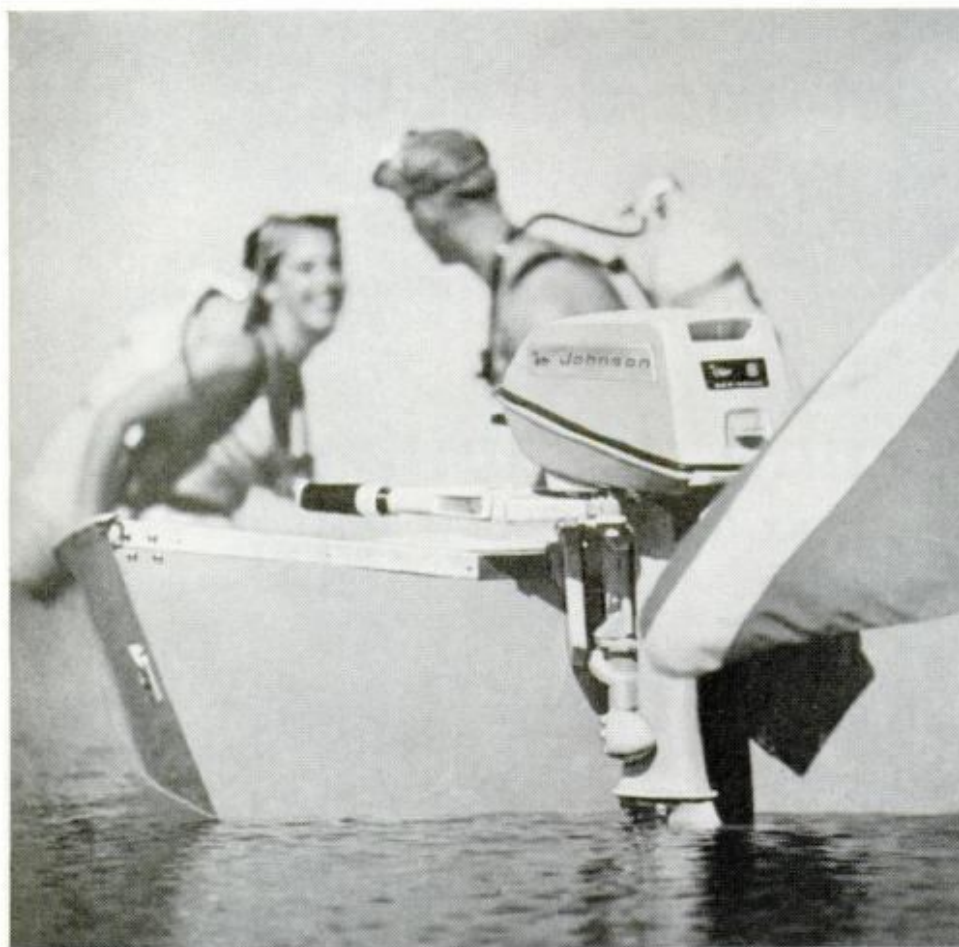
PRODUCTS OF  MOTOR COMPANY



'65 FORD  PICKUPS  
BUILT TO LAST LONGER

**Searching for an ultra-compact outboard with many "big motor" features...one good for fishing or fish-watching and that carries a 2-year warranty?**

**This luxury lightweight is it!  
The carefree, new 6 (a Sea-Horse, of course!)**



This new Johnson 6 is the latest and most distinguished descendant of the first truly quiet outboard. Compared with last year's 5½ hp it is lower, lighter, lustier. The all-new styling reduces powerhead height 1½ inches, reduces weight 6 pounds. Increased compression and a change in carburetion deliver the added zing.

**The complete angler's complete outboard.** Every big-motor feature that can be of use on a motor of this size is "built in" to the 6. Full gear-shift, twist-grip throttle, fixed high speed carburetor jets, full range silencing and more.

**17 new models in 10 power classes. From 3 to**

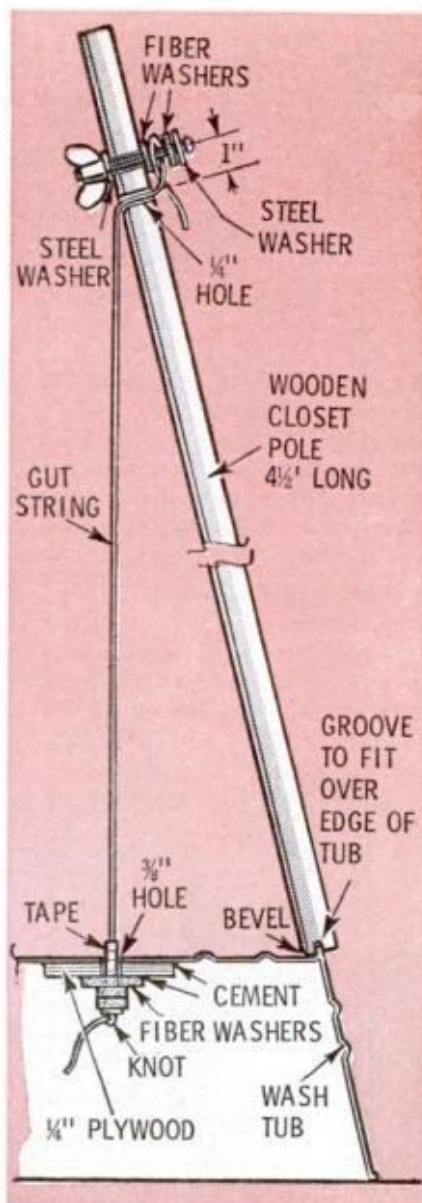
**90 hp, not one requires special marine gas or oil. As an additional saving, all use Johnson's new 50 to 1 gas-oil mix which halves oil costs and ups spark plug life 50%. What's more, all are fully corrosion-resistant and are backed by a 2-year warranty\* good for parts and labor.**

For the right engine to fit your needs, see your Johnson dealer. He's in the Yellow Pages. Johnson Motors, 1939 Pershing Rd., Waukegan, Ill. Div. Outboard Marine Corp. In Canada: Johnson Motors, Peterborough, Ontario.

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

**Another carefree *Johnson* ... first in dependability** 

# Hootenanny Washtub Bass Fiddle



**T**HE OLD WASHTUB bass fiddle is making a comeback. More and more, when folks get together for a hootenanny, the thumping sound of this homemade instrument is heard, backing up the singers and git-tar pickers.

It's a toss-up as to whether the washtub bass is easier to play or to make. Playing it comes naturally to anyone with an ear for music. Hold the tub down by placing one foot on the tub rim (right foot if you're right handed, left foot if you're a lefty). Now, pluck the string in time to the music. To change notes, vary the tension on the string by shifting the top end of the neck back and forth. In no time at all, you'll be thumpin' along with the best of 'em.

Making the fiddle is just as easy. Get a No. 1 or 2 (preferably No. 1) galvanized steel tub and drill or punch a 3/8-in. hole in the center of the bottom, for the string, and another in the side, for air escape.

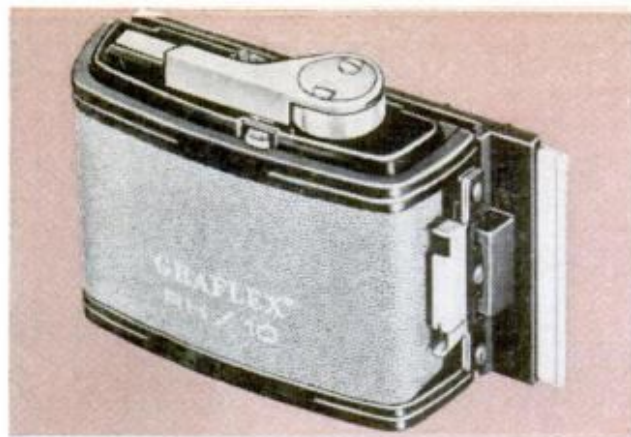
Cut a 5-in. plywood sounding disc and drill a 3/8-in. hole in its center then contact-cement it, plus a large fiber washer, to the underside of the tub, over the hole.

Almost any wooden pole will do for the neck, as long as it's 1 1/4 or 1 3/8 in. in diameter. A thinner one, such as a broom handle, will tend to deaden the sound. Drill the first hole, for the 1/4-in. bolt, about 4 in. down from the top. Note that the lower end of the neck is notched to fit the tub rim, and is bevelled so it can't press on the bottom of the tub.

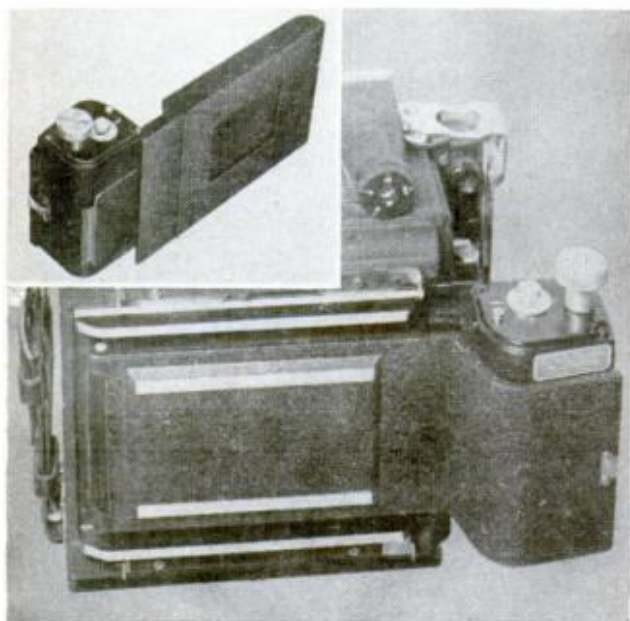
Finally, the string, which is a standard bass-fiddle D-string is knotted at the lower end, threaded through two fiber washers and wrapped with tape to lessen wear. Then it's threaded through the bottom of the tub, through the lower hole in the neck, and between the two fiber washers on the neck bolt (see detail). The tension created as you pull on the neck will clamp the string at the top.

# New for Camera Buffs

**NEW ROLL-FILM HOLDER** for 4 x 5 cameras slides into place like a regular sheet-film holder. It takes either 120 or 220 film. With the former, it gives 10 exposures measuring 2¼ x 2¾; with the latter it gives 20. Since this new format is proportional to 8 x 10 and 4 x 5, it requires less cropping than 2¼ x 2¼ or 2¼ x 3¼. Costs \$48 from Calumet Mfg., 6550 N. Clark St., Chicago, Ill. The 220 film size, by the way, is a new one. It's the same width as standard 120 but has no paper backing. This allows more exposures on a roll. It now comes in Professional Tri-X and Ektacolor Type S. Others are expected



**ANOTHER NEW LINE** of roll-film holders accepts 120 film only, and range in format from 2¼ x 2¼ to 2¼ x 3¼. Designed for all 2¼ x 3¼ and 4 x 5 Graphic cameras, they feature lever film advances that are much faster than previous watch-the-window types. Cost under \$50. Graflex, Inc., Rochester, New York



**VITRONA 35-MM CAMERA** features a built-in electronic flash (arrow) that operates from C-size 1.5-v. or rechargeable 1.25-v. batteries. Flash exposure is automatically set for you by a mechanism that's coupled to the focusing scale. Price, about \$120. Voigtlander, 381 Park Ave. South, New York, N.Y.

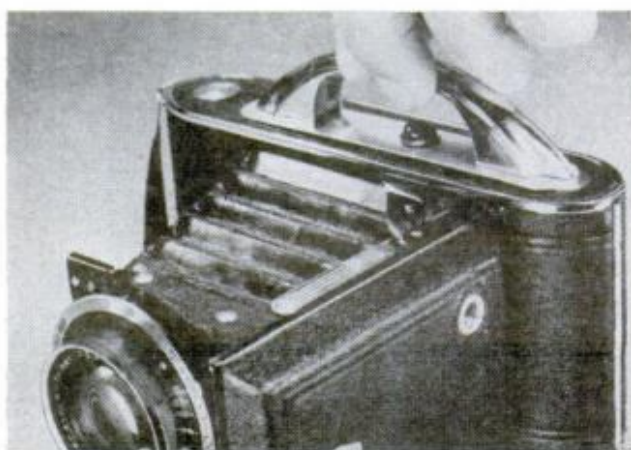


## PHOTO HINTS

**IF YOU WEAR EYEGLASSES** while using a magnifier to examine negatives or focus a view camera, the magnifier can easily scratch your glasses. This damage can be avoided, however, by applying a "cushion" of liquid rubber sealant to rim of magnifier



**A CONVENIENT HANDLE** for many cameras can be made from an ordinary drawer pull. Fasten the pull to a strip of sheet metal which has been drilled with a 5/16-in. hole to coincide with the camera's tripod socket. To avoid damaging the tripod socket, be sure the 1/4-20 screw used to fasten the handle to the camera is short enough so it can't bottom





### TRIPLE FOCAL LENGTH

of your telephoto lens with this 3x tele converter. You attach it to lens mount of a 35-mm single-lens reflex, then attach telephoto to the converter. A 105-mm lens becomes a 315-mm. A 135-mm becomes a 405-mm. Fits or adapts to many cameras. Costs \$29.95. Allied Impex, 300 Park Ave. South, N. Y., N. Y.



**POINT AND SHOOT:** The electric eye of the Alpa 9d uses three CdS cells instead of one to read light over the entire picture area. This gives you accurate exposures, even in light conditions that baffle other types of automatic exposure adjustments. Camera costs \$532.27. Karl Heitz, Inc., 979 3rd Ave., N. Y., N. Y.

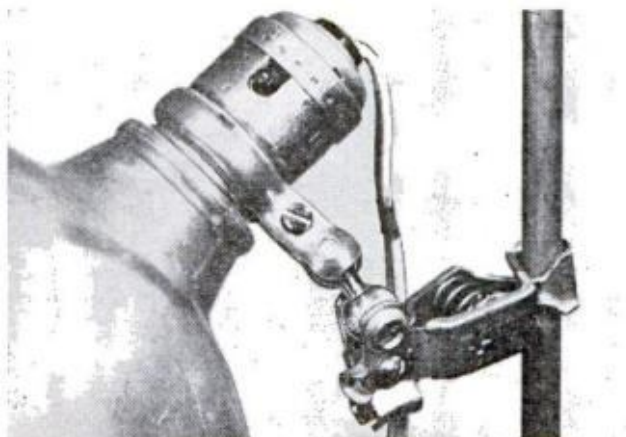
**DUAL-RANGE LENS HOOD** works in extended position (below) or collapsed. This permits its use with both normal and telephoto lenses. Available in series or custom sizes to fit on all single-lens reflex focal-plane cameras. Priced from \$2.99 to \$7.99. Spiratone, 135-06 Northern Boulevard, Flushing, New York



**YOU DON'T HAVE TO HIDE** the Model 573 "Decor" projector in a cabinet or closet after each slide show because it's styled to blend with living room decor. The unit takes 35-mm slides, changes them automatically at intervals of 4, 8, 16 and 32 sec. Under \$150. Argus, Inc., 595 W. Touhy Ave., Chicago, Ill.



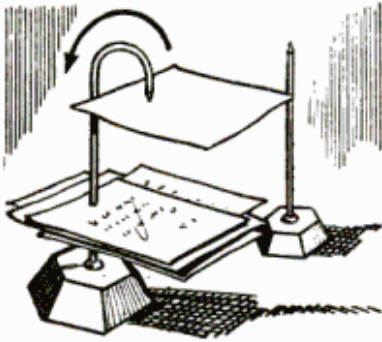
**TO PUT A SECOND OR THIRD PHOTOFLOOD** on your light stand, take the socket band and swivel assembly from a spring-type reflector clamp and fasten them to a 2 7/8-in. battery clip as shown below. The clip jaws will hold tightly to most light stand shafts. Once you've placed the light on the stand, you can quickly move it up or down by just squeezing the clip



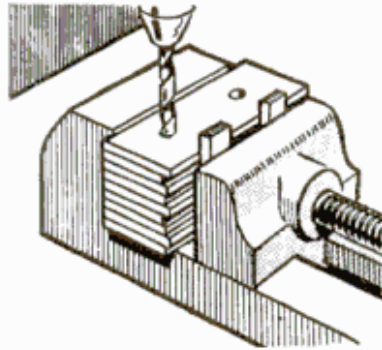
**THE INEVITABLE CLUTTER** that gathers in the bottom of a gadget case can be reduced by tacking a strip of inner tube or strong elastic inside the case near the top. Tack the strip in such a way as to create a series of loops. These loops will hold a wide variety of small items, such as extra film, lens brushes, filter cases and the like, within easy reach



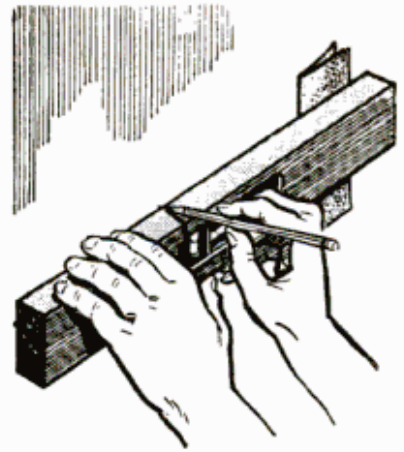
## TAKE A HINT FROM READERS



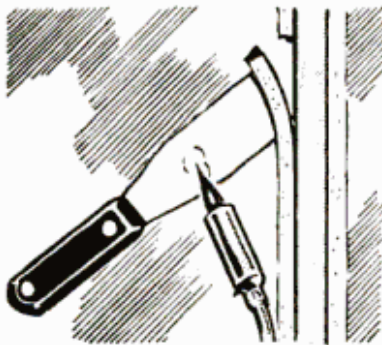
**THE SHARP, SPIKE-POINT** of a paper spindle, the type used for filing bills, is a hazard to unwary hands. Bending spindle downward into hook shape as shown eliminates the danger without sacrificing convenience



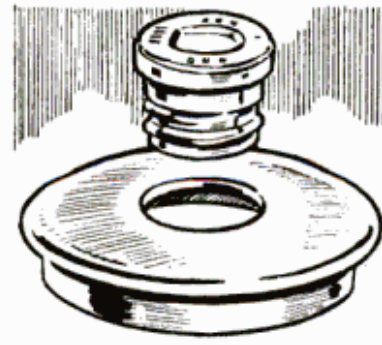
**NEED TO STACK** steel strips in a vise for gang drilling? Two lead or copper bars placed between the movable vise jaw and strips will conform to slight irregularities in the width of the work and hold the stack tightly



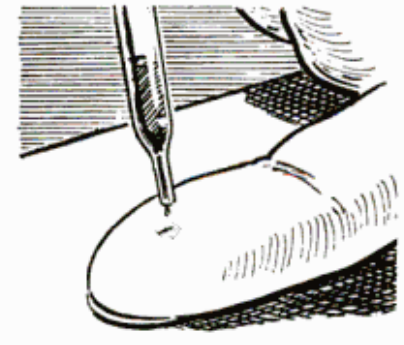
**WHEN YOU HOLD** a level against a wall for marking a horizontal line, the level is likely to slip. Placing a folded piece of sandpaper, grit side outward, between wall and level prevents accidental movement



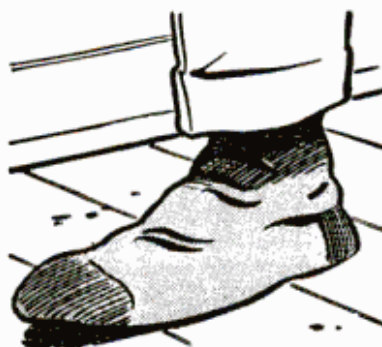
**HEAT'S THE THING** when removing putty from a sash, but the wood may char if the torch is applied directly. Instead, play flame against the blade of a putty knife while you use corner of the blade to remove putty



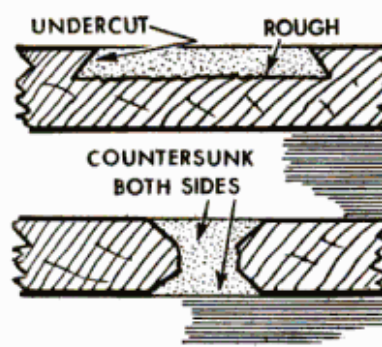
**IF THE GLASS** top of your percolator breaks, you can still have Sunday morning coffee if you improvise a new top by removing the glass shell of a burned out fuse. The glass shell is made of Pyrex and fits hole perfectly



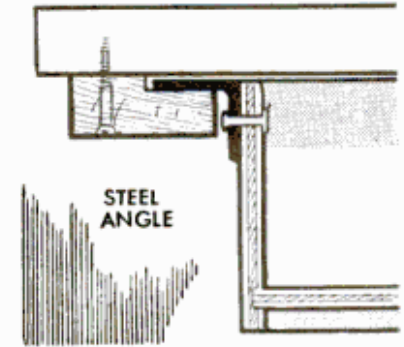
**OFTEN** when you are handling lumber, tiny, hard-to-see splinters become embedded in your fingers. Locating the splinters for removal is easier if you apply a drop of iodine to the spot. Stain makes splinter visible



**PAINTING A ROOM?** Try slipping an old pair of large socks over your shoes to protect the shoes from spatter. The socks let you wipe up paint drops from floor without stooping or hunting for a wiping cloth



**WHEN FILLING** a hole in either plywood or solid stock, the wood putty is "locked in" when the sides of the hole are undercut and the surface roughened as shown. If hole extends thru material, countersink both sides



**HANG A DRAWER** under your workbench by riveting a 1-in. steel angle to both sides of the drawer. The angles slide on two 1 x 2-in. strips that are cut as indicated and attached with screws to underside of bench

# Silencing Squeaks In Hardwood Floors

By Steven J. Howard

**R**ECENTLY, I made a survey of 75 homeowners in my community. "Name the No. 1 nuisance in your house," I requested.

About half of the men complained of moisture problems (fogged windows or a wet basement), 40 listed leaky faucets—and 15 said: "My wife!" But *one* problem appeared on *every* list, and topped most of them: squeaky floors.

When I pressed the issue, I found that only a couple of these men had ever tried to *silence* those annoying squeaks. The rest assumed that a noisy floor—like taxes—is something you just have to put up with. This isn't true, of course. There are a number of ways to chase a squeak—and none of them involve much of an investment in time or cash.

Neglecting the problem doesn't mean your house is going to fall apart. But squeaky floors don't get better with time. Far from it, they get worse.

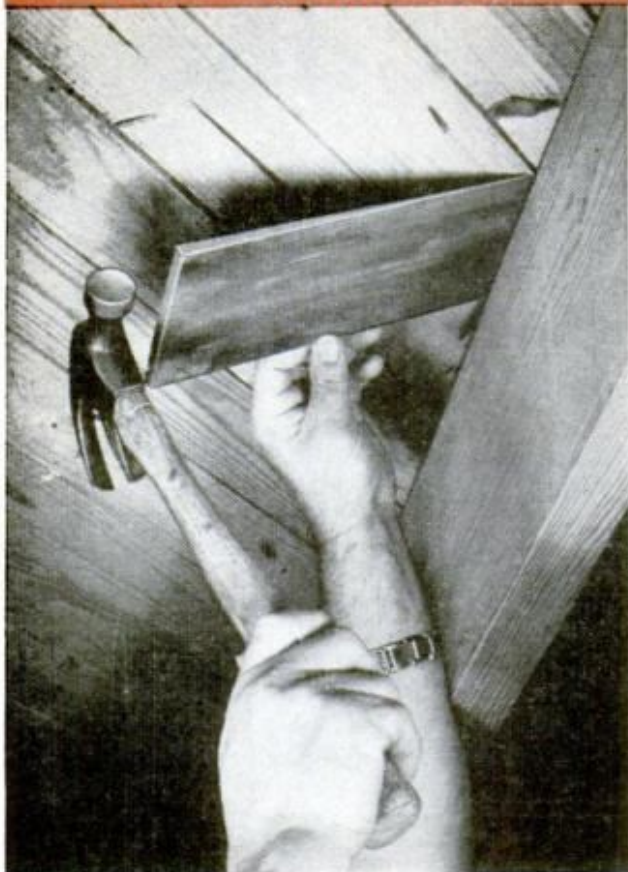
The trouble is widespread because of the way all floors are constructed—and because a natural enemy of wood is present in most homes, all winter long. This enemy is dry air. It pulls moisture from wood and causes shrinkage which, in turn, causes loose fitting. The result is bounce, sag, squeaks and creaks. It's particularly bad if the builder of your house used green lumber for the flooring—or left it exposed to the weather.

In times of high humidity—usually during the summer when your home isn't artificially heated—the winter-dried wood gains back some moisture, but never enough to counteract what's been taken from it. Once that wood shrinks, it seldom returns to its original tight-fitting form. However, one of the homeowners I surveyed does swear that his squeaky floor problem cleared up when he installed a good humidifier. (For a discussion of the virtues of humidification during the heating season, see *PM's* December, 1963 issue.)

On the other hand, if a wood floor is laid too tight to start with, excess humidity

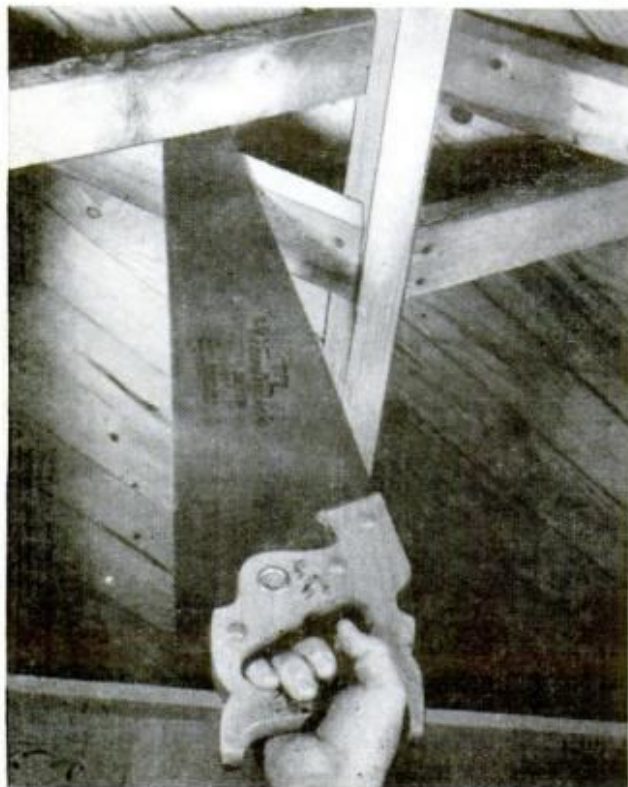


## ATTACK FROM BELOW



**ONCE SQUEAK** is located, check to see if shrink or sag has opened gap between subfloor and supporting joist. If so, drive shim into it—a wood shingle is ideal. If dipped in glue first, shim won't work back out

**CROSS-BRIDGING** that's butted tightly can cause a squeak when walked over. Movement of floor causes pieces to rub against each other. Easy way to separate them is to run a saw blade between edges



can result in swelling, which causes the hardwood strips to buckle. This opens a gap between the hardwood strips and the subflooring—a gap which closes only when you walk over it; and it closes with a loud protest!

Basically, a floor consists of two layers, and a squeak can originate in either of them. (We're not concerned, here, with floor coverings. If your floor happens to be surfaced with tile or linoleum or carpeting, the squeak still comes from the wood beneath. You can attack from below in the case of a first floor over an unfinished basement or a crawl space; otherwise, you'll probably have to lift the covering to get to work on that squeak.)

Companies that produce wood flooring materials are all agreed that the most common sound-source is the movement of the tongue of one flooring strip in the groove of its neighbor, as the result of wood shrinkage or swelling.

If this is your problem, simple lubrication may take care of the squeak—at least for awhile. Try squirting powdered graphite in the joints between flooring strips. If this doesn't work, force in a little liquid soap, using a clean oil can.

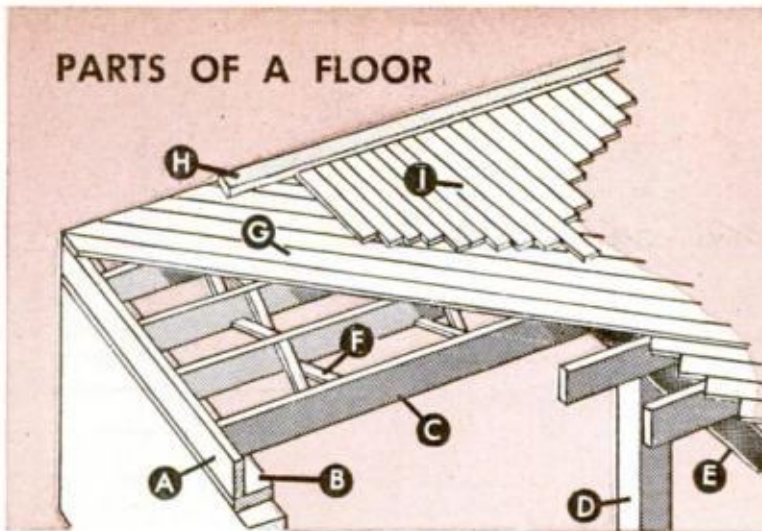
But suppose you live in a fairly new house—one where there's scarcely been time for the flooring to shrink. Yet recently, as you walk around, you notice a lot of barely audible squeaks. They're too many and too scattered to "lubricate"—the condition is simply a sign that the wood is starting to dry out.

These minor irritations can often be eliminated with a coat of penetrating floor sealer, brushed on with the grain. Work the sealer in between the floorboard joints as best you can, let it set a few minutes, then wipe off the excess *across* the grain. Follow this up, next day, by flowing on floor finish across the grain, with only your final, light strokes brushed *with* the grain, for appearance.

Another source of squeaks and sags is a *subfloor* that dries out and shrinks away from supporting joists. Where you can attack the problem from a basement or a crawl space, have someone walk around on top, as you listen from below. This lets you spot the area of the noise. If there's a gap between floor and joist at that point, shim it as shown at top left. If the gap is wide, try several shims, side by side.

Bridging is another possible source of noise. Where crossed pieces touch each other, they can rub, when weight is put on from above, producing a chirp the way a cricket does with its back legs. After you find which pair of bridging is at fault, you shave the pieces apart with a saw, as shown bottom left.

## PARTS OF A FLOOR



- A Header—nailed to joists
- B Sill—anchored to foundation
- C Joist—supports flooring
- D Post—supports girder
- E Girder—bears center load
- F Bridging—braces joists
- G Subfloor—nailed to joists
- H Soleplate—supports wall studs
- I Finish floor—nailed to subfloor

**FLOOR CONSTRUCTION** takes many forms, but this one is most common (in older homes) for both ground floor over basement and suspended second floor. In modern homes, subflooring is often solid plywood panels (quicker to lay, less likely to squeak). If boards (t&g or plain), as here, it may also be laid at right angles to joists. If girder supports a load-bearing wall, wall's sole plate may rest directly on it, not on top of subfloor

While you're at it, make sure bridging is nailed tightly in place. If you can move any of the strips by hand, bang several nails through them and into the joists until they're anchored solid. Not all houses have bridging, but when it's used you can be sure it's important to strengthen floor structure by keeping joists from twisting.

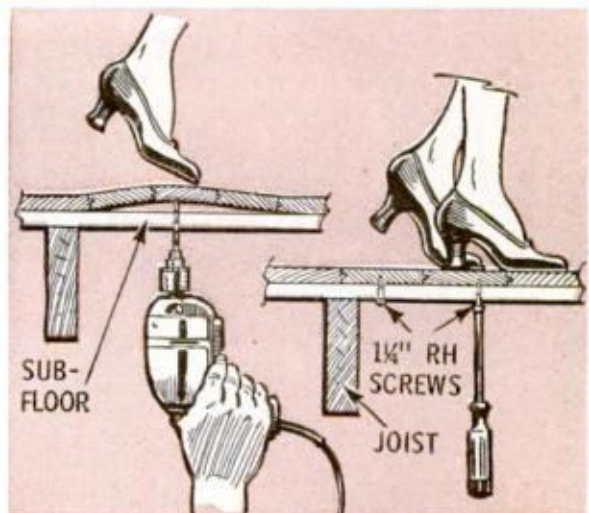
As I said before, flooring strips that rub together tongue to groove, and those that are warped, loose or inadequately nailed, are common causes of persistent squeaking. Again, where possible, attack the problem from under the floor, as in the photos and sketches below.

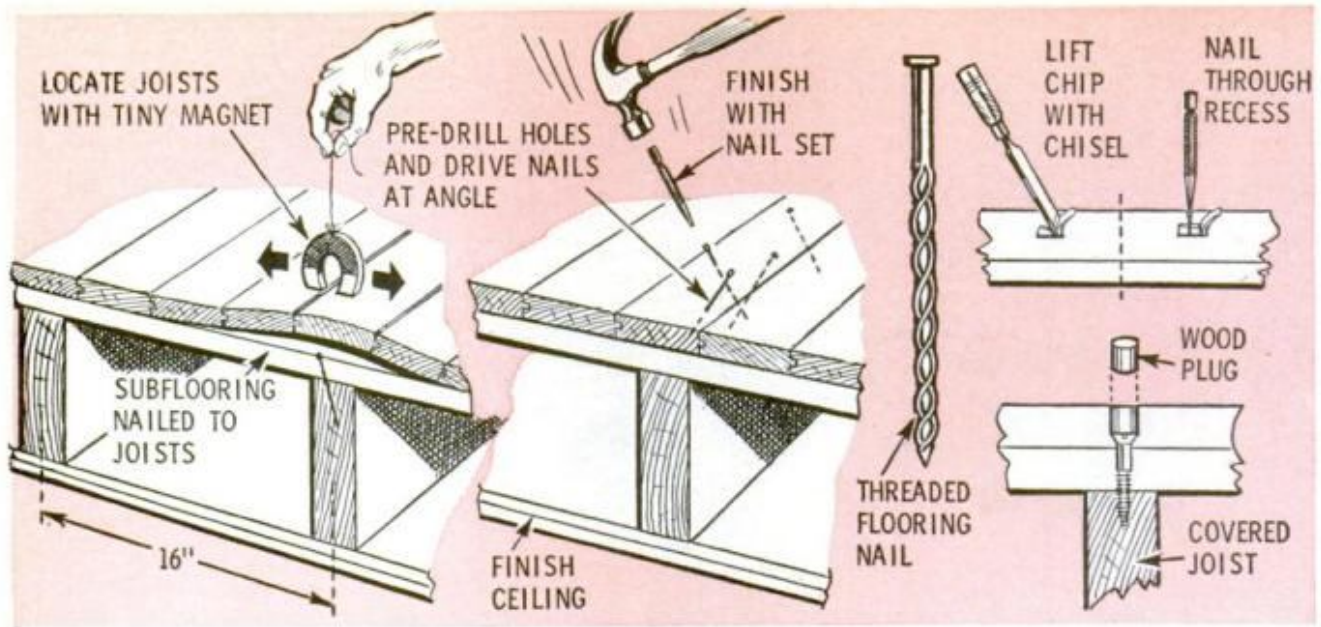
If floor strips are nailed directly to the subfloor, No. 10 round-head screws will usually do the job. First locate the squeaky board (or boards) by having someone walk on the floor above. You'll want to drill clearance holes that will pass the screw's threads through the subflooring. To avoid breaking through the top surface

of the finish flooring (and into the foot of your helper, up there!) you'd better equip your bit with a depth stop. The simplest way to do this is to drill first through a small block that will leave the right length of bit protruding when the block seats against the chuck. Round-head screws are used because the flat shoulder prevents sinking the head into the subflooring, so keeps the tip of screw from passing on through the finish flooring. You want it to enter the squeaky strip only far enough to get a good bite that will pull the board tight against the subflooring. Where the subfloor is  $\frac{3}{4}$  in. thick, a  $1\frac{1}{4}$ -in. screw does the best job. If the subfloor is thinner stock, try a  $\frac{7}{8}$  or 1-in. screw.

Turn the screw up snug while your helper puts full weight on the strip from above. Drive in as many screws as necessary to stop the squeak—but let's be practical. If more than four or five screws placed about four inches apart don't do

## HOW TO TIE DOWN BUCKLED FLOORING



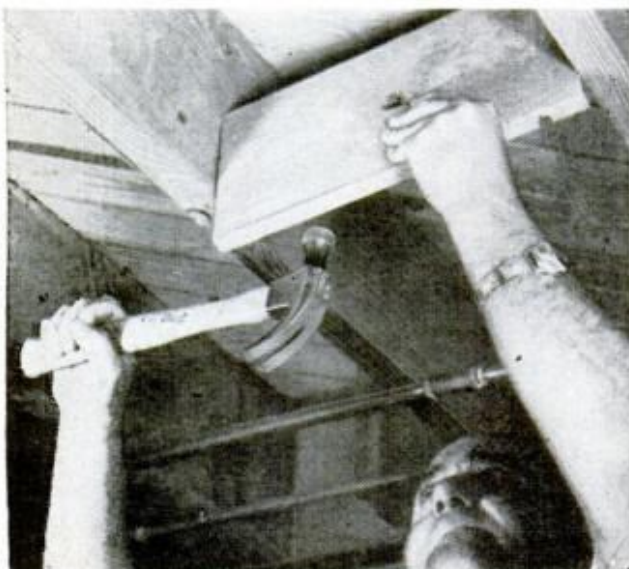


the job, you're either screwing into the wrong board or the squeak can't be conveniently eliminated in this manner.

There's one other thing to try before you give up the attack: Drill bigger holes through the subfloor—large enough to take the nozzle of a caulking or grease gun—and force thinly-mixed crack filler into the space between sub- and finish flooring. This may kill the squeak by keeping the floor strips from moving when stepped on.

The caulking stunt won't work, of course, in those rare instances where hardwood flooring is laid on sleepers, creating a permanent space between the sub- and finish floor. Sleepers are staggered nailing strips, commonly laid on a cement floor for the same reason you'd apply furring strips to a basement wall before you put up paneling. But you may encounter sleepers in above-grade floors in older homes.

**FLOOR SAGGING** under piano? Stiffen it with solid bridging. Cut stock lumber (1x8, 1x10, 1x12) for tight fit between joists, drive up against subfloor



You'll know with the first pilot hole you drill: if the bit breaks free and jumps ahead after the first  $\frac{3}{4}$  in., you're into sleeper space, and will have to tie down those squeaking floorboards with longer (probably 2-in.) round-head screws.

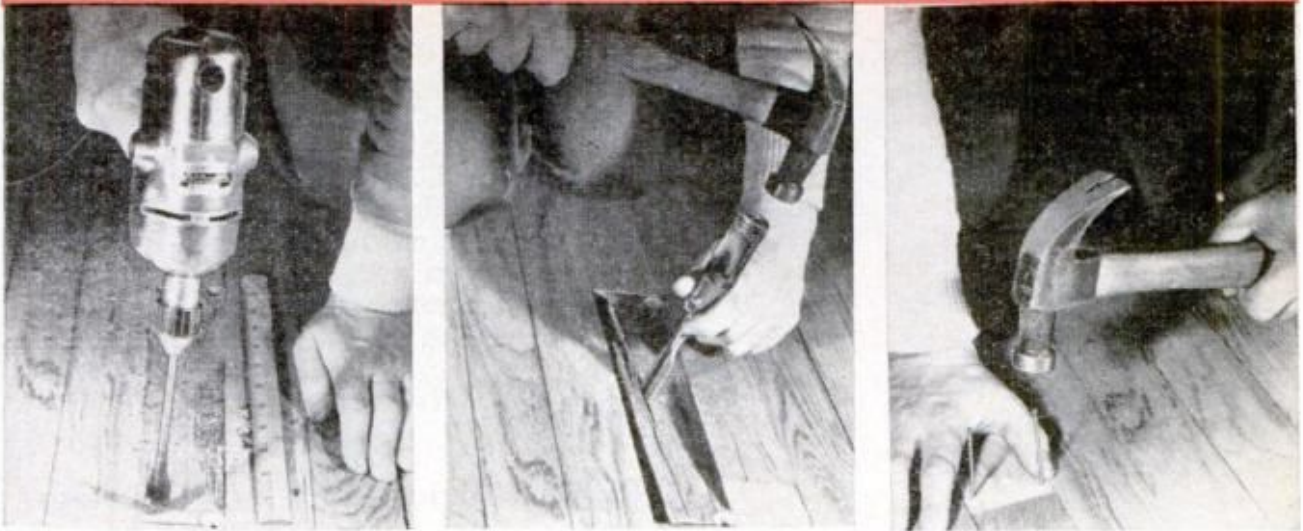
The problem of silencing floor squeaks is greater in homes where there's no basement or crawl space—or on the second floor, where you can't get at the subflooring because of the ceiling below it. Here, you must work from above, and your best bet is additional fastening. The big job is to find something into which you can drive nails, and this means locating nails already in the floor. You can do this with a small magnet hung on a string and moved along the squeaky floor board. When you feel or see a slight tug, you're over a nail—which means you're over the joist that the subfloor's nailed to. (You can also buy commercial stud and joist finders that work on this magnetic principle.)

Drill a small pilot hole through the flooring at an angle and into the joist. Drive in finishing nails and countersink them below the surface of the floor. Try at least two, but again, don't pepper the floor with nailheads. For better holding power, you may want to buy threaded flooring nails. There are two types—the spiral-thread, shown above, or a barbed-ring type. The small holes left by the nails can be filled with a wood filler and dabbed over with shellac or varnish.

If nailing doesn't do the job, maybe the maximum holding power of one or two screws will. Find the joist, as before. Drill pilot holes to accommodate  $1\frac{1}{4}$ -in. flat-head screws. Counterbore the holes to sink the heads and drive the screws firmly in place. The holes can be filled with a wood filler or wooden plug, which can be dabbed with a varnish to match the floor.

When squeaks resist these anchoring

## PATCHING A HARDWOOD STRIP FLOOR



**UGLY STAIN**, split or gouge can be removed by patching. Measure off damaged area—no less than 10 in. long—and drill large-diameter hole at each corner, stopping short of subfloor. With sharp chisel, make cut across ruined strip or strips between holes, then split out wood. Cut new strip for snug fit, nail each corner

methods, perhaps your problem is greater than localized shrinkage or warp. A large part of the floor may be sagging under a weight that's too heavy for the existing supports. The solution to *structural* squeaks is to strengthen the floor. The simplest way to do this is to tie the joists together with solid bridging, as shown lower left. Such a brace must be toenailed to both joists.

If this doesn't work, you may have to resort to floor jacks to support the sagging area. The best kind are the steel ones sold in lumber yards and home supply outlets for about \$6.50 apiece. They're adjustable and can be shoved firmly up against the sagging area as much as is needed to get rid of the sag. You can, of course, simply drive a 4x4 post in under the sag, if the situation makes this feasible.

If you live in an older home, wide cracks may have opened up between floorboards or, for that matter, floorboards may have suffered wood rot. Manufacturers have told me that wide cracks are a direct result of faulty workmanship in laying the floor since little regard may have been

given to moisture control.

According to one of these manufacturers, E. L. Bruce Co. of Memphis, Tennessee, "the physical characteristics of wood flooring are such that satisfactory and permanent installation cannot be assured without positive moisture control. Subflooring should be of dry stock. Expansion space should be left under base and shoe mold at all wall lines. The floor must be free to expand and contract with seasonal variations in humidity."

In addition, maximum protection against moisture can be afforded new flooring by back-painting the wood with a moisture-resistant paint, such as aluminum paint, prior to installation.

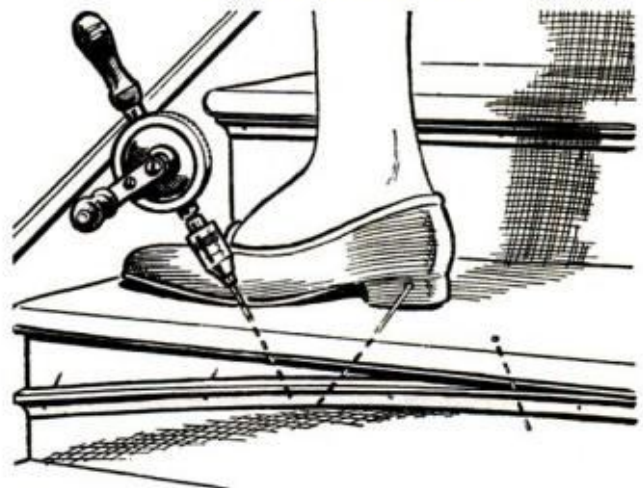
Suppose, though, that you're unlucky enough to have these gaps. You'll note that if this happens, the cracks open wider in the winter when wood has a minimum moisture content and become narrower in summer when wood becomes more moist. Is there anything to do about it?

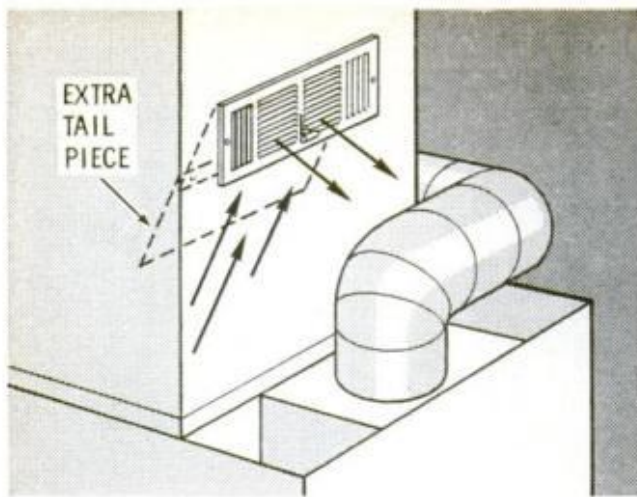
I hate to tell you this, but the answer is

[\(Please turn to page 219\)](#)

## SILENCING STAIR TREADS

**INDOOR STAIRWAYS** often squeak because tread rubs against riser. This play is caused by inadequate nailing, which has let the tread lift. To close gap, pry loose molding under tread's lip and have your helper put full weight on tread while you drill diagonally through it into riser with a 7/64-in. bit, then drive 10d resin-coated flooring nails in place. Re-attach molding before weight is removed. Threaded nails—or screws—are best for treads with stubborn warp. Glue in a wood plug over countersunk screw heads

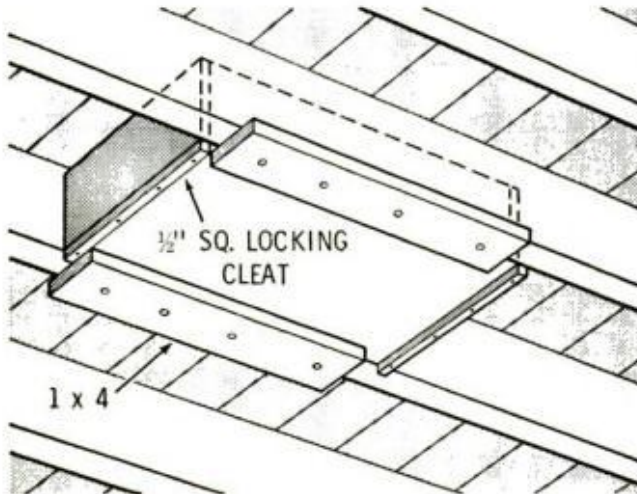




## Deflector Extension Boosts Heat

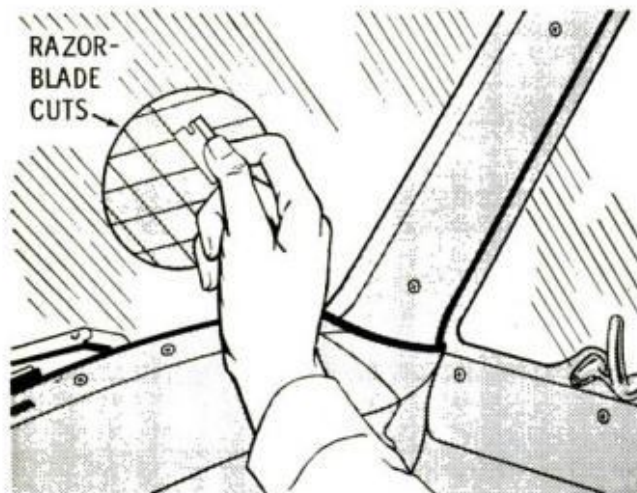
I wanted more heat in our basement playroom, but didn't want to install additional vents. Instead, I decided to try to boost the hot air output of the existing register in the furnace plenum. I found that all I had to do was extend the heat deflector of the grill so that more hot air would be deflected outward. Having no sheet metal, I cut open an anti-freeze can and wound up with a piece about 12 x 18 in. which I flattened and fastened to the tail piece with sheet metal screws.

—George Mayerchak



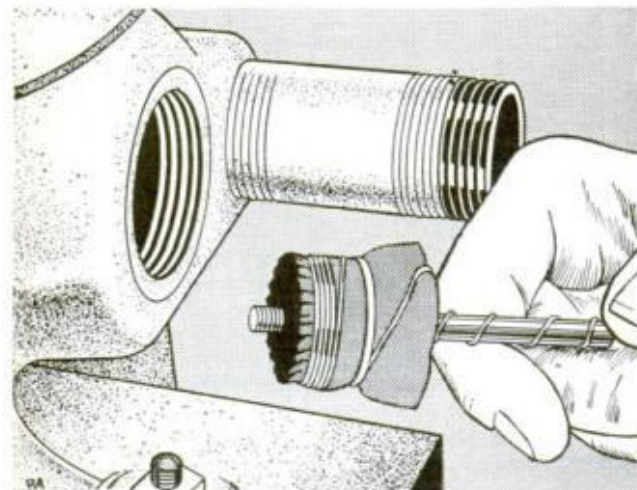
## Extra Storage with Joist Drawers

We were rapidly running out of storage room in our home when I hit on the idea of utilizing the space between the floor joists in the basement. After centering and nailing 1x4 runners to the edges of two joists, I constructed a plywood drawer to fit between the joists. The drawer measured approximately 6 1/4 x 14 1/2 x 24 in. For safety, I fastened a strip across each end to "lock" it in place. The drawer is removed by lifting it so that the strips can clear the end cleats. The space is ideal for seldom-used items.—A. Malone



## Stumping Sticker Snitchers

On the inside of my car windshield I have a sticker indicating membership in a country club. Admission to the club facilities requires no proof of membership other than the sticker. In order to prevent someone from peeling off the sticker and using it without club authorization, I made a number of diagonal razor cuts on the back. These cross cuts make it impossible to remove the sticker without it coming off in small pieces.—Joseph Braunstein



## Pump Repair Kink

Attempting to install double piston leathers in an electric water pump is tough because the leathers are oversize and often stiff. A solution is to compress the first leather to a smaller diameter than the cylinder bore by wrapping it with fishing line. After bolting the leathers together, turn them onto a long bolt so you can hold them in a vise while you tightly wrap about a foot of 40-lb.-test monofilament around the first leather. Then install the assembly in the bore, slowly pull out the line, and unscrew the bolt.—R. Micals





**PLUG SERVICING** is done with mechanical cleaners and testers. They are available individually or in combination units which do both. Here, a plug is being cleaned by abrasive action similar to sand blasting

## LET YOUR SPARK PLUGS BE YOUR BUILT-IN ENGINE ANALYZERS

By Morton J. Schultz

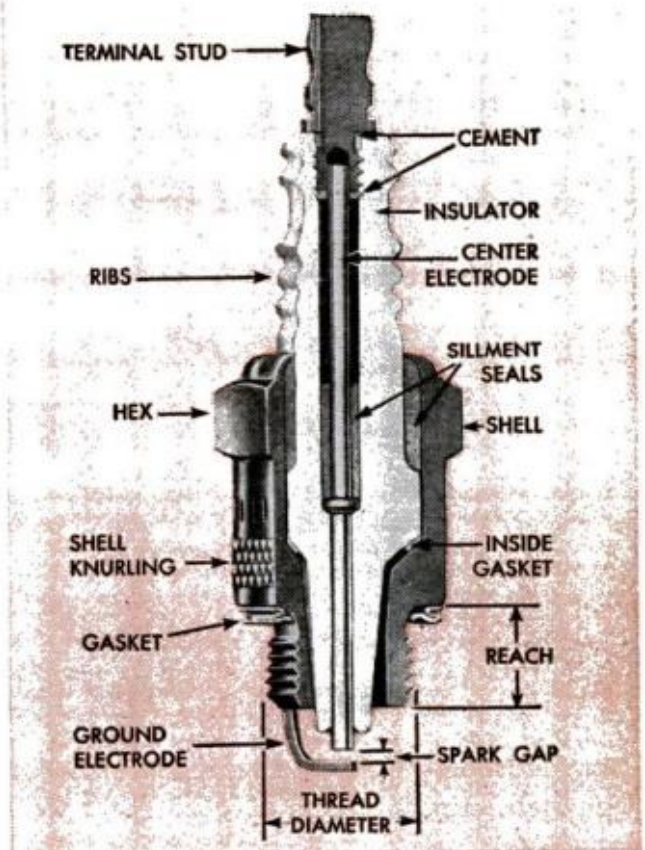
**D**ID YOU KNOW that your car has a set of built-in analyzers that can tell you a great deal about the engine's performance? Well, it does, and they're among the simplest parts in the car's engine—the spark plugs.

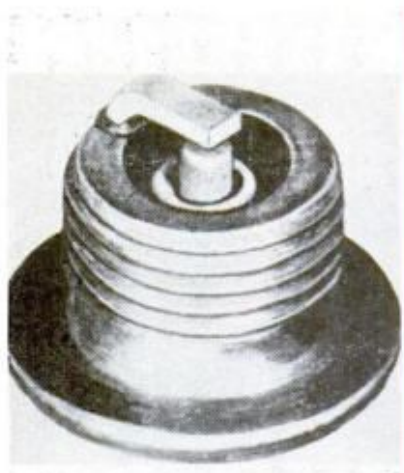
The motorist who services his own plugs, by examining them carefully, has an excellent opportunity to gain valuable insight into the operation of his engine. And, in most cases, once the trouble indicated by examination of the plugs has been corrected, the plugs usually can be restored to service—no matter how much mileage they've seen.

Before getting into service and how to analyze the plugs' appearance, you'll first want to bone up on spark plug nomenclature. The drawing on this page shows a typical plug and the names of its parts.

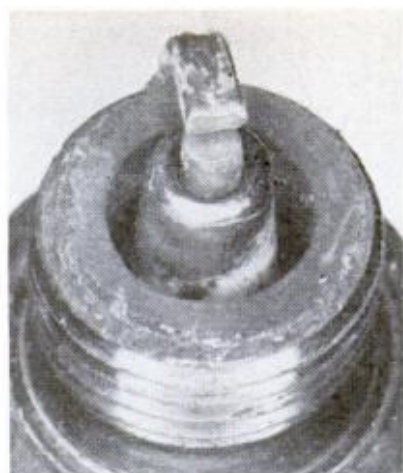
Secondly, you'll want to know how often to service the plugs. Most manufacturers suggest every 5,000 miles.

How about sophisticated service equipment, such as an ignition scope and plug





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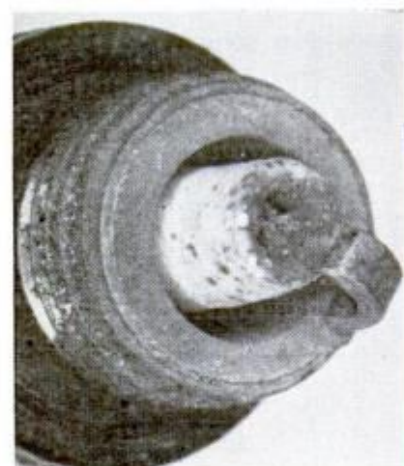
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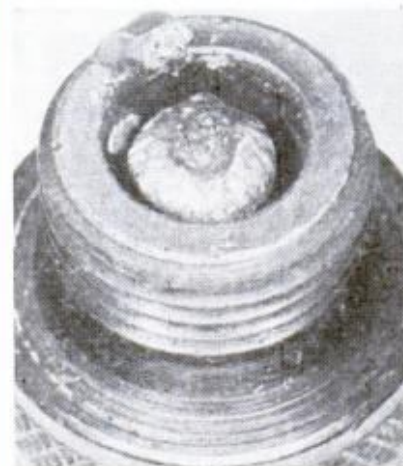
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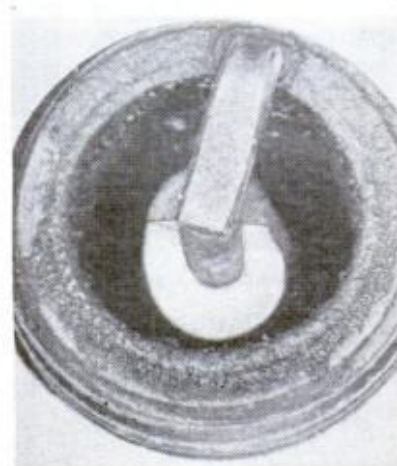
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# SPARK PLUG ANALYSIS CHART

CONDITION OF PLUG	APPEARANCE	MALFUNCTION	CORRECTION
Normal (Figure 1)	Light tan or brown deposits. Gap increase of .001 inch or less for every 1000 miles of operation	None	If electrodes don't show excessive wear, clean and restore plugs to service
Lead fouling (Figure 2)	Dark gray, black, yellow or tan cindery deposits, or a shiny glaze coating of the same colored deposits	Accumulation of byproducts of fuel combustion at high speed and under heavy load conditions	Clean and recondition plugs. If condition continues you may have to change to plugs of colder range
Carbon fouling (Figure 3)	Black, dry, fluffy carbon on tip	If only a couple of plugs are found like this, check for bad high tension lead, burnt or sticky valve, faulty breaker point, weak coil or condenser. If all plugs are in this condition, troubleshoot for too lean a fuel mixture, inoperative automatic choke, dirty or clogged air cleaner, stuck manifold heat control valve, or too much stop-go operation	Correct defect found in troubleshooting. Clean and restore plugs to service. If fouling is caused by excessive idling or stop-go operation, replace plugs with next hottest in the heat range
Oil fouling (Figure 4)	Wet, black, oily deposits	Can occur in a new or rebuilt engine before piston rings have become properly seated. In older cars, it indicates worn rings, cylinders, pistons, valve guides	If it's a new or rebuilt engine, degrease plugs, clean and restore to service. In older engines, correct the cause of oil consumption—otherwise cleaning or replacing plugs will only be a temporary help. Use of hotter plugs in engines with excessive oil fouling usually permits longer periods of service until defect is corrected
Overheating of plug (Figure 5)	White insulator tip, bluish-burnt cast on center and ground electrodes, too much electrode corrosion after short period of operation	Incorrect plug heat range, over-advanced ignition timing, too lean a fuel mixture, or inoperative or partially clogged cooling system	Check heat of plugs against that recommended for your car. Make any repairs indicated, and install new plugs of the heat range demanded. Discard old plugs
Gap bridging (Figure 6)	Deposit lodged between ground and center electrodes	Improper fuel combustion. Or deposits shredded from combustion chamber during rapid acceleration or high speed operation, thrown against hot electrodes and fused on contact to short out plug	Check fuel mixture. Clean and restore the plugs to service
Initial pre-ignition (Figure 7)	Melting of center electrode and, later, of ground electrode. Also blistered insulator, and/or aluminum or metallic deposits on insulator	Incorrect plug heat range, burned valves, over-advanced timing, inoperative or partially clogged cooling system, lean fuel mixture, or detonation caused by improper octane rating or low grade of fuel	Check heat range of plugs against that recommended for your car. Repair or replace faulty engine components. Replace plugs with those of correct heat range. These old plugs can't be restored to service
Sustained pre-ignition (Figure 8)	Ceramic firing tip melted	All the conditions described above, but allowed to continue for a longer time. By this time, there's a good chance that other engine components have been damaged by pre-ignition	Check engine carefully, and repair or replace damaged parts. Replace plugs with those of the correct heat range
Chipped insulator (Figure 9)	Cracked, split or chipped insulator at firing end	Excessive center electrode temperature or severe engine detonation. However, a defect of this sort is usually caused by use of incorrect gapping procedure—generally, bending the center electrode	Replace the plug. Make sure the correct gapping procedure is used. Check and set the timing. If the condition recurs, switch to a colder plug
Broken insulator (Figure 10)	Broken insulator	Foreign object in the combustion chamber. Since small objects can travel from one cylinder to another because of valve overlap, always check other cylinders as well to prevent recurrence of damage	Purge cylinders of foreign matter and replace the plug. This one can't be reused
Splash fouling (Figure 11)	Spotchy deposits on insulator	Long-delayed tuneup needed	Tuneup car and clean the plugs. Restore plugs to service
Scavenger deposits (Figure 12)	White or yellow accumulation around tip and on ground electrode	Normal with certain brands of fuel	Although deposits appear heavy, they can be easily flaked off. Clean, restore plugs to service
Dishing (Figure 13, page 182)	Ground electrode is cupped or dished	Reverse polarity	Check primary coil leads and switch, if necessary, to correct polarity. Check gap. If it's not excessive, restore plug to service after routine cleaning and reconditioning
Worn-out (Figure 14, page 182)	Severely eroded or worn center and ground electrodes. Light brown to tan deposits on insulator	Normal when gap wears at rate of .001" for every 1000 miles of operation	If you can re-gap to specifications, you can keep the plug in service by cleaning and reconditioning. However, if gap growth exceeds .010", replace the plug

cleaner and indicator, like the pro's use?

Well, an ignition scope costs about \$85. It's nice to have, but not necessary. According to the plug manufacturers, careful visual examination is effective.

On the other hand, a spark plug cleaner (photo, page 179) is usually needed to blast foreign matter away from the cylinders. But don't go out and buy one. Most gas stations have these, and the station you give your business to will often let you use it gratis. The indicator portion of the cleaner can tell you much, also, as you'll soon see.

Plug service involves four general steps, each having its own tricks of the trade. They are: removal, analysis, cleaning (or replacing with new ones), and installing.

**Removal.** Start by pulling the plug wire from the plug. In doing so be sure to grasp the *terminal boot*—not the wire itself—or you may rip its internal strands apart. Next, use a deep-well socket, an extension (if required), and a ratchet handle to loosen each plug only a turn or two. Then, before turning the plugs out by hand blow any dirt from around each plug with an air pressure hose. This keeps dirt and foreign matter from getting into the cylinder head threads. If an air hose isn't available, use

a brush, not a rag, to clean the dirt away.

Upon removing each plug, write on the insulator the number of the cylinder from which it came, using a felt marker or grease pencil. This is important since each plug is a barometer of engine condition as it applies to the cylinder from which it came. The marking can be wiped off easily before re-installation of the plugs. Incidentally, throw away the old gaskets, even if you keep the plugs in service. A collapsed old gasket might prevent firm re-seating of the plug and lead to combustion gas leaks that can over-heat the spark plug and cause pre-ignition.

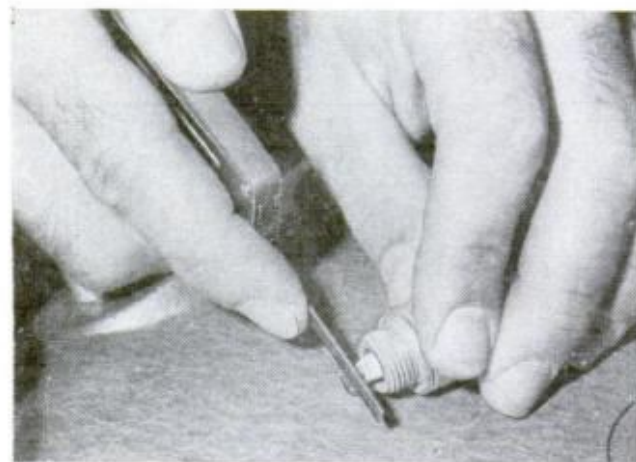
**Analyzing.** Examine the tip of each plug carefully. The chart on page 181 and the accompanying pictures tell you what to look for and what the appearance of the tip indicates about engine performance.

**Cleaning and Restoring.** The next phase of spark plug service involves a series of easily followed steps:

1. If the spark plug tip is oily, solvent clean and dry it before using the cleaner. Otherwise the abrasive given off by the cleaner can pack itself around the insulator tip. If the plug is then re-installed some of these particles can work loose and damage the cylinder wall and piston.



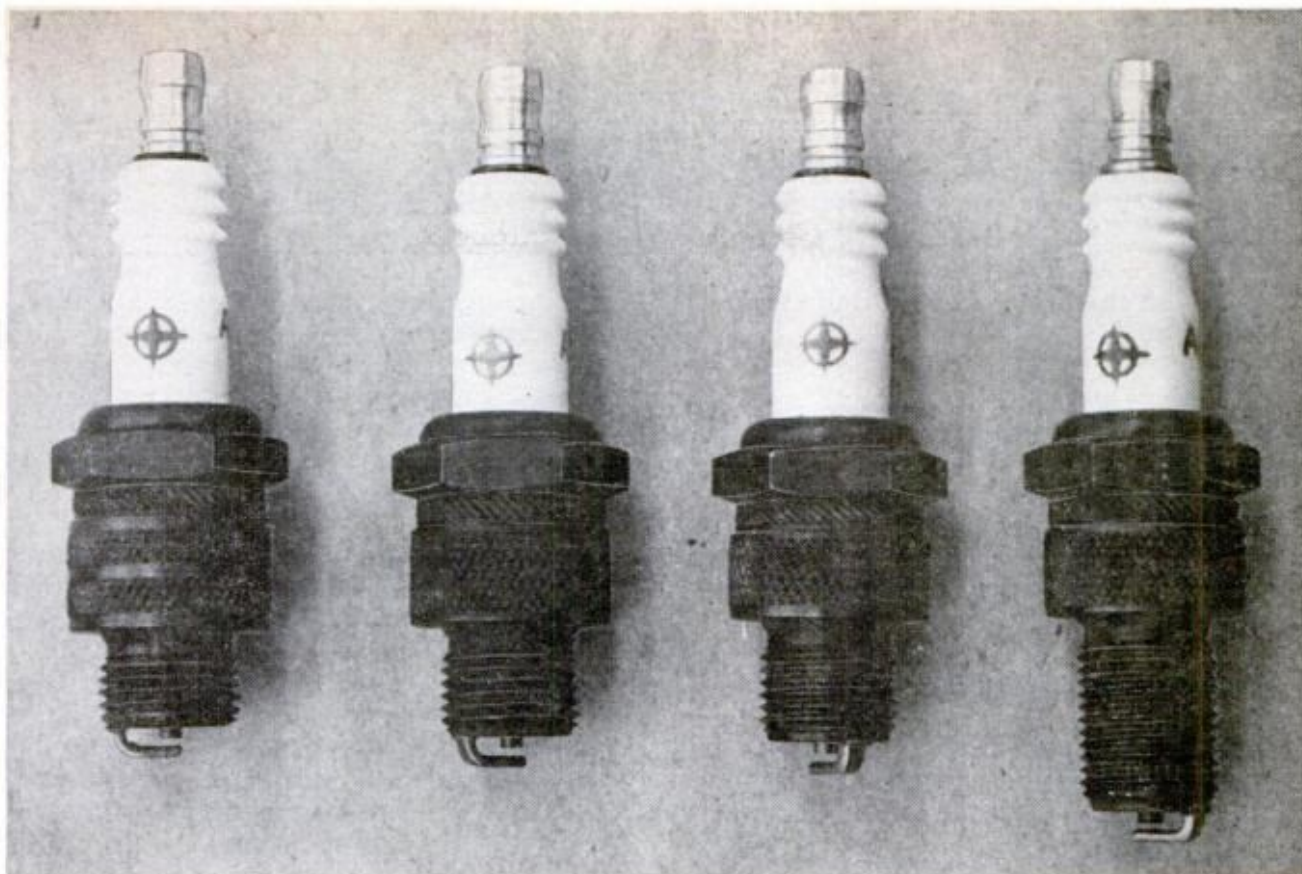
**ALWAYS RE-GAP** plugs with round-wire gauge. A flat gauge can "bridge" erosion pits on electrodes and give a reading that's smaller than actual gap



**BEFORE RE-GAPPING**, open the ground electrode slightly and file it, plus center electrode, flat and square. Surfaces of electrodes should be parallel

As a matter of fact, you should really clean the entire plug in a spark plug cleaning solvent to remove dirt and or rust from the threads and insulator. If this obliterates your identifying mark, simply rewrite the mark. To dry the plug after washing, especially the firing end, play a blast from an air pressure hose over it.

2. Insert each plug in the cleaner portion of the cleaning machine. Abrasive-blast the plug for about five seconds, rotating it as you do. Remove the plug and examine the tip for cleanliness. If necessary, blast it again until clean. If, when examining the clean tip, you see any hairline cracks,



**EVEN THOUGH SPARK PLUGS** may have the same thread diameter, as above, their reaches, or thread lengths, can vary widely. So be sure to check manufacturer's specs to find right thread length for your car

discard the plug without further ado.

3. With a bending tool, which is usually part of an approved spark plug gapping tool, open the ground electrode slightly and file both the ground and center electrodes until they're flat, square and bright with a point file. Adjust the ground electrode until it's parallel to the other. *Don't* use pliers for bending. Also, never bend or apply any pressure to the center electrode or to the insulator. This can split or crack the insulator tip. Bend only the ground electrode.

4. Use a round-wire-type spark plug gapping tool and gap the plug to your car's specification. The gap is properly adjusted when there's the slightest drag on the gapping tool as you slide it between the two electrodes.

5. At this point, you can test each plug on the testing portion of the cleaning-testing machine. But be aware of this point stressed by plug manufacturers:

Many perfectly good spark plugs with thousands of miles of service yet to be utilized are scrapped due to misinterpretation of the information obtained from a pressure-type tester.

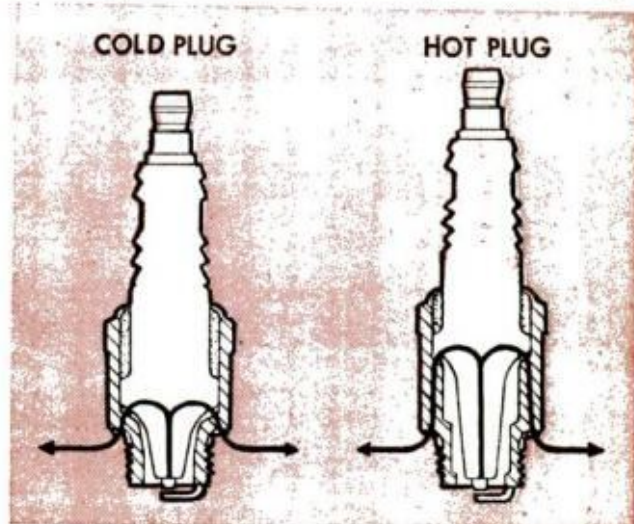
This misunderstanding comes about because of the differences between conditions in the tester and actual conditions in the engine. The tester, for example, operates on the principle of increasing air pressure in the testing chamber until a spark no

longer occurs between the electrodes. The air pressure in the tester is usually at room temperature, while spark plugs operate in an engine at temperatures ranging from 300°F. at idle speed to 1700°F. with the throttle wide open.

To get a true reading from the tester, use the following procedure, but keep in mind that when all is said and done, the best and final test is how those plugs operate when in use on the road:

- Make sure the plug electrodes have [\(Please turn to page 224\)](#)

**HOT AND COLD PLUGS** differ in how fast they dissipate heat of combustion (arrows). Hot plug runs hotter merely because the heat has longer distance to go



## AUTO CLINIC

**Q** Below zero weather causes my 1960 Ford with 352 CID engine to fire on one cylinder when starting and then kick the starter drive out. I've had it tuned up, but it hasn't helped. What will?—L.M., Mich.

**A** I'd look to the condition of the distributor cap and spark plug wires. The trouble may be caused by cross-firing either in the distributor cap or from one plug wire to another. Check for carbon tracks in the cap first. If any are found, get a new cap. If no carbon tracks, test each plug wire with an ohmmeter. Resistance in each wire should not exceed 24,000 ohms. After making tests and any needed repairs, set engine timing to specification. If this doesn't solve the problem, you'll have to remove the starter and check for a worn drive gear or defective drive clutch in the starter drive.

**Q** When I use the headlights and heater on my 1961 Chevrolet at the same time and the engine is running at normal speed, the battery "idiot light" shows a faint glow. However, with these accessories on and at idle speed, there is no glow. Generator and regulator check out OK. Is it anything to be worried about?—J.P.M., Ill.

**A** No. As a matter of fact, it's a common occurrence. At driving speed with lights and accessories turned on, a great amount of current is being generated by the generator. A little of this current is being fed back from the generator into the ammeter. At idle speed, current output is reduced and there's no feedback—hence, no glow. Some Chevy owners tell us that they got rid of the glow by changing bulbs in the "idiot lights." Newer bulbs probably have a greater resistance to the feedback current. Really, though, it's not necessary to switch bulbs since the faint glow doesn't mean electrical trouble.

**Q** There's a sort of crunch or creaking noise in the front suspension of my 1962 Meteor that occurs when I apply the brakes to stop in either a forward or reverse speed. Have you heard of this?—J.P.S., Kansas

**A** Yes, and it could occur as well with the 1961 Meteor and all Comets from 1961 through 1964. The cause of the problem is insufficient lubricant in the front suspension upper arm inner shaft bushings. The solution is to lubricate these bushings, which involves a lengthy procedure including some grinding of the bushings themselves. The way to do the job is outlined in Lincoln-Mercury Service Bulletin 48 (6/26/64).

**Q** Whenever I make a sharp left turn with my 1962 Oldsmobile 88, the car stalls. Why?—M.A.A., Colo.

**A** There are two likely reasons. First, the carburetor float might not be adjusted properly, which causes the carburetor to get a load of gas on a sharp turn. Flooding like this will cause a stall. Secondly, there's a baffle on the float chamber of your Olds carburetor. If you've had the carburetor taken off recently for cleaning or repair, perhaps the baffle wasn't reinstalled or wasn't tightened enough, which would also cause a flooding condition, particularly on left turns when the gas level is tipped.

**Q** I have a 1961 Volkswagen with 35,000 miles on it that's developed a loud engine noise. I've been told it's the camshaft. Could it be?—R.J.K., N.H.

**A** I think the camshaft is a sound theory since VW's with that much mileage have been known to develop this type of trouble. However, before ripping into the shaft I'd check for a loose rocker arm and a bent or broken push rod—either of which might cause engine noise, and which are a lot less expensive to repair. If checks indicate that the camshaft's at fault, you'll have to replace the cams and followers, and recondition the rocker assembly. I'd also consider changing the clutch pressure plate at the same time since this part, too, often goes bad around the 35,000 mile mark.

**Q** As you know, the starter on the 1959 Buick LaSabre is on the gas pedal. When I turn on the ignition key, the starter often revs before I get my foot on the pedal. Other times, it won't start the

engine, but just hums, and I have to turn off the ignition, wait, and try to start it again. It often takes quite a few tries. What's up?—E.J.A., Maine

**A** There's a vacuum switch on the carburetor that controls the starting of this car. When it gets clogged with dirt or shorts out, it'll cause this exact condition. I'd replace it.

**Q** Ever since doing engine work on my 1963 Austin, I've had a peculiar situation. The engine keeps running after I shut off the ignition, and to stop it I have to put the transmission in gear. It seems to be happening only on one cylinder. What do you think?—K.M., Ill.

**A** Most likely in doing that engine work the head was removed. If so, there's a good chance that the head gasket wasn't refitted properly. It might be overlapping right into the cylinders, especially that one you mentioned. If this doesn't prove out, then I'd get mighty suspicious of the carburetor. This trouble has been known to happen on the Austin when the carburetor runs too rich. I'd check the fuel-air ratio and make necessary adjustments.

**Q** What would cause a 1957 Dodge V8 with a 12-volt electrical system to burn a set of points every 2000 miles?—F.H., Minn.

**A** The main reason for this in any car with a 12-volt electrical system, not only the Dodge, centers around the resistor on the coil. If it's "opened," then too much current will flow to the distributor and hit the points, burning them quickly. It's also possible that, if the car's been worked on, someone failed to tie all current-carrying wires going to the distributor into this resistor. This is all assuming of course, that the generator and voltage regulator are in good condition. If the generator is generating too much or if the voltage limiter is malfunctioning, it's also possible to get too much current to the points. I'd replace the resistor first, make sure all wires to the distributor are tied in and, failing this, give the charging system a test with a volt-ammeter. By the way, are you certain that those points are being adjusted to specification?

## Monthly Service Tips

★ There have been reports of gas fumes in the trunks of 1964 Comets. The trouble's been traced to loose fuel filler hose clamps, and it's spelled out in Service Bulletin 55 (Aug. 14, 1964). Cure for the problem is to have your Mercury dealer remove the two present clamps and replace them with two new ones carrying part number 8A-8287.

★ Hot tip for owners of Dodges with the 426 Hemi-Charger engine: Cylinder head bolt torque is critical on this engine. In order to get proper cylinder head gasket compression, Lubri-plate has to be applied to the bolt threads and between the bolt head and hardened washer. The bolts then have to be torqued to 75 foot pounds. The man doing the job has to make sure he doesn't get any of the Lubri-plate between the hardened washer and bolt boss, since this can result in excessive bolt tension and could cause head bolts to break. If you haven't had this job done, you'd best get the car back to your dealer. The "news flash" came from Dodge on July 7, 1964.

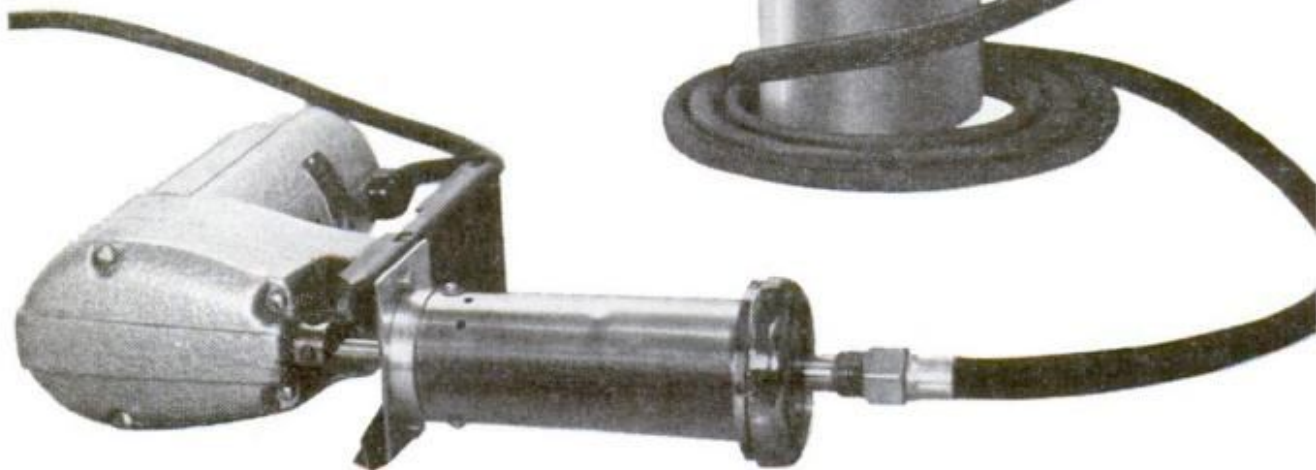
★ If you have an overheating problem in a 1964 Mercury with air conditioning, get the car back to your dealer pronto. It's probably being caused by a fan spacer that's too short. The new, longer one is part number C4AZ-8546-B.

★ If your car's equipped with a window-type distributor cap (for ease of adjustment) make absolutely sure that this window is closed after the car's been worked on. In many cases, the window drops down of its own weight after the adjustment tool is removed. But if it's accidentally left open, dusty air can enter the distributor and cause pitting of points.

As a service to Popular Mechanics readers with problems relating to their cars or to driving in general, we invite you to submit your questions for answering through this column or by mail. Address Auto Clinic, Popular Mechanics Magazine, 575 Lexington Avenue, New York, N. Y. 10022, enclosing a stamped, self-addressed envelope.

# SABRE SAW COMPRESSOR

By Howard W. Teter



IF YOU OWN a sabre saw, you can put it to work driving this potent little air compressor. In spite of its small size and short stroke, its performance is amazing. It easily develops more than 50 lbs. pressure, and because of its high operating speed (upwards of 3000 strokes per minute) it delivers plenty of volume to supply a bleeder-type spray gun. It's adaptable to any sabre saw of  $\frac{1}{2}$ - to 1-inch stroke, except models having orbital blade motion.

Materials to make the compressor will cost about \$2. The body, which is a cylinder and surge chamber to even out pulsations, is made from a slip-joint trap extension, a common item at most plumbing supply shops. The extension should be  $1\frac{1}{2}$ -in. in diameter and must have a threaded portion and nut on the large end.

Put the extension in a lathe and cut off a section to the proper dimension. It's best to remove the chrome plating with emery cloth while the piece is still in the lathe. This will greatly improve heat emission.

The cylinder head, which is also the check-valve seat, and the surge chamber end plate are turned from flat brass about  $\frac{3}{16}$ -in. thick. To hold the cylinder head in proper position ( $\frac{1}{8}$  in. above the flare) while soldering, cut a block of wood to fit loosely inside the tubing and set the block upright on the bench with the disc on top. Then flux the edge of the disc and slip the

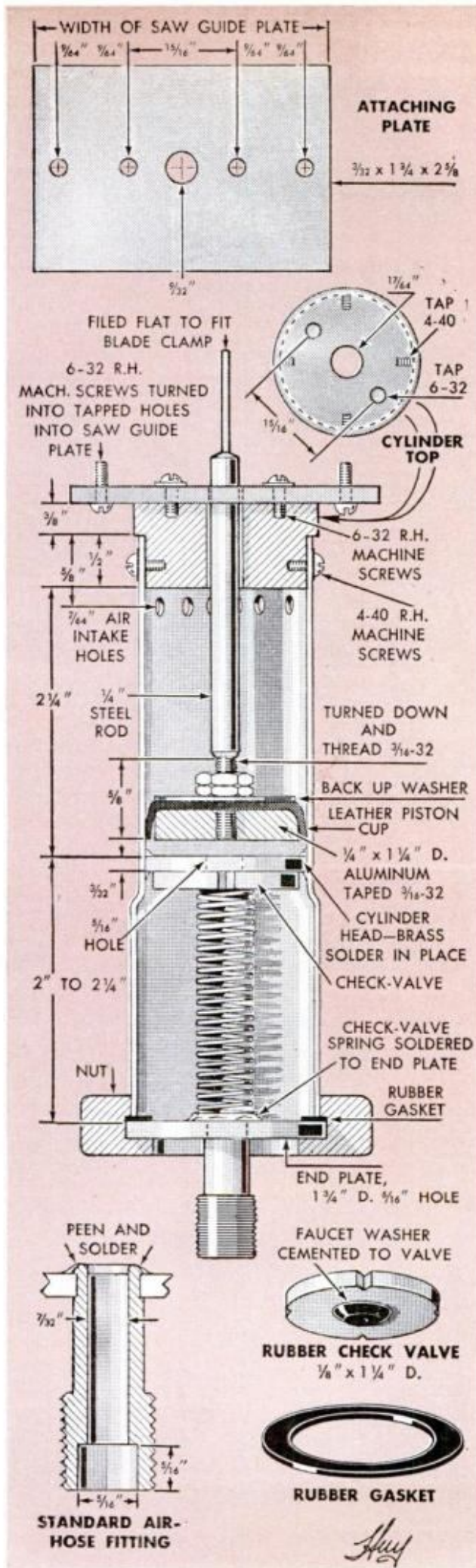
larger end of the tubing down over it. Apply a torch flame to the outside, taking care to avoid leaving bits of solder on the cylinder wall.

The check valve is cut from a flat piece of rubber taken from a truck inner tube. A few notches around the edge will insure free air flow. The valve spring is kept centered by a  $\frac{1}{4}$ -in. faucet washer contact-cemented to the middle of the check valve. A suitable spring can be obtained from a discarded window-shade roller. Cut off a 20-turn length and stretch it until it is 3-in. long when released. The top end fits snugly on the faucet washer.

A drilled and tapped space filler, preferably aluminum or other light metal, fits inside the leather piston cup to displace air that would otherwise be trapped there. Make the piston rod from a  $\frac{1}{4}$ -in. carriage bolt, 5-in. long. Since saws vary, its exact length will have to be determined by trial fitting. When the saw's ram is at bottom dead center, the piston should almost touch the cylinder head.

When assembling the piston, work a generous amount of machine oil into the leather to soften it. Blot off any excess, then oil the cylinder wall lightly before inserting the piston. After several hours of use, more oil can be worked into the leather, but too heavy an application may contaminate the air stream. ★★★



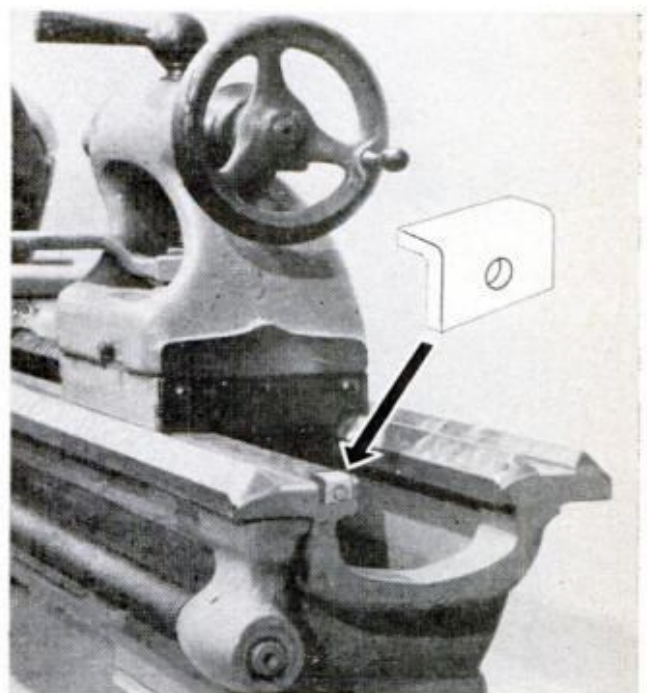


### Long Arm Simplifies Loading

Tipping bulky crates onto a handtruck was always a two-man job until one shipping department provided its workers with "grappling" hooks bent and welded from 3/8-in. rod. Now one man can easily reach over and pull the crate onto the truck without assistance. A handle, cushioned with a piece of garden hose, was formed on the hook as shown.—Robert J. Phillip

### Safety Stop for Tailstock

The tailstock on your lathe would cost a pretty penny to replace. To avoid accidentally shoving it off the ways take time to add this simple stop. Bend it from 1/8-in. mild steel and drill it to fit a hole drilled and tapped in the bed.—Henry Sevcik



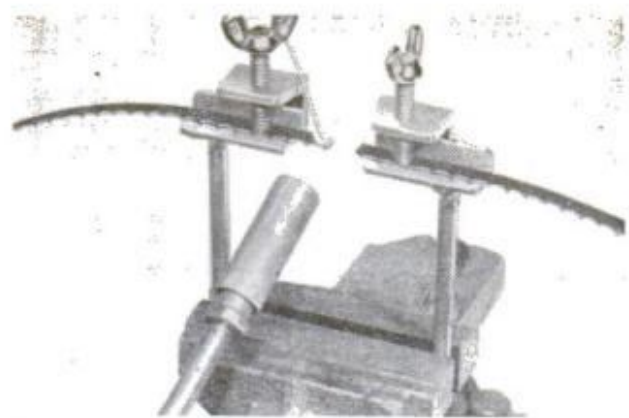
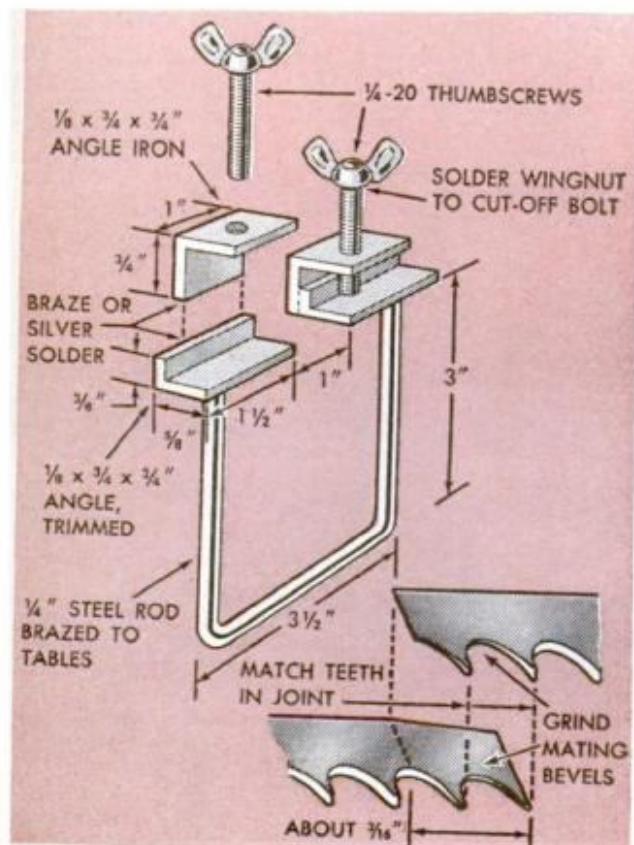
# BRAZING FIXTURE FOR BANDSAW BLADES

YOU CAN SAVE up to half on blade costs if you buy bulk 100-ft. rolls and make up your own bandsaw blades—either wood- or metal-cutting. But you have to know how to silver-solder the joints.

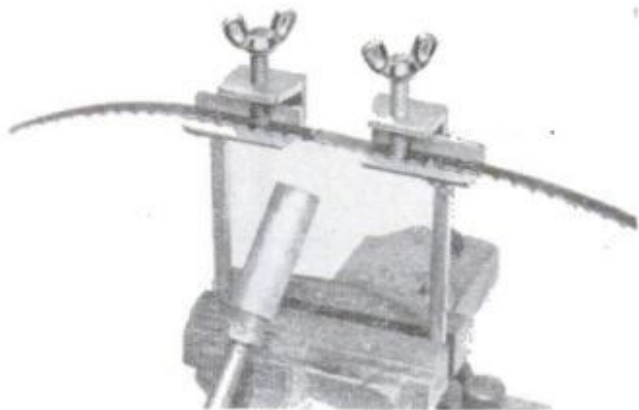
This technique is easily mastered, if you make the simple clamping fixture detailed below. And silver-soldering has an advantage over fusion-welding: The joint can be taken apart by heating, to pass the blade through pierced work, then re-soldered.

To make the fixture, cut a 3-in. and a 4-in. length of steel angle, trim one leg of the latter as shown, then center and braze the shorter length to it. After brazing on the U-shaped rod, cut a 1-in. segment from the middle of the angles. This assures that both tables will be in the same plane.

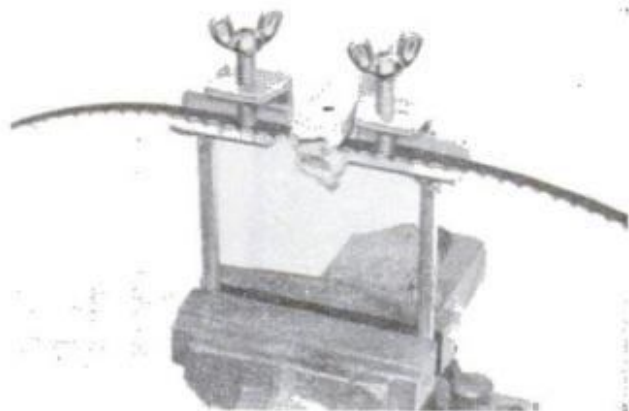
A silver-soldered butt joint won't hold; you must overlap the ends with mating bevels. The four steps in brazing are shown at right. You apply heat from below to keep the flame from blowing the flux away as it dries. If the solder balls in the first step, you used too little flux and should file the bevel bright before re-fluxing. Once the upper blade-end springs down against the lower one, you swing the torch to heat from the top until the upper end glows red and the solder melts again. The asbestos wrap on the clothespin assures slow cooling.—*Manly Banister*



**CLAMP BLADE** outer face up, apply flux to bevel and heat from beneath till solder flows, coating it



**LOOSEN CLAMP** on right and bring other bevel in to overlap. Heat till solder melts and bevels join

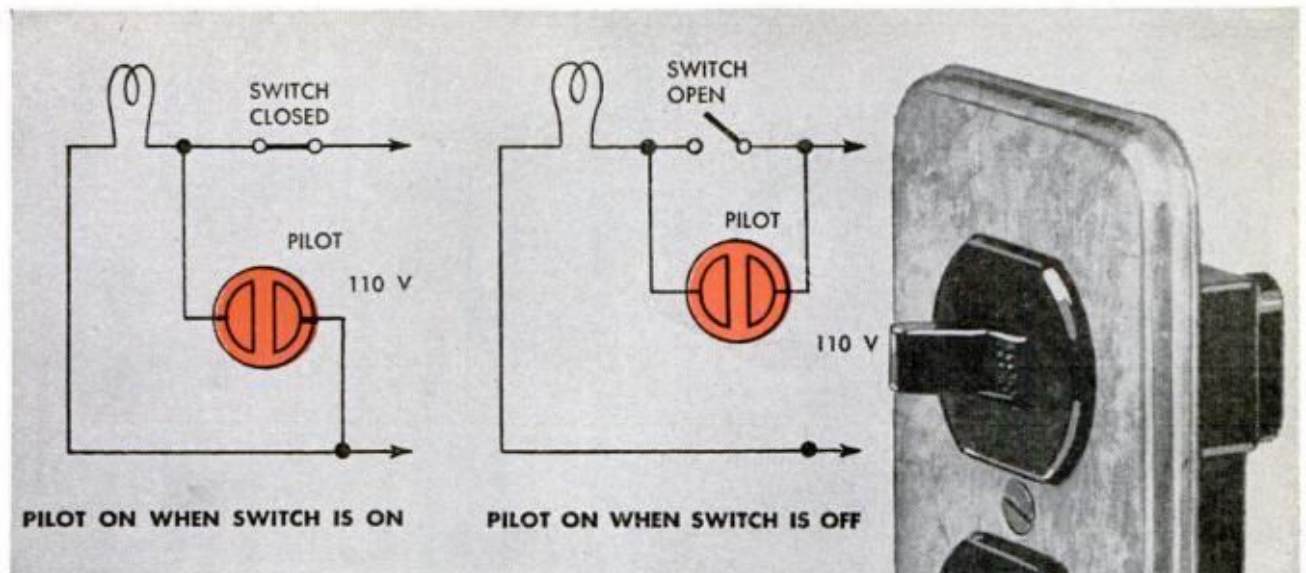


**WHILE PLAYING** flame on joint from above, clamp on asbestos-jawed clothespin, remove flame, let cool



**GRIND EXCESS** silver squeezed out of joint on both faces. Use three-cornered file to clean gullets

# Bright Ideas for the Amateur Electrician

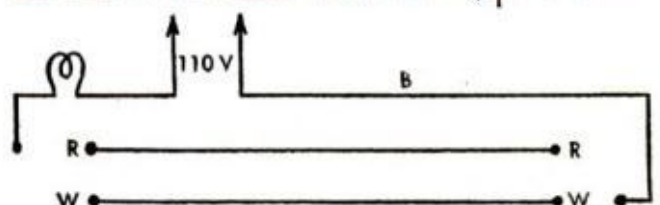
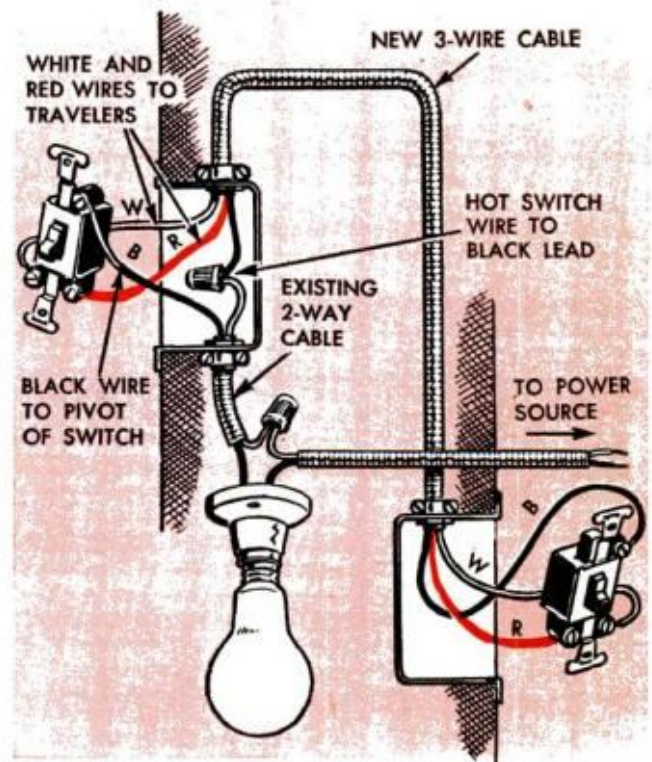


**YOU NO LONGER NEED TO GROPE** for a light switch when you come in at night—a new combination switch-and-pilot makes it easy for you to spot the switch at a glance since it can be wired to make the pilot glow when the switch is off. This convenient one-piece product by General Electric also can be wired in the normal manner to serve as a telltale warning light for important circuits that control a food freezer, heating plant or other critical appliance. It fits any standard Gem box and duplex receptacle plate. The diagrams show the two different ways to wire it.—*Joseph Braunstein*

**ONE LIGHT SWITCH** per stairway is a nuisance and a hazard. If the switch is at the top of the stairs, you can't turn the light off after you walk down. If it's at the bottom of the stairs, you may take a spill walking down in the dark to turn it on. The solution, of course, is a switch at each location—and adding another one is something you can do yourself.

First cut a hole in the wall for a common Gem box. Then remove the fuse controlling the circuit and take out the old 2-way switch at the top of the stairs. Next run a 3-wire (#12 or 14 ga.) BX cable from one switch opening to the other, and replace the fuse. Now with a test lamp determine which wire of the circuit is hot. Again remove the fuse and splice the hot wire to the black wire of the 3-wire cable with a solderless connector.

Your new switches have to be the 3-way type and you will find that each one has three terminals. One, which is bronze, is called the pivot, the other two, which are brass, are called the travellers. The second wire of the circuit is connected to the pivot terminal. The red and white wires of the 3-wire cable are connected to respective traveller terminals of each switch. Finally, fasten the switches in their boxes, add the plates, replace the fuse.—*Sam July*



# Heavy Duty Shop Vacuum Cleaner

By Harold P. Strand



**A**LL YOU NEED to build this efficient shop vacuum cleaner is the motor-blower unit from an old, upright household vacuum cleaner, an empty five-gallon grease can and a few odds and ends found around most shops. The cost will run well below what you'd pay for an equivalent commercial unit.

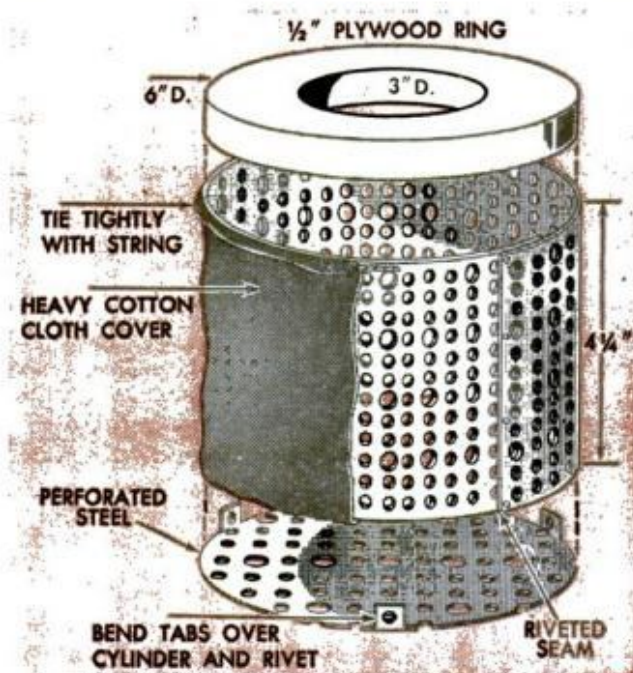
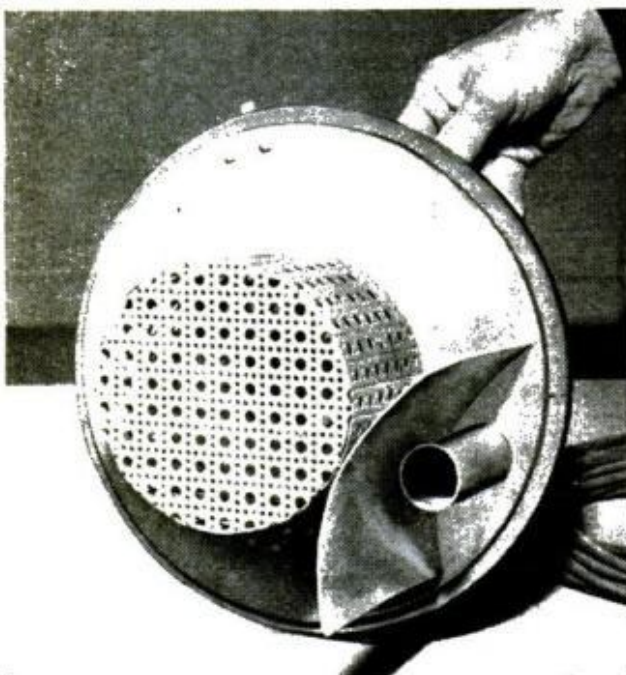
I built this unit from an old upright Universal which had been relegated to the attic. However, almost any similar type

household vacuum cleaner can be used, as long as you modify the plans to accommodate differences in size and shape.

If you have to buy an old machine, it should run you about \$5 to \$10 at a second-hand store or vacuum-cleaner repair shop. Before buying one, turn it on and make sure there's very little arcing at the brushes.

Sometimes you can rejuvenate the motor sufficiently by disassembling it, cleaning

**CYLINDRICAL FILTER**, consisting of a perforated metal screen and a cloth bag, fits over suction port of the blower to protect mechanism from dust, debris. Sheetmetal baffle "throws" debris to bottom of canister



it thoroughly, smoothing the commutator with fine sandpaper, installing new carbon brushes and replacing worn out bearings. If the cord is worn or otherwise deteriorated, it's a good idea to replace it with a new rubber-covered one made specifically for use on vacuum cleaners.

### Strip Down the Old Cleaner

Your first step is to strip down the old cleaner to the motor housing and blower. If it's a Universal, make up a small housing from sheet metal to enclose the space between the two lugs to which the handle attaches (see drawing, page 193). On this housing, install a toggle switch and a grommet for the line cord. The two leads from the motor also enter this enclosure for connecting to the line cord and switch. With other make cleaners, you can locate the switch on the canister cover, or where the line cord enters directly into the motor through a grommet, a cord switch can be spliced in quite easily.

The grease can used for the canister should be well cleaned with a solvent, then washed with hot water and detergent. Remove the handle and apply primer inside and out. After drying, apply a coat of gray enamel or other suitable finish.

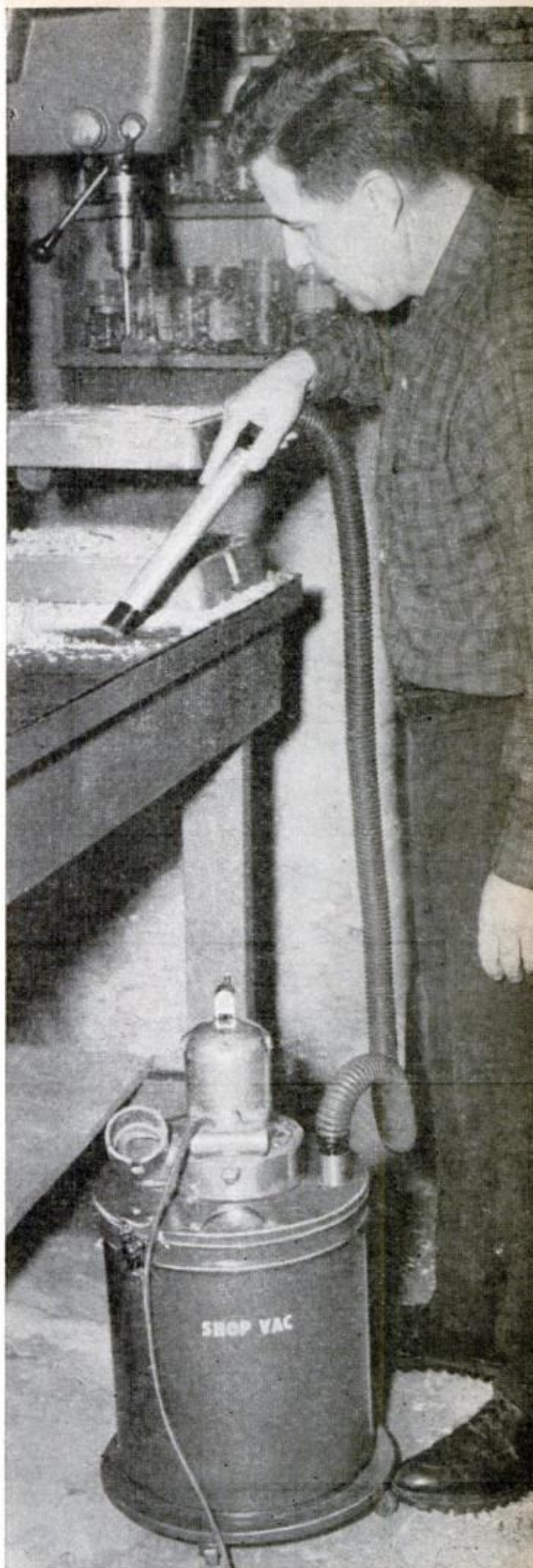
The base for the can consists of two plywood discs. One should fit in the can's recess, where it is secured with screws driven in from the edge. The other is made larger and is attached to the top disc with glue and screws. Installing four casters completes work on this section.

The canister cover is also made of two plywood discs laminated together with glue and screws. However, it has a center opening which is cut to fit the suction port of the vacuum-cleaner blower, which projects from the Universal when the front hood is removed. With some other makes, the dust-collecting front hood may be a part of the general blower housing and therefore not removable. In that case, you'll have to cut this part off with a hacksaw before proceeding.

### Mount Machinery on Cover

The motor-blower unit is attached to the cover with three small brackets and screws. A gasket cut from an old inner tube assures a tight seal.

A hole must also be made in the cover for press-fit mounting of the new suction intake, which is the short length of tube to which the vacuum-cleaner hose will be attached (see drawing, page 192). If you can't find a tube of the right diameter, make one by rolling up a piece of 26-ga. galvanized sheet steel and soldering the seam, taking care to get it perfectly round by forming it on a piece of pipe.



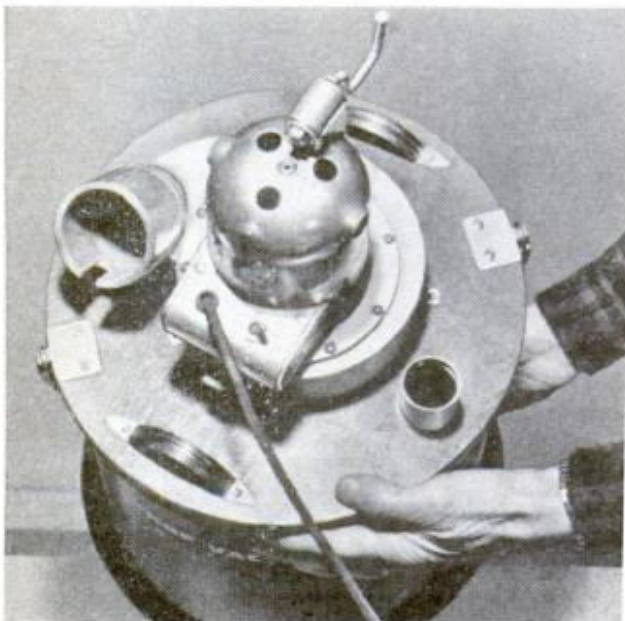


**ASSURE EFFICIENT OPERATION** by emptying canister periodically and brushing off the cloth filter bag



**CLOTH BAG** that covers blower-intake filter should be of closely woven cotton or other material that will "trap" dust particles. Tie on with double string

**TOP VIEW** shows layout of the mechanical parts on top cover. Note hook at top to hold cord when machine is idle. Handles are stock drawer pulls



Two handles on the canister cover will facilitate emptying, and a strip of rubber or felt cemented to the underside of the cover makes an effective gasket. Two suitcase latches attached to the canister will hold the cover down tightly. The hooks which engage the loops of the latches were made from  $\frac{3}{32}$ -in. soft steel. The cover should be painted before installing any of the above parts.

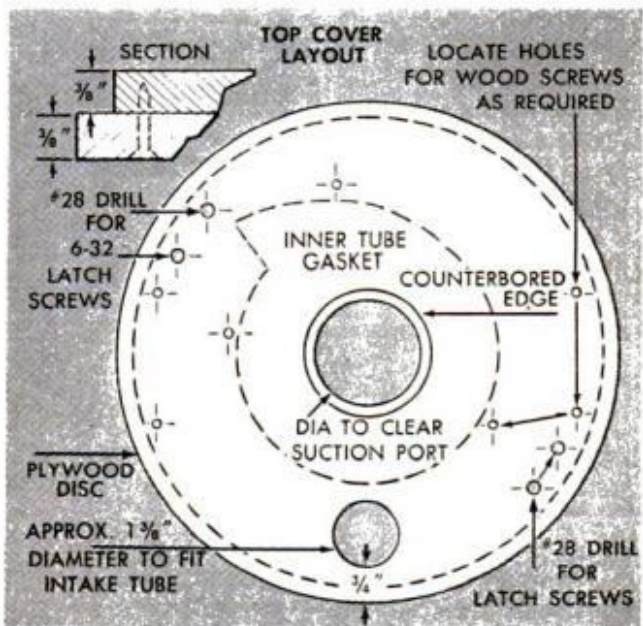
Now you must make a filter to protect the suction port of the blower. Cut out a plywood ring and attach this to the underside of the cover, under the center opening. Then make a cylindrical screen from perforated metal such as radiator enclosure grille or hardware cloth. Fasten the filter to the plywood ring with screws. To complete the filter, add a draw-string cover made from a close-weave cotton or similar material.

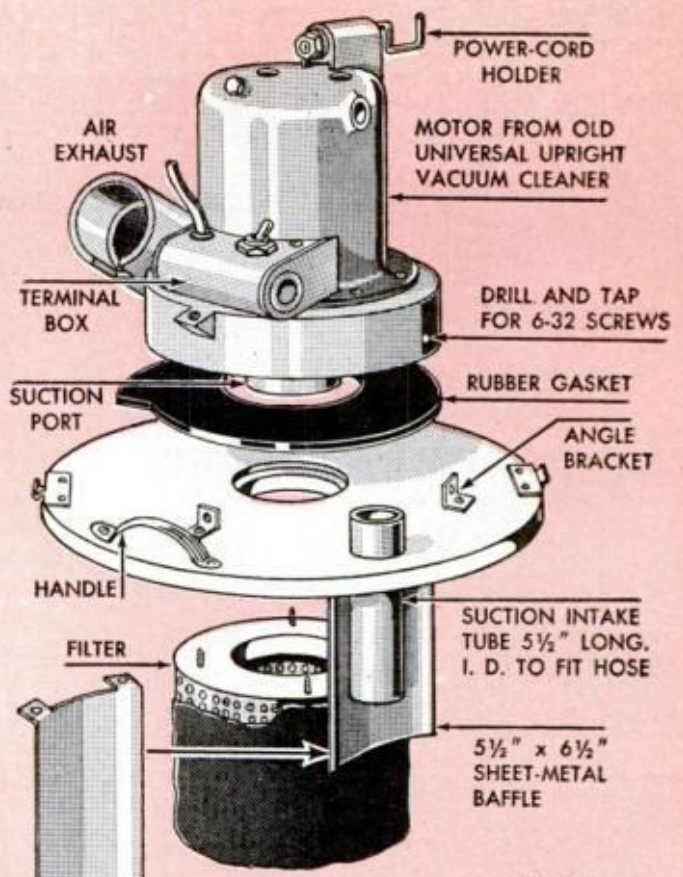
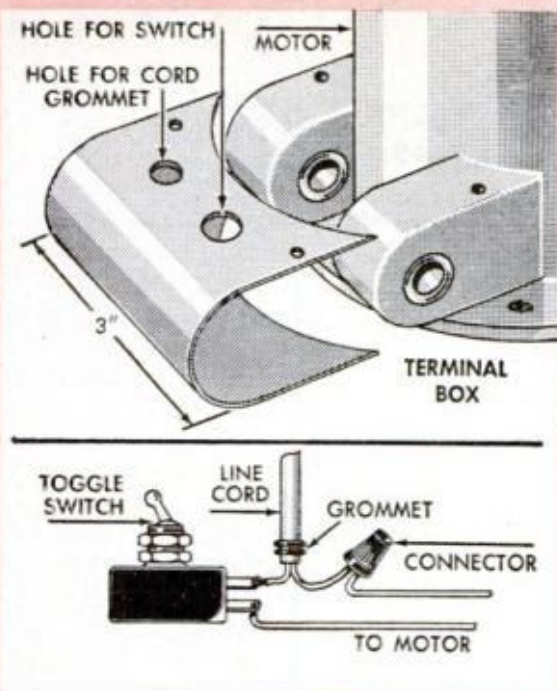
### Protects Filter

Next, install a curved baffle of sheet metal between the filter and the suction intake tube to deflect incoming shavings and chips from the filter and direct them to the bottom of the canister.

Now all you need to get maximum use out of your shop vacuum cleaner is the hose, a long nozzle, a small round brush attachment and an extension tube. These may be taken from the original household cleaner, or purchased from a dealer who carries replacement parts. Fit the hose to the suction intake tube, securing it with a hose clamp or a length of wide flexible plastic tape.

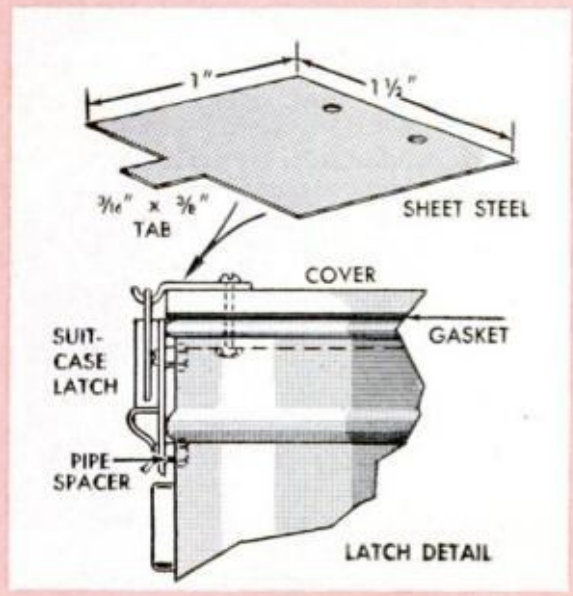
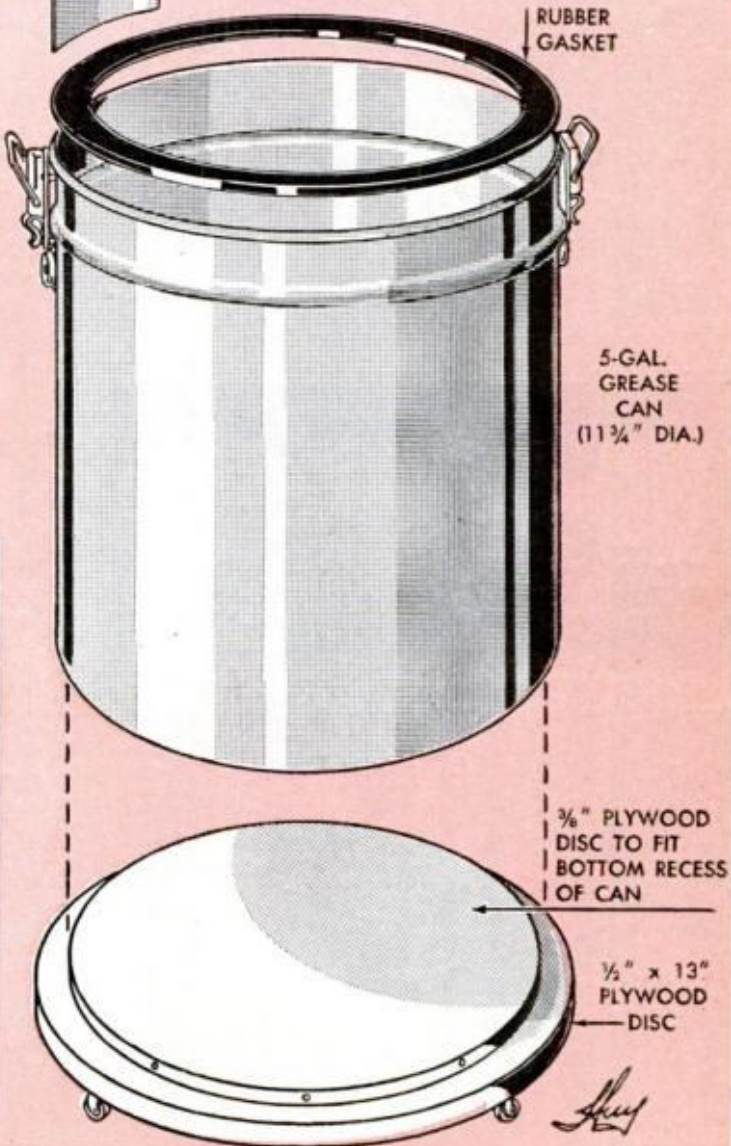
When operating the vacuum, follow the same common-sense rules that apply to any such machine, whether shop or household type. Empty the canister regularly, and brush off the filter. Also, to avoid clogging, do not try to pick up any object





such as a large scrap of wood that won't pass easily through the hose. Also, it might be best to stay away from large nuts, bolts and metal scraps, which might damage the baffle.

Incidentally, it's important to keep the bearings of the vacuum-cleaner motor well lubricated, via the grease cups at each end of the motor. Since the motor is now operating in a vertical position, there is some downward thrust on the lower bearing due to the weight of the armature fan, which will place some extra wear on this bearing if allowed to run dry. ★★★



# MILL KEYWAYS In Your Lathe

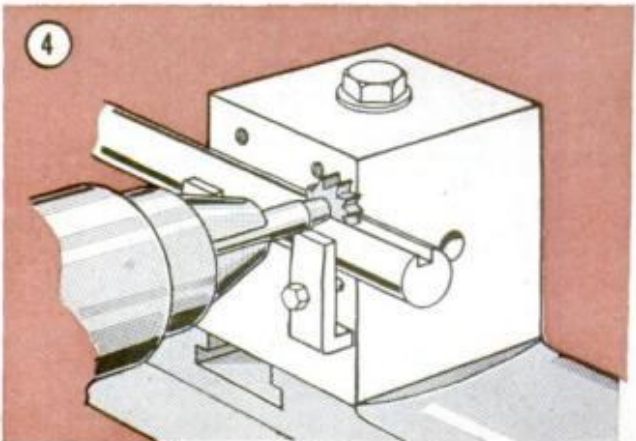
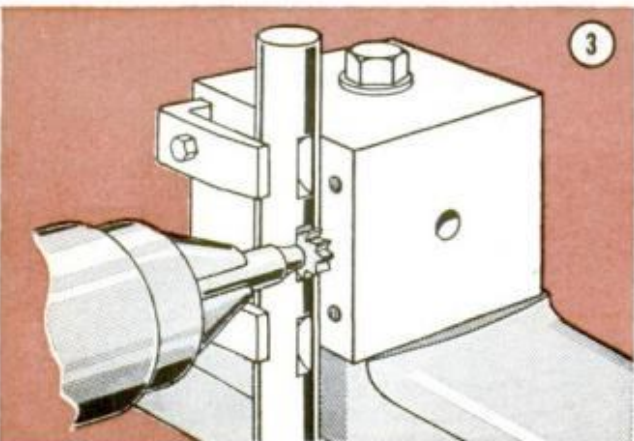
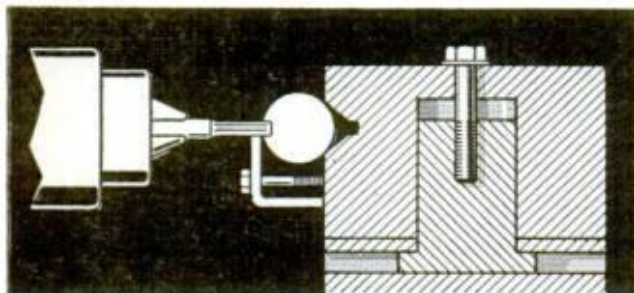
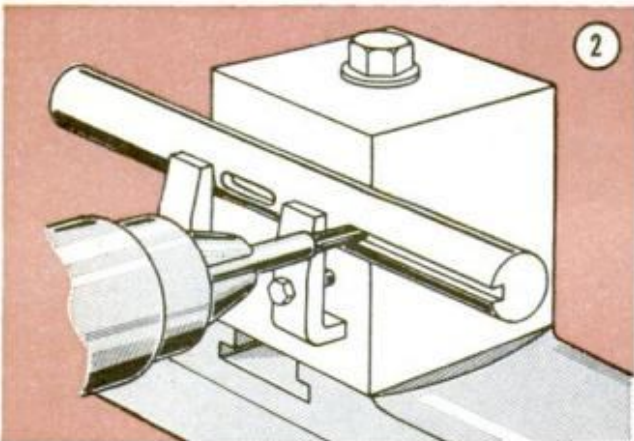
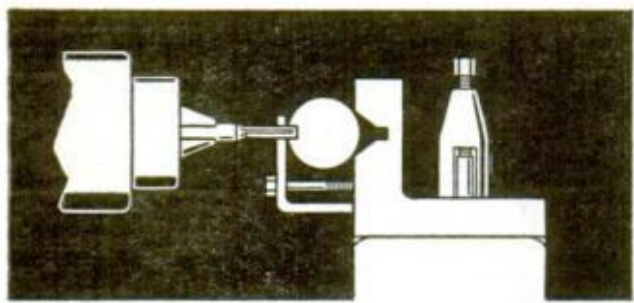
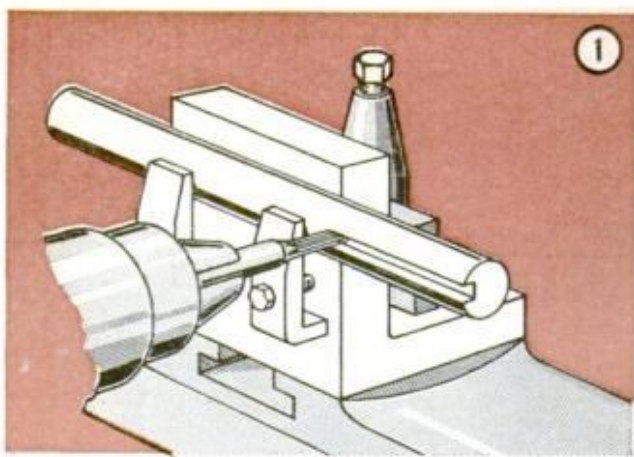
DOES YOUR machine shop consist of a lathe—*period*? No matter: you can teach this one tool to perform nearly all machining operations. As a start, try cutting keyways in shafts of various diameters.

You can hold straight-shank end mills in a collet or chuck, or in a taper-shank adapter inserted directly into the hollow headstock spindle. The only accessory you have to make is a sturdy clamping fixture you mount on the compound rest to position the work. The precision controls of the carriage and cross-feed screws let you move the work into the cutter and draw it past, as well. This means you can cut both open-end keyways and blind slots.

One such clamping fixture can be made of heavy angle (Fig. 1) bored to take the toolpost and clamped to the rest by means of a steel bar slipped into the toolpost slot. After it's in place, mill a V-groove across its face (as shown in the cross section) by mounting an angular cutter in the headstock and drawing the work past it with the cross-slide feed screw. The groove thus formed lets you clamp the work in an accurate horizontal plane at lathe-center.

An alternate fixture (Fig. 2) is a steel block bored to receive a flanged post (like the lower end of the toolpost) so you can clamp it to the compound rest's T-slot with a large capscrew.

Figs. 3 and 4 show set-ups with a Woodruff keyway cutter in the headstock; the cut, in such a case, is made at right angles to the spindle. Woodruff keyseats are made by clamping the work in a vertical position and feeding it into the whirling cutter. Again, if you mill an accurate V-groove across the block, you can position the work quickly.—C. W. Woodson





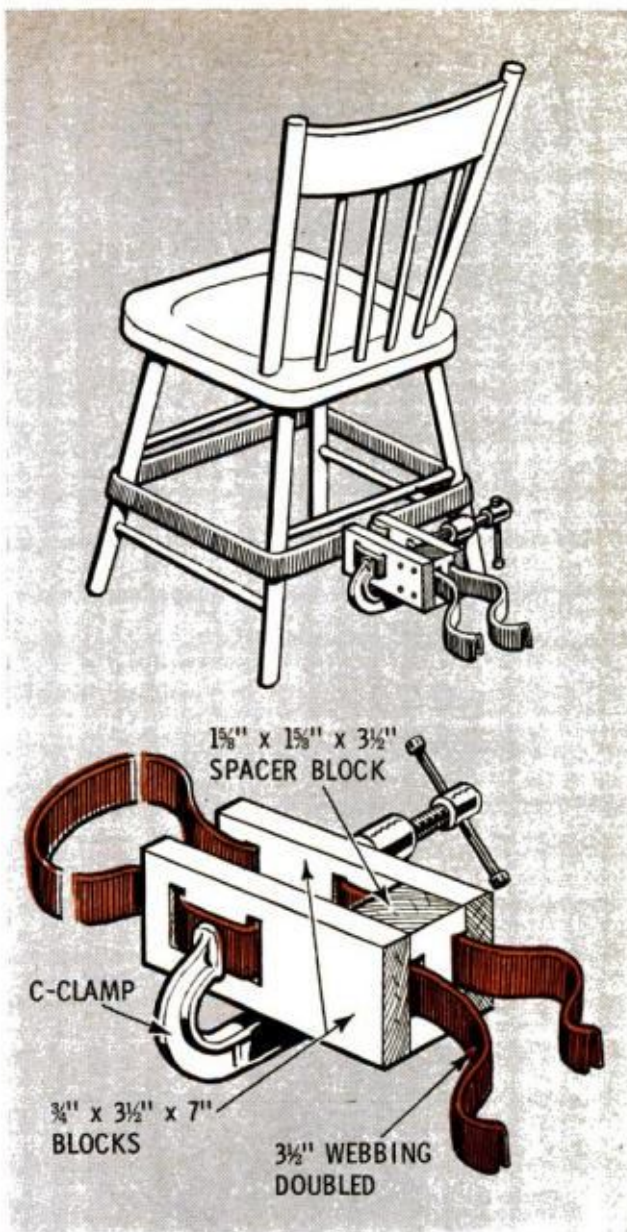
## C-Clamp Tightens Band Clamp

With some upholstery webbing, a C-clamp and three pieces of  $\frac{3}{4}$ -in. stock, you can make a very workable band clamp for gluing up round or irregular objects. Cut and notch the wood parts as detailed at right, then fasten the spacer block to *only one* of the side pieces with glue and  $1\frac{1}{2}$ -in. No. 6 F.H. screws.

The  $3\frac{1}{2}$ -in. webbing, which is folded into a double thickness  $1\frac{3}{4}$  in. wide, is readily obtainable at upholstery shops for about 20¢ a yard. Three yards should be enough for most jobs.

To use the clamp, thread the ends of the webbing through the double slots in the side pieces as shown and out through the slots in the spacer block. Pass the loop around the work and pull the strap ends hand tight. Then apply a C-clamp so it will grip the band on either side. Tightening the C-clamp exerts pull on the webbing band and gives necessary tension. Although there is very little stretch in upholstery webbing, check the band after an hour or so. If any slack has occurred, another turn of the C-clamp will take it up.—Hayden Ricker

**To simplify painting** of jewelry and other small items that are too small to hold readily in your hand, stick the items on a piece of masking tape. The tape will hold them securely for painting with a small brush, and may be left on the tape while drying. The tape can be used repeatedly for this purpose. —Ken Murray



## NEXT MONTH IN SHOP AND CRAFTS

- ★ **8-FT. HYDROPLANE.** Any boat that can skim over the water at a sizzling 33 m.p.h. when pushed by a little 14-hp. outboard is a bargain in the power department. But when the build-it-yourself price tag is only \$25, it becomes a bang-up bargain in all departments. You'll find detailed plans for this one-man speedster in the March issue of *PM* so don't miss it
- ★ **CAULKING THAT LASTS THE LIFE OF YOUR HOUSE.** They don't shrink or crack. They adhere to most any material. They resist ultra-violet radiation and remain flexible from -65 deg. F. to 250 deg. F. These are just a few of the startling characteristics of polysulfide sealants. If you're interested in finding out more about these amazing synthetic rubber caulking materials, be sure to get the next issue of *PM*. It has all the facts
- ★ **HOW TO KEEP YOUR WHEELS FROM COMING OFF.** Proper wheel maintenance involves more than just making sure that the lugs are turned up tight. Neglect it and one day while speeding down the highway you may suddenly find yourself frantically trying to control a three-wheeled car. For a step-by-step guide to wheel maintenance, check the March issue
- ★ **DOVETAILING JIGS FOR YOUR ROUTER.** All you furniture makers will be interested in this one. Once you've made this set of template jigs, you'll be able to cut fast and accurate open and half-blind dovetail joints in (what else?) jig time. You'll find full plans for making the jigs plus easy instructions on how to use them in the next issue of *PM*

# Life-Saver in Your

*Pocket-sized blinker will warn off traffic should you break down on the highway. Build it for only \$4*

By Fred Blechman

WHAT A TIME for a flat tire! Night, on a dark road in the middle of nowhere.

The problem is not in changing the tire, but in avoiding being hit by an approaching car whose driver doesn't see your disabled vehicle. Leaving your parking lights on is one solution, but this imposes a fairly heavy drain on the car battery, and these lights don't command attention if

there's much other lighting in the area.

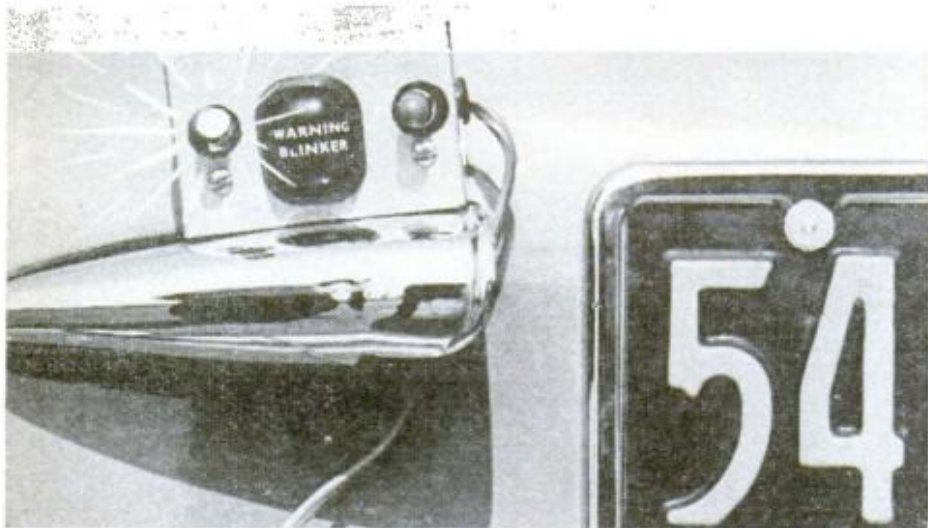
Another possibility is to use a dry-cell battery powered flasher. But very often the batteries in these units are dead at the moment you need them most.

A better solution is to build the compact warning blinker described here. It plugs into the automobile cigarette lighter socket for power, provides two alternately blinking lights and takes up almost no storage space.

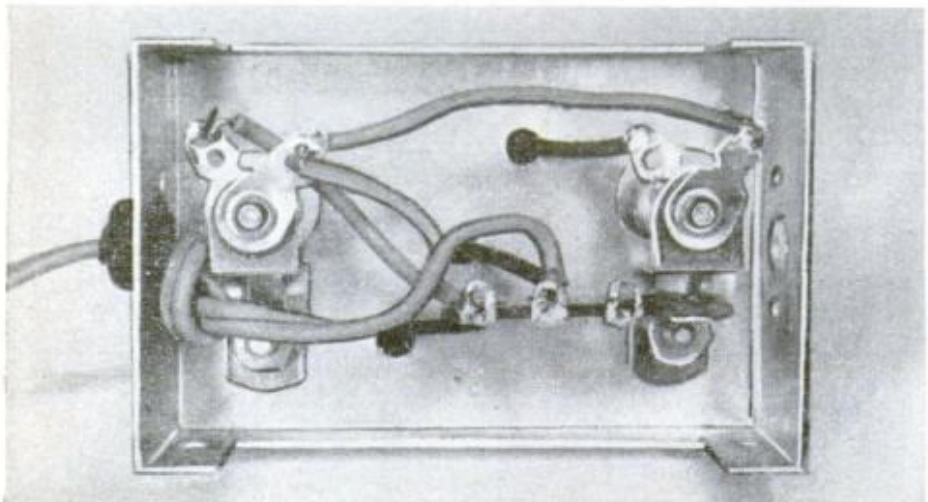
With about \$4 cash and one hour's labor (probably less), you can have your own.

Construction is kept as uncomplicated as possible by using a preassembled transistorized flasher module. In all, there are only three electronic parts to interconnect.

**BLINKER** is small enough to put almost anywhere. You'll probably want to keep it at eye level or higher so it can be seen easily. Add a magnet to the case, and you can just stick it in place the next time you have to change a tire



**WIRING** is kept as uncomplicated as possible. As an additional help, you don't have to worry about the placement of leads inside the case. If desired you can solder the lamps into the circuit and avoid using sockets



TO CIGARETTE  
LIGHTER PLUG  
6 OR 12 VOLTS

# Glove Compartment

All parts are mounted in a small  $3\frac{1}{4} \times 2\frac{1}{8} \times 1\frac{1}{8}$ -inch box. If you use the aluminum case listed, be sure that none of the wiring contacts the case.

For my unit I drilled three holes in the face of the case for the module leads and cemented the module to the front of the case again making sure that these leads did not touch the case.

If you intend to use the unit with a car that has a 12-volt electrical system, use No. 57 or 1815 bulbs. For 6-volt systems use No. 55 or 47 bulbs. Be sure to wire the cigarette lighter plug (available at most auto parts stores) with the proper polarity, the hot side to the center prong and the ground to the remaining contact.

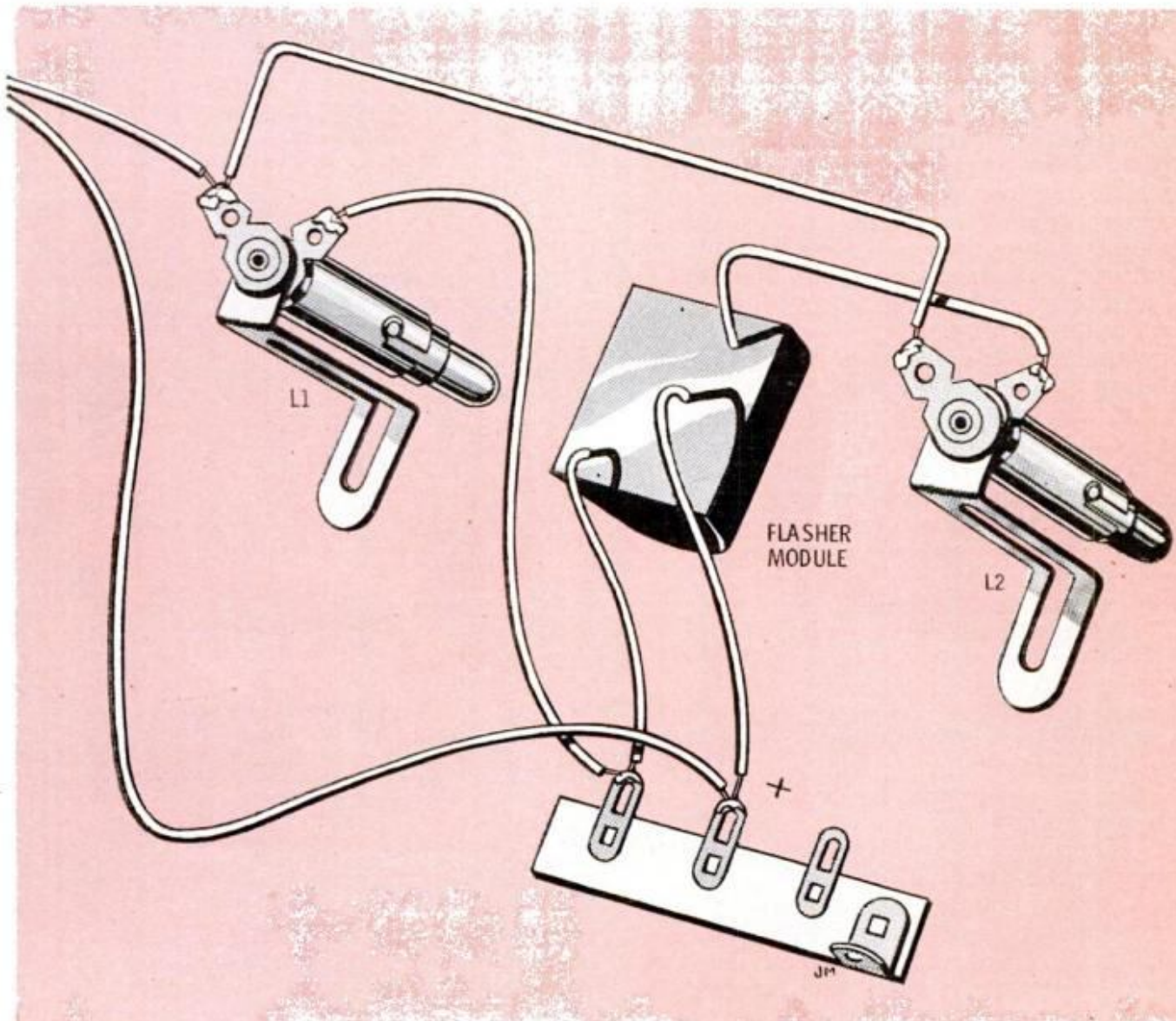
The cord that connects the plug to the flasher is ordinary lamp cord and can be made any length. Normally about 10 feet is enough. As a final touch, coat the bulbs with a light layer of red nail polish.

Chances are you'll never have to use this flasher. But you'll appreciate it should it ever become needed.

## PARTS LIST

Flasher Module (Lafayette SP-296 or equivalent)  
Cigarette Lighter Plug (see text)  
L1, L2—6 volts: No. 55 or 47  
          12 volts: No. 57 or 1815  
Pilot Light Sockets (2) (Dialco No. 705 or equivalent)  
Case,  $3\frac{1}{4} \times 2\frac{1}{8} \times 1\frac{1}{8}$  (Bud 3017A or equivalent)  
Lamp cord, terminal strips, cement, miscellaneous hardware

**LARGE-SCALE PICTORIAL** diagram shows complete wiring in detail. The only connection to the flasher module that must be made where it's shown is the middle lead. The other two can be reversed, and the unit will still work



# COLD

## Sounds the Alarm

*Heating plant quit? This \$5 low-temperature alarm will warn you quickly before the house gets cold*

By Harold Strand

THIS SIMPLE ELECTRONIC ALARM can be invaluable as a warning that the temperature in your home has fallen below set limits of the regular thermostat controlling the heating system.

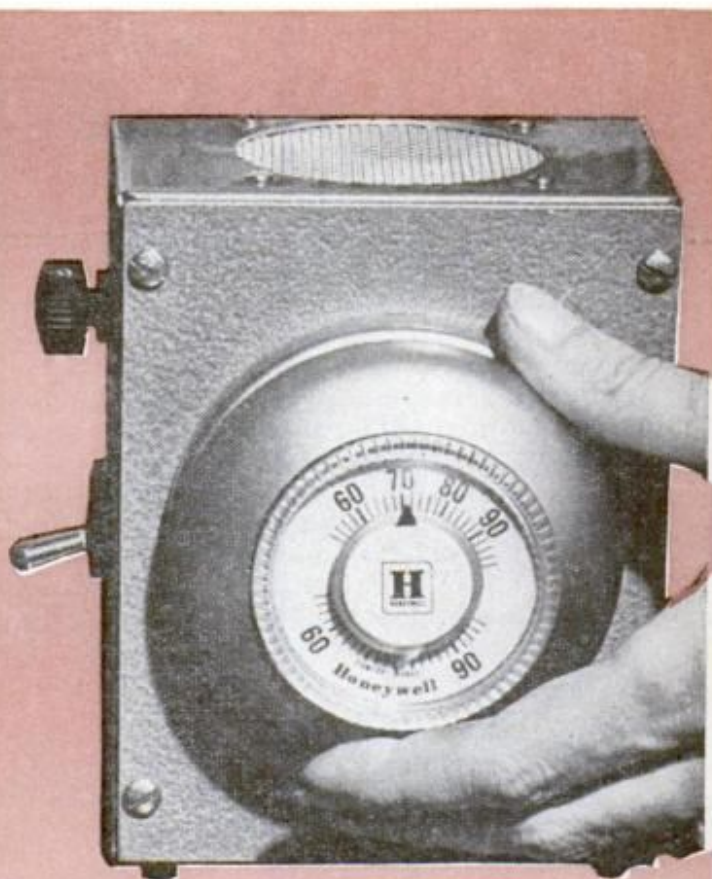
The temperature drop could be caused by a power failure or trouble in the heating plant. It could happen at night, causing frozen or burst water pipes plus the discomfort of waking up to an ice-cold house. It would be especially important should there be an ill child in the house.

A thermostat mounted on the front panel of the low-temperature alarm triggers the device. If for any reason temperature in your home should drop, the thermostat is activated and the alarm goes off. Keep the alarm set five degrees lower than the thermostat for your heating unit. This will give ample warning.

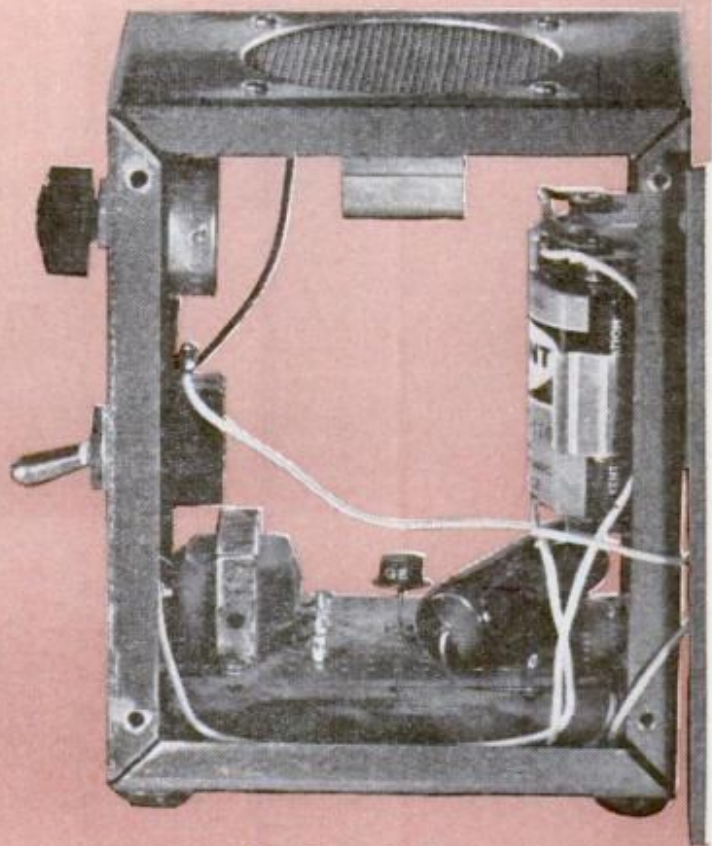
The unit consists of an audio oscillator operating at about 400 cycles. When triggered by the built-in thermostat the oscillator output is fed to a small speaker. The resulting tone is quite penetrating and sure to wake almost any sleeper. It can be set to a suitable volume level.

Wiring is fully detailed in the pictorial diagram. Work slowly and solder carefully. Do not insert the transistor into its socket until all wiring has been completed. Make sure battery polarity is correct before trying the unit the first time.

You can test the completed alarm in several ways, but the simplest is to set the alarm thermostat to a temperature higher than that in the house. Immediately, the thermostat contacts should close and the alarm sound off. Now lower the alarm thermostat setting, and the signal tone should stop as soon as you get below the room temperature. One last hint: Keep the alarm level on a flat surface or it will not operate properly because of the mercury switch in the thermostat.



SET THE ALARM by adjusting alarm thermostat five degrees lower than the heating plant thermostat. If temperature drops, the alarm sounds off

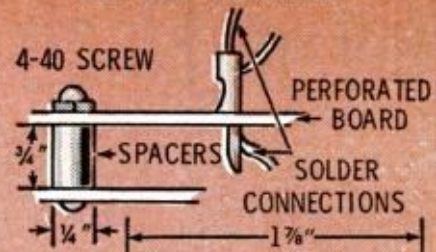


IN THE COMPACT METAL CASE, the speaker is mounted to the top, the perforated circuit board to the bottom and two controls come out the side

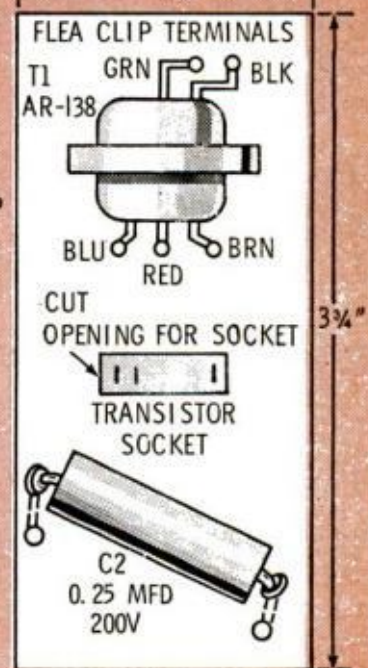
### PARTS LIST

- R1—12,000 ohms, 1/2-watt carbon resistor
- R2—500-ohm potentiometer (IRC VC-931)
- C1—20 MFD, 15 volts, miniature electrolytic capacitor
- C2—0.25 MFD, 200 volts, paper capacitor
- BATT 1, 2—9-volts (RCA VS-300 or equivalent)
- J1—closed-circuit miniature phone jack
- S1—spst toggle switch
- T1—transistor output transformer (Argonne AR-138)
- 2N188-A transistor and socket
- Speaker, 2 1/2-inch diameter
- Sheet perforated phenolic for chassis
- Battery holder for two C cells
- Room heating thermostat (I used Honeywell T86A but other types should work just as well)
- Case, 4 x 5 x 3 inches
- Rubber feet, rubber grommets, knob for potentiometer, spacers to separate circuit board from case

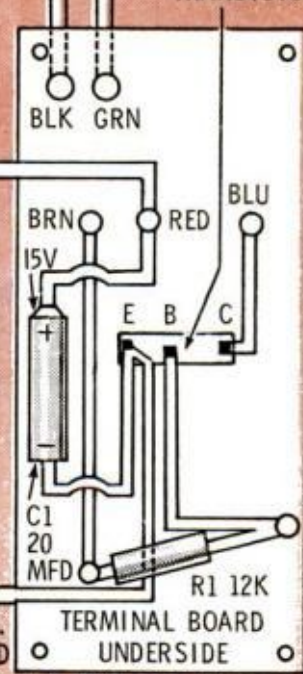
### FLEA CLIP TERMINALS



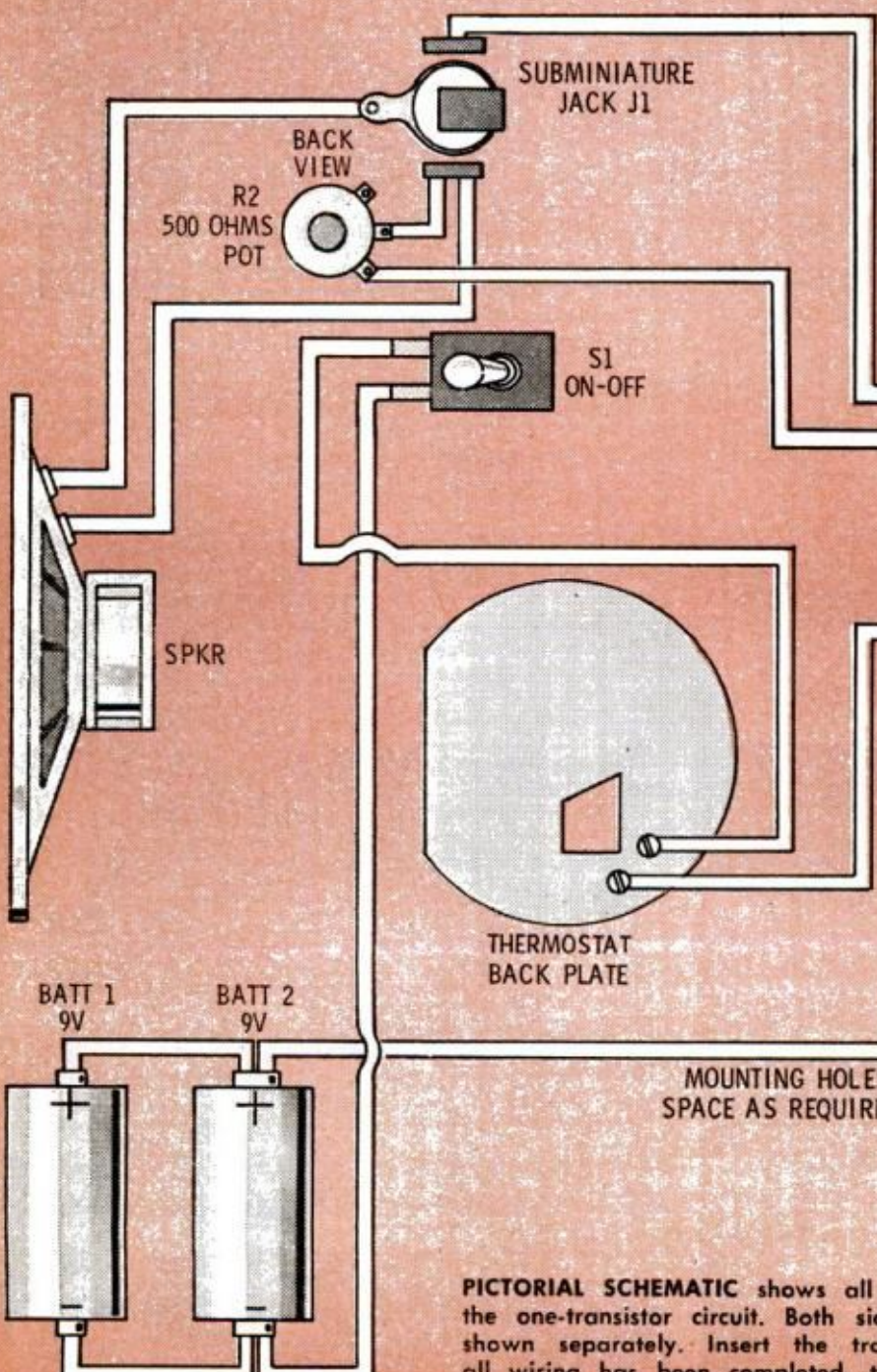
### TERMINAL BOARD TOP



### TRANSISTOR SOCKET PLUG IN 2N188A TRANSISTOR



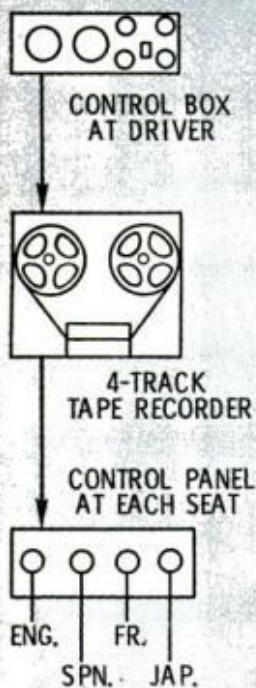
MOUNTING HOLES. SPACE AS REQUIRED



**PICTORIAL SCHEMATIC** shows all wiring and parts layout for the one-transistor circuit. Both sides of the circuit board are shown separately. Insert the transistor into its socket after all wiring has been completed, then slip batteries into holder

GB

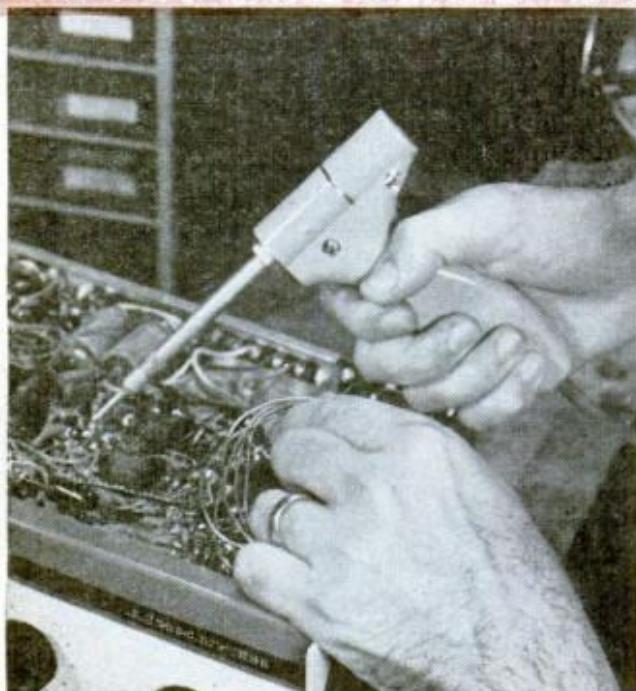
# New in Electronics

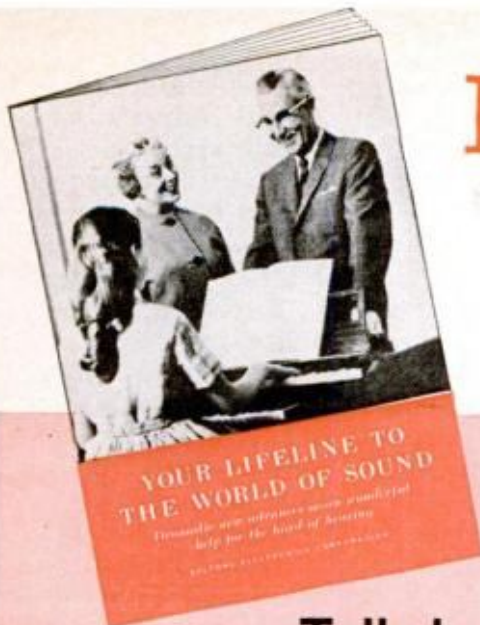


**SIGHTSEEING IN FOUR LANGUAGES** is the purpose of Tourmatic, a sound recording tape unit that lets a bus driver conduct a sightseeing tour in French, Japanese, Spanish and English at the same time. Located near each passenger seat are four plug-ins, each one for each language, fed from a continuous-loop tape cartridge. A special 3M tape carries the prerecorded narration. The system is now in use in San Francisco and Los Angeles

**PISTOL-GRIP SOLDERING IRON** solves the how-to-get-at-it problem in crowded electronic circuits. With 20 interchangeable screw-on tips to choose from, there's bound to be one to fit your job. Low wattage (40 or 60) makes iron suitable for transistor circuits, too. Made by General Electric Co., Shelbyville, Indiana

**SUPER-SENSITIVE** cadmium sulphide photographic light meter gives a reading even when the light level calls for a 30-minute exposure. Battery powered circuit reads reflected and incident light. Color coded scales calculate proper lens openings and shutter speeds. The KG-275 meter kit from Allied Radio, Chicago, costs \$15.88





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## Weapons for Hot Little Wars

(Continued from page 147)

pode and spews out lethal pellets at tremendously high velocities over a fan-shaped area when it is tripped off. It led to another ingenious idea which just might do the trick: the Claymorette. This method involves mounting a series of miniature Claymore-type units on each side of the vehicle to pour a deadly hail of pellets against ambushers.

Perhaps even more important to the Army than new counterambush weapons is the development of ambush-detection systems for use in guerrilla warfare. The ideal system would (1) detect the ambush party before it attacks, and (2) not alert the ambushers to the discovery so that they in turn could be ambushed.

While little information is releasable on new ambush-detection developments, it is known that a wide variety of approaches is under study and experimental testing—electronic, acoustic, seismic (through earth tremors), biological, and physical.

### Spots Hidden Foe's Radiations

A very small portable "short-range guerrilla detector," probably using micro-miniature electronic techniques, is the goal of one experimental program. The rapidly growing new science of radiometry, in which objects are identified by their radiated energy with a receiving device which does not itself emit telltale radiation, may make a contribution in this field. But the extremely austere size, weight and power requirements of counterinsurgency fighters put severe restrictions on detection systems.

This has led to some exotic efforts, shrouded in secrecy, which do not depend primarily on electronics. Some concepts entail smelling out ambush parties by chemical and biological techniques.

One "way out" idea is to train certain types of birds to locate concealed forces and signal their presence back to the friendlies. Studies for the Army by a private firm have already established that birds can be taught to recognize human presence under certain conditions, and follow this recognition with a particular response.

Of course, if birds not indigenous to a particular area should be used, there would be the risk of pot shots at them by an enemy who suspected their purpose. Such attempts, however, would probably serve to tip off the friendly forces anyway.

Along with the intensified interest in guerrilla warfare since 1961 has come a procession of weird weapons proposals: the bow and arrow, the dart gun, and

especially the medieval crossbow.

"For some reason, people seem to think bows and arrows are a must for this type of warfare," says one puzzled officer at the Army's new Limited War Laboratory, where many new guerrilla warfare items are under development. Investigations so far haven't shown superior qualities for the bow and arrow, he indicates. And the logistic problem would still remain. But they may well come in handy for local forces unaccustomed to firearms.

While the conventional bow-fired arrow appears to be "out," its little cousin the *flechette* is definitely "in." This small steel dart, equipped with a vane or fluted shaft, forms the basis for one of the most exciting small arms developments in recent years, the Special Purpose Individual Weapon, or SPIW (pronounced "spew").

Now approaching a crucial milestone in its development, the SPIW may well become the standard weapon of future Special Forces and airborne troops. Capable of firing interchangeably either *flechets* at point targets or grenades for wider area coverage, the SPIW will have such prime advantages—especially for the counter-guerrilla fighter—as light weight, versatility of firepower, and improved hit capability.

### Little Arrows Are Light

The tiny projectiles have a terrific lethality potential. The exceptional lightness of the SPIW system is also a favorable factor of the *flechets* as opposed to conventional ammunition.

Unlike the conventional rifle grenade adapter, the grenade firing capability of the SPIW is instantaneous and completely interchangeable with the *flechette* portion of the weapon. This, along with bipod firing capability for sustained automatic fire, gives it the highly prized versatility.

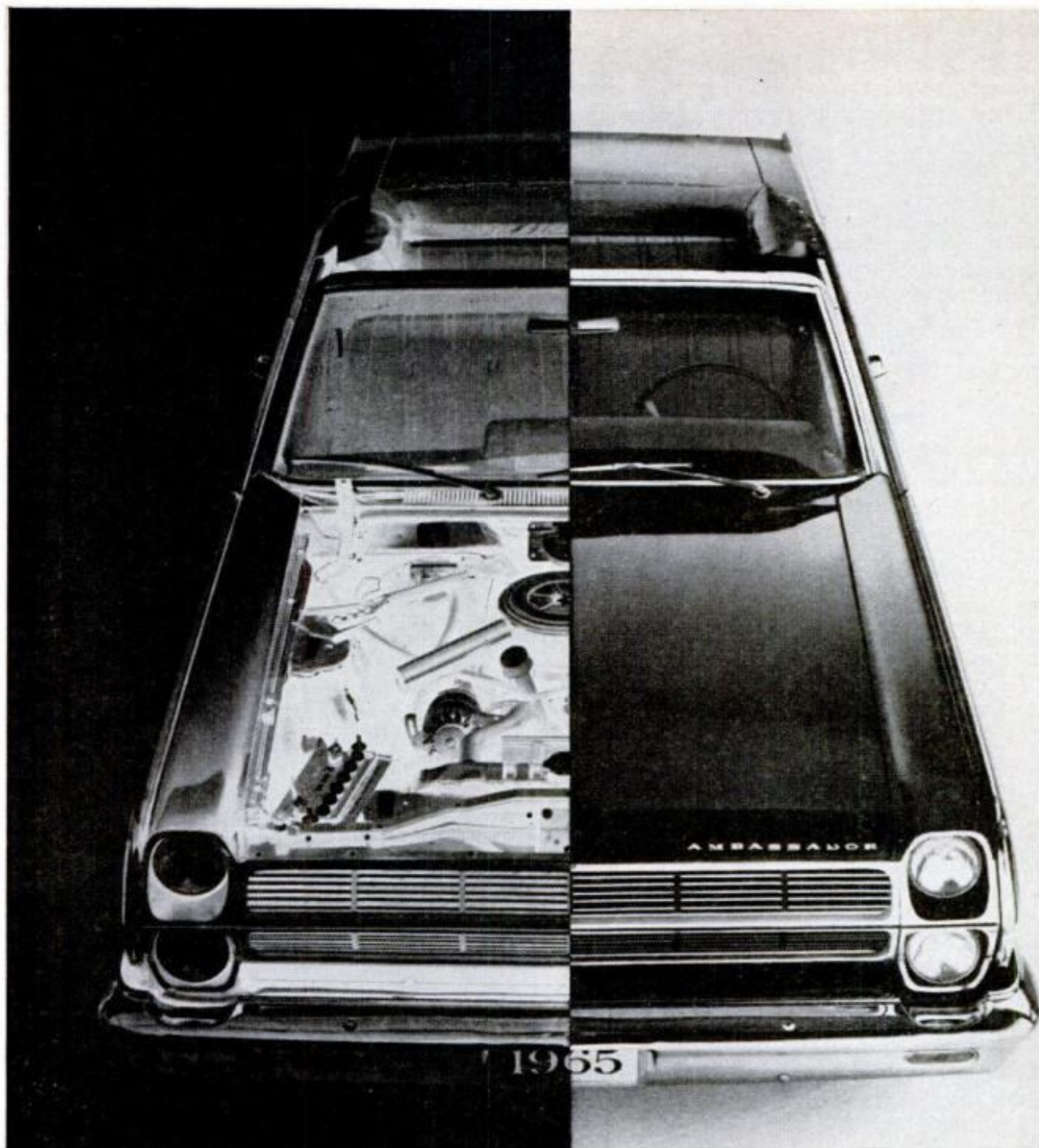
In the near future, the Army expects to choose one of the four different experimental versions developed by three commercial firms and one arsenal, and get on with full-scale development. This will be a giant step, when taken; SPIW is the only small-arms weapon the Army now has under actual development, although various proposed items are tested periodically.

The "duplex" rifle cartridge, a new development which significantly increases a soldier's ability to hit his target by firing two bullets simultaneously with each shot, should contribute in a big way to the effectiveness of guerrilla fighters, especially when it is adapted to the smaller hand weapons of the Special Forces.

The second bullet, which nestles into a cavity in the base of the first, does not

[\(Please turn to page 206\)](#)





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## Weapons for Hot Little Wars

(Continued from page 204)

follow exactly behind the first bullet when fired, but deviates slightly to increase the radius of the strike area.

The Pentagon's Advanced Research Projects Agency is also in the small arms research business, largely for use by friendly native forces. ARPA continues to sponsor exploratory work with the concept of subminiature rockets fired from a hand weapon, called variously Gyrojet, Micro-rocket, and antipersonnel subminiature rocket gun.

### Experts Not Happy

The concept has been demonstrated, but not yet to the satisfaction of most experts. Accuracy at ranges more than a dozen or so yards is a major problem. Instability of the tiny rockets is one factor; attempts at correction lead to complex devices which then defeat the original purpose—a cheap, hand-held rocket gun able to fire a large number of rounds. So don't look for this one to get out of the lab soon.

The same applies to that perennial will-o'-the-wisp, the "weapons kit" which will make up in the wink of an eye anything from a pistol to a light machine gun. An effective unit just isn't in the offing.

### Laser Needs Too Much Energy

As for the exotic laser, the beam of concentrated light sometimes touted as the prototype of a hand-held Buck Rogers type "heat ray," the current consensus is that the problem of providing the large amounts of energy necessary probably eliminates this item for the time being. Look for other coming laser applications, however, for such small-war missions as target ranging and night photo lighting.

The one-shot, throw-away flame projector is something else again. Prototype models for testing are now being provided by the Limited War Lab.

There is no bulky backpack-and-hose arrangement here, as in the conventional portable flamethrower. This is a true "fire-stick," with launch tube, propellant and combustible agent in one lightweight package. The agent ignites after being propelled a short distance in front of the operator, then travels many dozens of feet to its target. Work is also going on to try to increase the number of "shots" possible from the one launch tube.

The treetop jungle canopies for helicopter landings are also in the prototype test stage. The advocates of this idea, greeted with skepticism in some quarters, think it could signal a marked advance in use of choppers in densely wooded areas.

Now the whirlybirds either have to find clearings or the demolition boys have to blow up enough trees to create one. Both are time consuming and disruptive of the major objective, which is to offload troops and gear as close to the enemy as possible. If they can create their own treetop heliports at will, they can be used for staging areas, observation posts, listening stations, even for troop bivouac.

The core of the system is a perforated 16-foot-diameter matting of aluminum. This is lowered by the helicopter onto a crisscross of nylon nets. Testing is to be conducted soon in the southeastern United States.

### Treed for 24 Hours

The line-descent brake is an important adjunct to the treetop canopy. Originally developed for emergency use by a parachutist entangled in the trees, the lightweight device permits controlled descent by rope friction on a ladder-type series of hollow aluminum rungs. Including 150 feet of rope, the unit weighs about six pounds. Paratroopers entangled in dense tree growth have sometimes required as long as 24 hours to extricate themselves.

These are but a few of the items of equipment being fashioned in military and industry laboratories and workshops to try to provide this country with the kind of superiority at "the lower end of the spectrum" that it now possesses in strategic missiles and aircraft.

The Limited War Lab, for instance, has worked on leech repellants (lanolin added to a standard formula keeps the repellant on the skin much longer in wet climates); special high-frequency radios (the background interference in southeast Asia is 100 times greater than in such other dense areas as Panama); ration and survival kits tailored for hot, cold and dry climates; smoke grenade improvements; load-handling equipment for jungle areas; fuel pumps and filters to meet the special needs of helicopters in these areas; boats with ducted fan engines to buoy them up over obstructions; a rifle sight with built-in centering devices to speed the training of recruits; and numerous projects in a variety of fields that are still secret.

In view of the "balance of terror" being accomplished by nuclear weapons with respect to "big wars," it becomes increasingly possible that crucial future issues may well be decided by the success or failure of relatively small groups of fighting men in far-off jungles, deserts and mountains, engaged in "dirty little wars" that might be won or lost depending on the forethought that went into their equipment. ★ ★ ★

# A wood paneled room in a weekend?



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## Remote Wind Indicator

(Continued from page 154)

of the short side and drill a  $\frac{1}{4}$ -in. hole. After you have drilled the hole, round the end of the short side with a file or grinding wheel. Finally, insert a  $\frac{1}{4}$ -in. bolt to act as a shaft for the small ball bearing ( $\frac{1}{4}$ -in. I.D. and  $\frac{5}{8}$ -in. O.D.). Small washers placed between the bearing, arm and nut will hold the bearing in place. These should be small enough so that they won't extend beyond the inside race of the bearing.

The next step calls for fitting this assembly to the rotating shaft. Place the long side of the arm in the slot you have cut in the pipe, positioning it so that the outside edge of the bearing meets the copper segments of the stator as close to parallel as possible. Now, holding it in the slot with your hand, rotate the arm carefully to see that bearing is running properly and that it doesn't hit any bolt heads. When it is positioned so that it moves around the complete circle without obstruction, make a mark on the pipe for a hole that will intersect the metal strap and drill a hole through the pipe and arm for a  $\frac{3}{16}$ -in. bolt. When bolting the arm in the pipe, make sure that it isn't so tight that it binds the arm and prevents it from pivoting on the bolt.

The ball bearing on the rotor must make constant contact with the copper segments. To ensure this, first drill a  $\frac{1}{16}$ -in. hole in the rotor arm at the point where it makes the twist. Next, cut a  $\frac{1}{4} \times \frac{1}{2}$ -in. strip of copper and drill a  $\frac{1}{16}$ -in. hole in one end. Solder this strip to the rotating shaft as close as you can to the brass bushing which holds the plexiglass in position. Install a small coil spring with one end in the hole on the rotor and the other in the copper strap. This spring will draw the ball bearing up against the segments and insure positive contact.

Construction of the vane will depend on the design used. Designs such as a flying duck, sail boat or dog can be attached to a piece of  $\frac{3}{8}$ -in. pipe by cutting a slit in the pipe, inserting the base of the design and soldering it in place.

Whatever design you choose for the vane, make a paper pattern before you start cutting the sheet copper or galvanized sheet iron. Also, be sure to make the vane large enough. A sheet of metal about 12 x 15 in. is sufficient for this purpose. It can be cut with a tin-shears or a sabre saw.

Naturally, it's important that the rotor and vane point in the same direction. The simplest way to accomplish this is by placing the complete assembly in a vise. Use

a level to make sure that the long pipe shaft is in a horizontal position.

One end of the tee of the vane assembly is still open. Slip this over the  $\frac{3}{8}$ -in. pipe opposite the rotor-stator end. Because of gravity, this assembly will assume a position with the arrow pointing straight up. Now, turn the rotor until the bearing that contacts the copper segments on the plexiglass is also pointing straight up. With the arrow on one end and the rotor on the other end pointing straight up, solder the vane in place at the tee.

Only one more step remains to complete this phase of the assembly. Cut an 8 x 12-in. piece of galvanized sheet iron and inscribe a  $1\frac{1}{8}$ -in.-dia. circle exactly in the center of this sheet. Cut in from one edge of the sheet and cut out the circle in the center. By bending the sheet at the cut, you can slide it over the 1-in. copper pipe, where it can be soldered in place. It should be positioned about 24 in. from the vane end of the assembly. Before soldering it in place, determine the pitch of your roof and position the sheet at the same angle when soldering it to the pipe. Seal the entry cut with solder.

Install the unit as close to the peak of the roof as possible, locating the center of a 2-in.-dia. hole for the pipe  $2\frac{1}{4}$  in. from one of the roof rafters. Drill this hole from inside. Next, remove the stator-rotor assembly and insert the shaft through the hole in the roof, lifting the shingles so that you can slip the galvanized sheet under them. Then, while holding the assembly plumb, nail the galvanized sheet in place on the roof. To prevent leaks, spread caulking compound or tar over the sheet of metal and on the shingles when replacing them.

To secure the assembly in the attic, cut a 2 x 4 long enough to reach from a rafter on one slope of the roof to a rafter on the opposite slope about 30 in. below the peak and nail it in place. After plumbing the shaft with a carpenter's level, secure it to this length of 2 x 4 with a 1-in. pipe strap. You may have to shim a little to make plumb, but it is extremely important that the shaft be exactly vertical. Place another 1-in. pipe strap around the pipe on the roof rafter where it enters.

After the shaft is secured, reassemble the rotor and stator, making certain one of the segments of the stator is pointing to the north. Then tighten the stator to the shaft so that it will not move from this position.

The simplest method of installing the indicator panel is to mount it in a square cabinet with nine equal compartments, three in each direction. (Plans for such a cabinet appear on p. 154.) Mount a small

Christmas-tree "twinkle light" socket in each one of the eight outer compartments by drilling holes in the back panel just large enough to accept the sockets and gluing them in place.

To connect the panel to the stator, take one wire from each socket, scrape the insulation from the end, twist all eight ends together and solder. (These wires all go to a common source.) Connect the remaining wires from the sockets to a multiple-wire, color-coded cable leading to the segments on the stator mounted in the attic. One of the wires is attached to the supporting shaft of the assembly,

#### WIND INDICATOR MATERIALS LIST

- 1 pc. 1" i.d. rigid copper pipe, 5'
- 1 pc. 3/4" i.d. rigid copper pipe, 1'
- 1 pc. 3/8" i.d. rigid copper pipe, 6'
- 1 pc. 3/8" i.d. rigid copper pipe, 3'
- 1 pc. 3/8" x 3/8" copper coupling
- 1 pc. 1" x 1" threaded/sweat copper adapter
- 1 pc. 1" x 3/4" copper reducer-coupling
- 1 pc. 1 1/4" x 3/4" copper reducer-coupling
- 1 pc. 3/4" x 3/8" copper reducer-coupling
- 1 pc. 5/8" o.d. ball bearings, 1/4" i.d.
- 1 pc. 1 1/8" o.d. ball bearing, 1/2" i.d.
- 1 pc. Plexiglass disc, 5"-dia.
- 1 pc. 16-oz. (or 23-ga.) copper, 5" x 5"
- 2 pcs. 1" pipe straps
- 1 pc. 1-5/16" i.d. hard rubber or Bakelite washer, 1 7/8" o.d.
- 1 pc. 1" x 1 1/4" brass bushing
- 1 pc. 8" x 12" 28-ga. galvanized sheet metal
- 16 pcs. 1/8" x 3/4" bolts
- 1 pc. 1/8" x 3/8" x 8" strap brass (for arm)
- 1 pc. 10-conductor wire to run from stator to panel, length as needed
- 1 pc. Bell transformer, 110-v. to 10 v. or 15 v.
- 1 set Christmas-tree "twinkle" lights

which is actually the ground for the rotor. Eight of the wires are attached, one each to one of the two bolts in each of the eight copper segments. One each of the corresponding color-coded wires is attached to wires leading to sockets in the panel assembly. The cable can be run from the attic down through a wall to the panel.

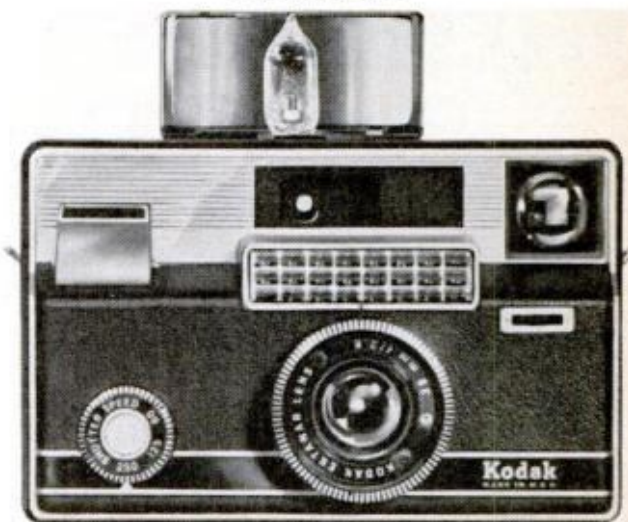
A 10- to 15-v. bell transformer in the basement provides the power. One of the low-voltage wires is connected to the eight wires soldered together in the panel. The other wire from the transformer is connected to the wire that carries the current to the shaft of the assembly. As the vane turns with the wind, the rotor makes contact with the different segments of the stator and completes the circuit to a corresponding light in the panel.

A flashed opal glass large enough to fit over the front of the panel is used to diffuse the light. On this you can place decal letters to identify the wind directions (These letters are available in various sizes at most stationery stores.)

As a safety precaution, be sure to ground the wind vane as you would a TV antenna. ★ ★ ★

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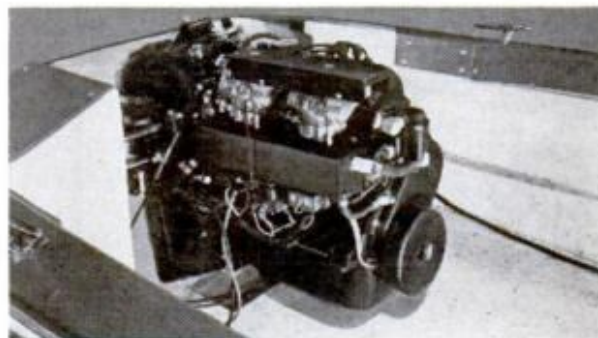
# BRAND NEW 60 hp MERCUISER STERN DRIVE



**THE ENGINE:** Up until now, there were three practical ways to power a small boat: an outboard engine, oars, or a sail. Inboard engines took too much room in the middle of the boat.

Now, a true "compact," MerCruiser 60 Stern Drive, makes it possible for you to enjoy the convenience, fuel economy and low maintenance of a 4-cycle inboard *without losing room in the boat*. Why? Because MerCruiser's compact 60 hp engine is mounted directly to the transom where it takes no more room than the motor well for an outboard.

Four-cycle marine engines have long been a favorite of many boaters and MerCruiser 60 is the newest design in light, compact 4-cycle power. It has a direct-drive alternator . . . no brushes to wear, no contacts to arc, and no regulator required. We eliminated all belts. Its direct-drive water pump is "out-board" and equipped with a telltale so you can tell at a glance that it's working properly. The ultimate in vibration isolation, new Dyna-Focal aircraft-type



mounts mean a new definition of silence . . . eliminate mounting rails and engine bed! MerCruiser's husky new engine and new drive unit counterbalance each other on the transom. Simple to install. All steering and control mechanisms are inside the boat.

MerCruiser 60 uses conventional 4-cycle fuel and oil. Fuel consumption is dependent on boat and load conditions but our test boats with MerCruiser 60 have been running 4½ to 5 gallons per hour at full throttle . . . that's from 25 to 36 miles an hour on 14 to 18 ft. boats. At cruising speed, the fuel consumption is as low as 3 gallons per hour.

as small as 14 ft.



**THE DRIVE UNIT:** Much of the new MerCruiser 60's performance comes from the inherent advantages of a stern drive: propeller thrust parallel to the plane of motion; adjustable tilt angles; and no angled prop shaft, strut, or rudder to cause drag. Much also is due to MerCruiser's smooth, one-piece castings, adequate gear reduction ratios, and exclusive Jet-Prop exhaust. The Jet-Prop reduces drag, improves engine breathing and buries noise and fumes far behind the boat. The MerCruiser 60 drive unit has an exclusive cable tilt mechanism that allows you to adjust the drive angle for shallow water running

or to raise the unit out of the water, entirely, for inspection or beaching.

Why don't you drop by your MerCruiser dealer's today, and take a stern attitude with him. He'll show you why more MerCruisers are sold than all other stern drives combined... 60, 110, 120, 150, 190, 225, and 310 hp gasoline; 60 hp diesel.

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**STERN DRIVE POWER PACKAGES**

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And what a really fine precision tool to own. It's drop-forged from special bit steel, heat treated full length, machined for accuracy and sharpness, highly polished, too. Two cutters supplied with each bit. Model No. 21 with  $\frac{5}{8}$ " to  $1\frac{3}{4}$ " boring range also available. Ideal for home handyman, professional woodworker, or farm. See your independent hardware dealer soon.



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## Our First Moon Scout

(Continued from page 130)

and do a score of other jobs—this is a tremendous task. Then add three complications: The scientific payload cannot exceed 65 lbs., everything that Surveyor learns must be relayed a quarter of a million miles to earth, and the moon craft must be able to “live” in a 500-degree temperature range.

All this seems like an impossible assignment and yet, by combining pure science and down-to-earth engineering, the Hughes' staff has reached solutions that appear simple, once they are explained.

### Built-in Temperature

How, for instance, can the electronics equipment be kept at between 0 and 125 degrees F. when the outside temperature climbs to 260 degrees F. during the day, and then plummets to minus 240 degrees at night?

“Actually, battery energy will maintain a comfortable inside temperature at night,” explains Sheldon C. Shallon, Hughes' chief scientist for Surveyor, “and thus the real problem is daytime heat dissipation.

“So, for once, the electronics ‘black boxes’ are pure white, for maximum reflection of the sun's heat. Inside the white skin there's a super-insulation of 75 layers of aluminized Mylar, crinkled so that one sheet touches the next only here and there.

“If the inside temperature still climbs too high, bimetallic switch buttons will click together and provide a metal heat channel to a glass window that has a mirrorlike one-way coating. The window admits very little outside heat, yet can radiate a great deal of interior heat.”

Does the system work? The electronics white boxes have been “baked” under a solar simulator (heat lamps) in a vacuum chamber. And they have been chilled with liquid nitrogen until their temperature was that of the utter cold of the lunar night. The system works perfectly.

### Can Break Concrete

Again, how would you design a device to “determine the mechanical characteristics of the lunar surface?”

On Surveyor the answer is simple and direct. The “soil sampler” is merely an instrumented pantograph arm that has a reach of four feet, extended, and that swings left or right on command. Spring-loaded, it can whack at the surface like a pick (it's strong enough to break half an inch of concrete). It can dig a hole 20 inches deep, can claw a furrow by retracting itself and meanwhile measure the drawbar pull.



These operations will be performed upon radio command from technicians stationed in Jet Propulsion Lab's operations room in Pasadena, who will watch the results on television. If small rocks happen to be in the way, the mechanical arm can push them to one side and then attack the material below.

To analyze the composition of surface materials, a beam of alpha particles from radioactive curium is used. The "scattering" of the alpha particles provides a rough measurement of the elements that are present, such as calcium or iron. The device can distinguish between meteoritic and igneous rocks.

A seismograph bolted to the spacecraft's frame not only will detect moonquakes, if any, it will also determine if there is much expansion and contraction of the surface because of temperature changes and will even pick up the impact of meteorites hitting at a distance.

### Cameras' "Eyeball" Moves

One of the most sophisticated portions of the lunar lab is its television section and, in particular, a pair of "survey" TV cameras. They can look almost all of the way around the horizon and take stereo picture pairs of about a third of the adjacent area. The cameras are actually stationary: they peer into pan-and-tilt mirrors in their hoods. It is the hood and mirror "eyeball" that moves, guided by tiny motors.

Obedient radio commands, the cameras will change from close-up wide angle to semitelescopic, will change lens apertures from f/4 to f/22 and will even change filters to permit construction of true color photos on earth. By stereo-ranging, distances to features such as cliffs and craters will be measured so accurately that topographic maps can be prepared.

### Blood Will Boil

A century or so ago, "civilized" nations used to deport some of their worst criminals to awesome parts of the earth where the heat, insects and disease soon killed them off. Today, paradoxically, we are planning to dispatch three of the fittest, bravest Americans to a hell far worse. On the moon the daytime temperature is above the boiling point of blood. At night, without protection, you would freeze in a microsecond. There is no air, no water.

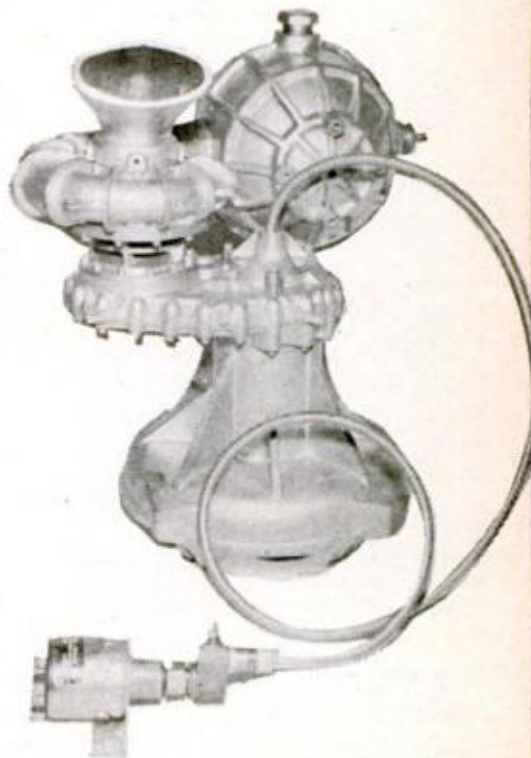
To fire men out into space toward the moon, land them there and then bring them safely back to earth, will be the most fantastic undertaking yet attempted by mankind.

Surveyor, the "mechanical American," will lead the way. ★ ★ ★

FEBRUARY 1965

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This is the SOVEREIGN. A 19-ft. news-making tiger of a boat. It's ARMOR-HULL, new "sandwich" hull construction technique. To make it, Lone Star used aluminum for the outer hull, FOAM-PAC for the center, fiberglass for the inner hull. Then, bonded them together as one material with unrivaled qualities of strength, flotation and impenetrability. There are several reasons why Lone Star is the first company to conceive and create ARMOR-HULL. One, FOAM-PAC. Lone Star developed this high-density polyurethane foam, with 7 times the strength of ordinary foam, three years ago at a cost exceeding \$100,000. Two, production skill. Lone Star's two decades of boat building experience make it possible to originate a new hull . . . load it with equipment . . . price it competitively. Result — the SOVEREIGN. Impervious to leaks. Next to impossible to sink. Practically rivet-free so it goes much faster . . . in well-insulated quiet. Check smart-looking outboard and I/O versions at your Lone Star dealer's. Or write today for free color catalog on the "Fun-makers", Lone Star's complete line of aluminum and fiberglass fishing boats, runabouts, cruisers and boat trailers.

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## Laughing Tables

(Continued from page 122)

It wasn't quite *that* simple, of course. If you talk to Parkwood's plant manager, Hollis French, he'll fill you in on a few of the problems as he walks you around the factory behind a four-by-eight-foot laminate containing a pair of table tops.

"When the Fred Waring request came," says French, "we were intrigued. We can't take on such limited production projects as a rule, because they'd tie up the plant. But this one had national appeal, and it posed some tricky problems. You don't just slip a bunch of cartoons drawn on any kind of art paper, with all kinds of paint, into a laminate. Many papers would shed the plastic, and some pigments are incompatible with the resins we use.

"Since we'd pioneered development of quality woodgrain reproduction — using four colors in a rotogravure process—we knew the headaches involved."

### Blistered Funnies

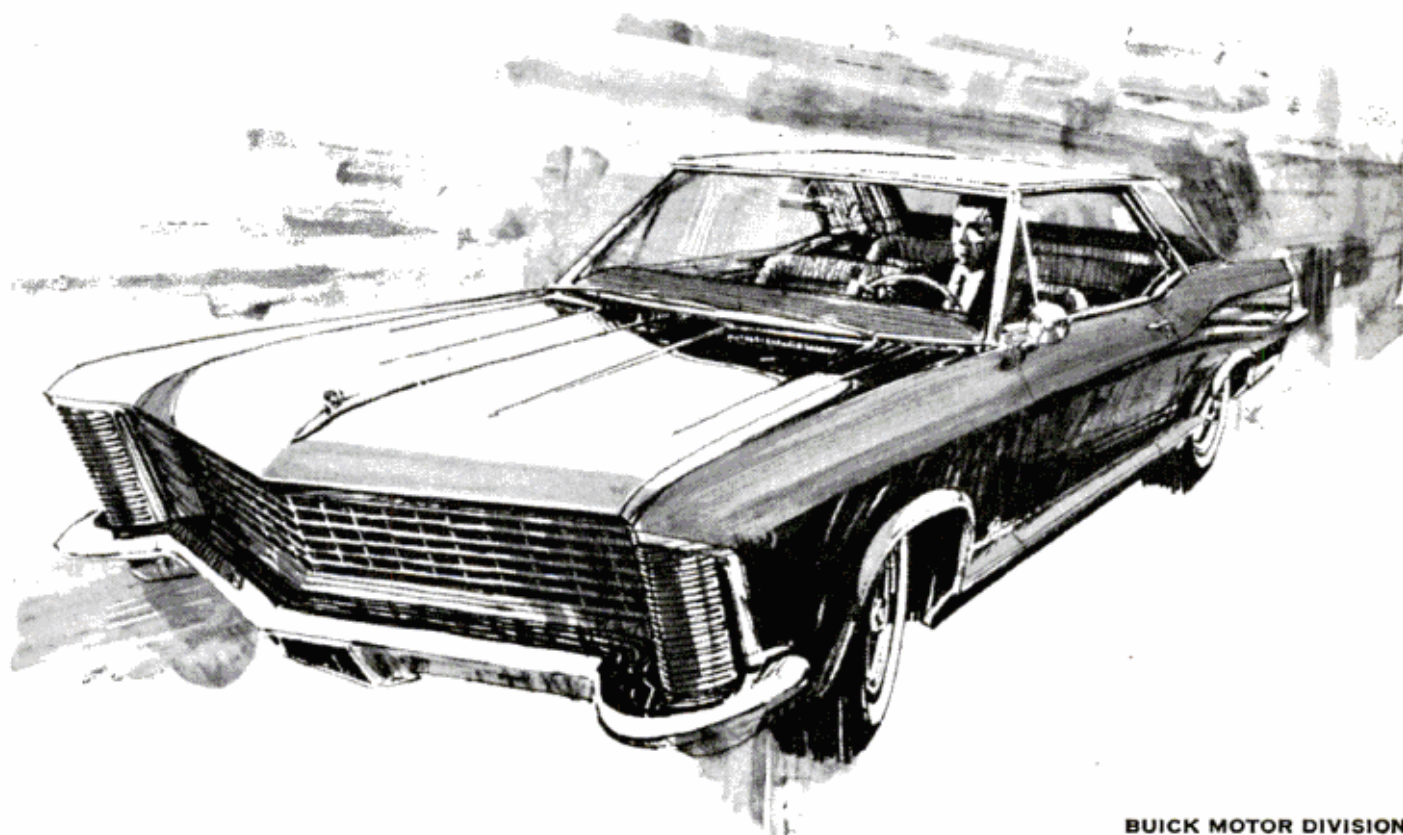
First of all, the cartoonists had to re-draw everything on special resin-treated paper, using special inks. "Even so, we had troubles," recalls French. "Certain color inks refused to soak up the top protective layer of melamine resin, and raised blisters on the finished sheet."

Today, however, the bugs have all been worked out. Every few months, a batch of table top cartoons sneaks through the line at Parkwood—along with a regular run. Like the printed woodgrain reproduction, the cartoons constitute the "design sheet," topping a pile of seven or eight layers of brown Kraft core stock impregnated with phenolic resin. Over it, last of all, goes a special rayon base paper impregnated with melamine resin.

This sandwich—about two inches thick—is stacked between metal plates, and slides into a press that clamps down on it to the tune of 1000 pounds per square inch at 280° F. When "cooked," it comes out looking just like the slick material that goes on your kitchen counter—about 1/16th of an inch thick. The top sheet has melted into a hard, indestructible transparent surface protecting the colorful cartoon design sheet beneath it.

Thus "immortalized," the Shawnee cartoons are shipped to Cataaugus, N.Y., where they are bonded to a plywood table-top fitted with a Waring-designed edge molding. From there they go to Bill Flick's carpenter shop at the Shawnee Inn.

"I just bolt them to iron pedestals, shim them up and set them out in the place reserved for them in the Cartoon Room," he explains. ★★★



BUICK MOTOR DIVISION

## The new Riviera Gran Sport or, How we put muscles on the Riviera's muscles

If you start messing around with a fairly normal looking Riviera someday and it suddenly commences making loud noises and leaves you fast sinking astern, that we're happy to say, was no normal Riviera.

What we've gone and put together is a land version of the wartime Q boat, i.e., a merchantman with hidden guns.

What's this? you say. Buick rattling its sabre and uttering warlike cries? They're supposed to be in the business of making nice, big, reliable, well-engineered, soft-riding automobiles.

We still are. But we've opened a new branch office.

Which brings us back to the Riviera Gran Sport. It packs what might be termed pretty heavy artillery: 2-4BBL, 425 cubic inches, 360 horsepower and 465 lb-ft of torque. And it plasters all this down on the road via a limited-slip differential with 3.42:1 gearing.

The steering is power assisted, with an extra-quick 15:1 gear ratio available for it. The brakes, also power assisted, are massive 12-inch finned aluminum drums up front, 12-inch finned cast iron on the back. Specify the heavy-duty set of springs, shocks, and stabilizer bar and you have the complete Q boat.

Next month we're doing something loud and strong with the Skylark. Keep watching this space.

---

**More Riviera Gran Sport Standard Equipment:** *Automatic transmission—3-speed torque converter; 2¼" low-restriction dual exhausts; 8.45 x 15 tires on 6JK rims; bucket seats; console; padded dash; tilting steering wheel; full carpeting; 2-speed wipers; washers; map light; back-up lights; trunk light; smoking sets, front and rear; electric clock; speed warning buzzer; trip mileage indicator; things like that.*

## Is Aviation Going Automatic?

(Continued from page 113)

beacons in the middle of the ocean."

True, some long-range radio navigation aids, such as the American Loran and the British Decca and Consol, do stretch over the ocean, Granger explains. But they depend on long-distance radio reception, which gets temperamental at times. "Ultimately we had to rely on celestial navigation—taking a fix on the stars, the way mariners have been doing for centuries."

### Stars Okay for Slowpokes

"It worked pretty well for slowpoke piston planes," Granger remembers. "They give you a relatively stable point from which to take your stellar readings. Then you'd sit down and plot your position. For a three-star fix, that took about 12 or 13 minutes, when a new reading was needed."

At jet speeds, the navigator's job gets more hectic. If you are flying 600 m.p.h., you are already 150 miles beyond the point at which you took the reading before you figured your fix. And you might be more than 100 miles off course. You'd be zig-zagging all the way across the ocean, correcting your course after each fix.

TWA was the first to solve this problem with Doppler navigation—a self-contained electronic system that largely eliminates the need for celestial readings or ground-based radio aids.

Captain Granger, who still likes to trade his executive chair for a pilot's seat whenever he gets a chance, demonstrated Doppler navigation for me under actual flight conditions. Our course—a vast arc swinging around part of the globe from Kennedy Airport, New York, to Orly Aerodrome, Paris—was broken into five segments. Before takeoff, Granger reached up to the overhead control panel in the cockpit of the huge Boeing 707 and dialed instructions into the Doppler system's course computer. "Compass heading 086 degrees; 1000 miles to go." That was the first leg of the trip. It would take us to the Great Banks off Newfoundland.

### Over-Water Flight

When the plane had pushed itself to cruising altitude—34,000 feet—Granger cut in the Doppler, linking it directly to the autopilot. Now the Doppler was in control of the ship. I watched the computer read out instruments, giving us continuous readings of groundspeed, heading, drift, and miles-to-go until the next course change. One indicator automatically registered deviations from the preset course. Sometimes it flipped slightly off center,

warning us that we were about two miles off course. But then it came right back to zero, as the autopilot moved in and nudged our nose back on the correct track.

"That's sidewind," said Granger. "Occasionally we get a gust that blows us south. But the Doppler puts us right back on course. Without the Doppler we wouldn't even know the effect of a wind change until we took the next fix. By that time we'd be a long way off. But the Doppler monitors the course continually and makes instant corrects for drift. This way we don't zigzag."

Meanwhile the miles-to-go dial was spinning down toward zero. Ten miles before the scheduled course change, the Doppler flashed a warning light. Now we were to veer eastward over the open sea. Granger reached up and set the second leg of our course into the machine: "Compass heading 103 degrees, 520 miles to go."

When the first leg was completed, the Doppler computer automatically switched over to the second course setting, banking the plane into an imperceptible turn.

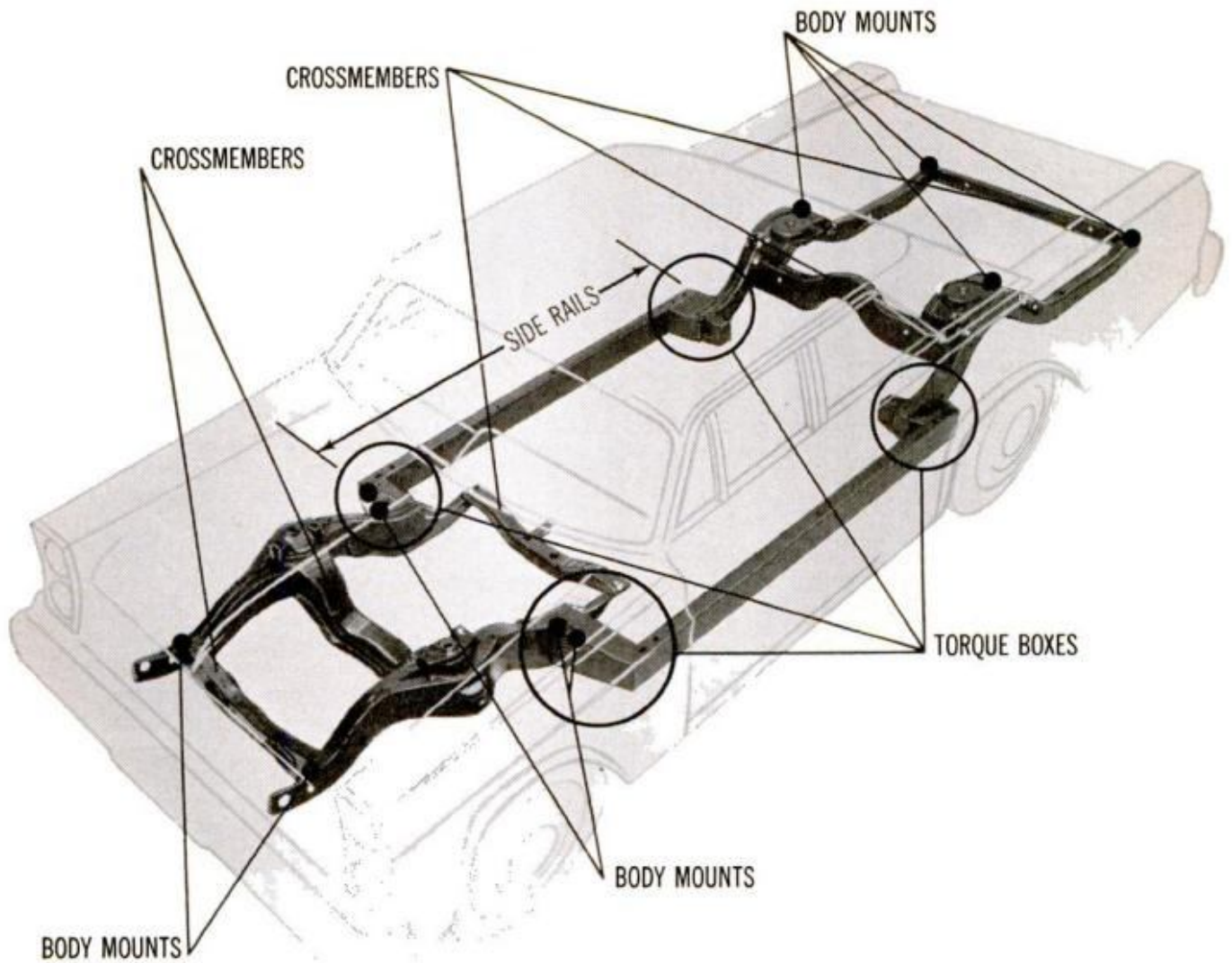
"If for any reason it hadn't switched to the new course, a special warning light would have lit up," explains Granger. And, he adds with a grin, "The reason I had them put in that warning light is that the Doppler has never yet failed to make a scheduled course change. Something that reliable makes you overconfident."

### Sophisticated Radar

In essence, Doppler is a sophisticated kind of radar, which senses the frequency shift in a radar beam after it is reflected from the ground or ocean surface. Four beams are sent out from the aircraft at forward, rearward, and sideways angles. If the plane moves toward the place where a beam hits the ground, the returning echo will be higher in frequency than the beam sent out. If the plane moves away from the point of reflection, the frequency of the returning echo is lower (because of the so-called Doppler shift, named after the Austrian scientist who discovered this principle, as applied to sound waves, more than 100 years ago). The frequency shifts are exactly proportional to the plane's speed toward or from the four beams' reflection points on the ground. From these data, a small computer calculates the speed and direction of the plane's motion with respect to the ground, monitors its flight path, and keeps it on course.

Course adherence is so accurate with Doppler that on a 3000-mile overwater flight, planes are rarely more than two miles off their charted track. This may allow the airlines to pack more planes into

(Please turn to page 218)



## Ford Motor Company's new road-tuned "Ring of Steel" frame reduces rough rides to a memory!

A Ford or Mercury frame is a road-tuned "Ring of Steel," an advanced design scientifically developed in our labs and solidly proved on our test tracks. It is a totally new way of combining torque boxes (front and rear), full length deep-box side rails, ladder-type crossmembers, and low-resiliency body mounts.

The four flexible torque boxes absorb shocks. The butyl rubber body mounts isolate the body from the frame—further diminishing vibrations and harshness. And the frame itself, in the shape of rugged side rails and crossmembers of steel, encircles the passenger compartment. The effects of jolts and jounces, road noise and surface flaws never reach the body—they're tuned out by the frame. You and your passengers sit within a road-tuned ring of steel. The ride is smoother, softer, surer all the way. Try a revelation ride in a new Ford or Mercury first chance you get.

The smoother ride for '65 comes from . . .

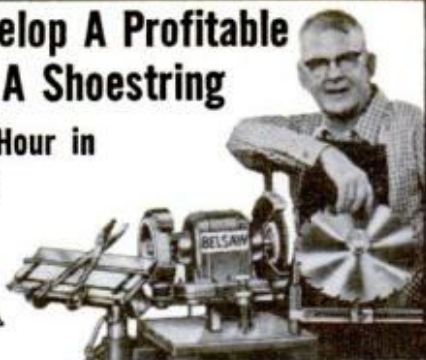


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## Is Aviation Going Automatic?

(Continued from page 216)

a given airspace without sacrificing safety.

For all its merits, Doppler still has some drawbacks. It gets its heading information from the plane's compass, and airborne compasses sometimes get slightly erratic. For this reason the Doppler must be recalibrated at the outset of each trip. So you need some other navigation method—celestial or Loran—to check the Doppler. Besides, the Doppler works best over choppy water. If the sea is very calm, the radar beams glance off the smooth surface at an angle (as from a mirror) and only a tiny fraction of the beam's energy bounces back to the plane. Calm spots in the ocean can cause the Doppler to conk out momentarily and lose count of the plane's mileage, though it automatically gives warning whenever this happens.

To get around these drawbacks, Sperry Gyroscope Company has developed an even more advanced navigation system that takes its cue from the inertial guidance used in military missiles. Pan American World Airways is now installing this inertial system in 55 of its Boeing 707 jets.

### Inertial Guidance for SSTs

Basically, inertial guidance provides the pilot with the same data as Doppler but derives the information in a different way. Instead of measuring radar reflections from ground or sea, the self-contained inertial-guidance system uses gyros to sense all changes in aircraft speed and direction. A computer tallies up all these changes along the entire trip and converts them into readings of position, speed and drift.

In operation, inertial guidance is even simpler than Doppler. Instead of having to set his course and distance into the computer, the pilot simply dials the geographic coordinates of his starting point and destination into the control panel. The computer figures out the course and distance.

Because of its high accuracy and total independence of any outside reference point, inertial guidance will probably be the standard navigation system when tomorrow's SSTs burn up the sky on their 2½-hour hops to Europe.

When you're pushing Mach 3, even the slightest navigation error mounts up to an enormous distance in a few minutes. A plane going astray at 2000 m.p.h. may soon find itself in serious trouble—running out of fuel or crossing into neighboring traffic lanes. But electronic navigation will help keep the monstrous speed demons on a tight leash, and electronic landing systems will help bring them safely down to earth. ★ ★ ★

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## Silencing Squeaks in Hardwood

(Continued from page 177)

"no" unless you want to start ripping out floorboards and installing a new floor.

"How about all those 'wonder' fillers," you might query, "Isn't there one that'll do the job?"

Here's what the Forest Products Laboratory of the U. S. Department of Agriculture has to say on this:

"There is no satisfactory way to eliminate such cracks short of taking up the floor and relaying it. If the cracks are filled with a soft putty or crack filler in the winter, some of the filler may be squeezed out during the following summer to be tracked over the floor. If a wood filler is used, the wood may be further compressed during the summer. In either event, the cracks will open again during the next winter and may become worse than before filler was applied." So when cracks develop, your best bet is to learn to live with them.

You *don't* have to live with a floor that's spotted with stains, gouges, splits or rot, however. You can patch such areas with new flooring. The job isn't hard (several of the steps are shown on page 177).

1. Measure off the damaged area and draw a line above and below it, at right angles to the side joints. If possible make *one* limit line the end of the existing board, but don't make your patch shorter than 10 inches, or it'll look like a patch.

2. With a large bit, drill a hole in each corner of the damaged section, close to the limit lines.

3. Use a sharp chisel to tap cuts across the strip, on the lines at each end, between the holes. Then split out the marred board, end to end, with the grain. Be careful not to damage the tongue and groove of adjoining pieces.

4. Cut a square-end piece of new flooring to the length of the finished hole. Naturally, if your floor is oak, you use a piece of oak—if maple, use maple. In order to sink this piece into place, you'll have to trim off the bottom flange of its groove, to clear the tongue of the adjoining piece.

5. Insert the tongue of the patch-piece into the groove of its neighbor and press it down carefully. Seat it firmly by tapping with a hammer on a scrap block.

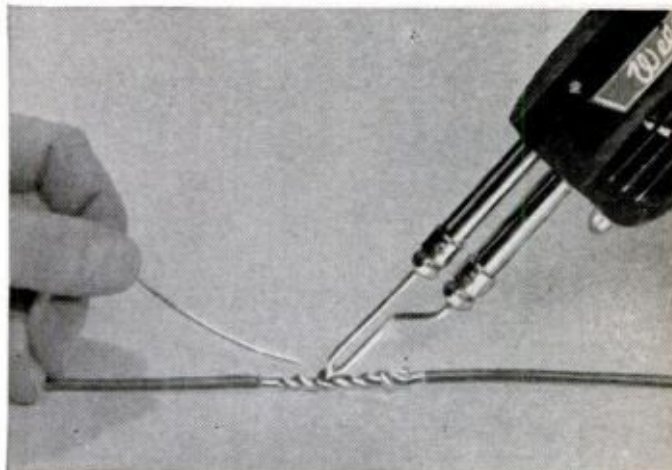
6. Nail each corner through pilot holes drilled slightly smaller than the finishing nails. Countersink the heads.

7. If the replacement piece is slightly raised above adjacent boards, plane or sand it down flush to the floor.

8. You can now match the patch to the color of the rest of the floor with stain, or crayon rubbed in with alcohol. ★★★

FEBRUARY 1965

## SOLDERING TIPS FOR ELECTRICAL PROJECTS



### HEAT WIRES NOT THE SOLDER

Wires or leads will then become hot enough to melt the solder and it will flow into the joint. Never apply heat directly to the solder.



### USE PROFESSIONAL EQUIPMENT

Virtually all radio and TV servicemen use Weller Dual Heat Soldering Guns. A Weller Expert Soldering Kit includes everything you need for strong electrical connections.

A Weller Dual Heat Gun is indispensable in electrical soldering. Heat and spotlight come on instantly when trigger is pulled. 2 trigger positions let you switch instantly to low 100-watt or high 140-watt heat. Low heat prevents damage to components and prolongs tip life. High heat is ready when you need it.

Kit includes gun in plastic utility case, 3 tips, tip wrench, flux brush, soldering aid and solder. Model 8200PK \$8.95. Weller Electric Corp., Easton, Pa.

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## LEE OIL, AIR & FUEL FILTERS

Available wherever you go for your car needs.  
Lee Filter Corporation, Edison, New Jersey

## Rebinding Damaged Books

(Continued from page 161)

which can be wiped up with a damp cloth.

**STEP 18.** Return the body of the book carefully to the case. Place waxed paper or foil between the boardpapers and the boards and wrap another sheet around the book. Insert in the grooving jaws of the press and tighten the wingnuts. Tear the foil away from the back of the book and pick out and shape the corners of the cloth with a pointed folder or stick. Leave the book in the press overnight.

**STEP 19.** Remove the book from the press and separate the case from the body. If the case is stuck along the edges of the back so that the body can't be freed, don't



**REPAIRING A TORN PAGE.** Lay a piece of foil or waxed paper under the torn page and top it with a piece of cleansing tissue. Using a toothpick, apply library paste to the *edge of the tear only*. Bring the torn edges together and rub with the finger. Lay on a piece of cleansing tissue, topped with foil. Close the book and press overnight. Remove foil and tear away cleansing tissues. Clean off adhering paper fibers with an eraser or razor blade.

worry about it. The turn-in is trimmed only on the boards. (Don't ever try to trim it across the spine, or you'll cut through the cloth and spoil the case.) Mark the turn-in  $\frac{3}{8}$  in. wide around the open edges of each board and trim out with a sharp knife and straightedge. Pull out the excess cloth and discard it.

**STEP 20.** Place newspaper under the boardpaper to protect the book and coat the face of the boardpaper with thin glue. Glue the super tab down to the boardpaper, but keep glue out of the groove.

(Please turn to page 222)



Model  
65



*Always have fresh hot batteries  
when you need them.*

The Everlite is the only battery charger that will recharge all types of dry cell batteries up to 12 volts including flashlight (all sizes), lantern, hot-shot, telephone, ni-cad, mercury, hearing aid, radio, tape recorder, toys and camera batteries. The Everlite is so powerful (charges 3 times faster) that with the addition of the model 66 kit it can boost auto batteries to assure fast starts on cold mornings.

The Everlite is practically non-breakable, simple and foolproof—any child can use it with absolute safety. Plugs into any 115v. AC outlet. Can't overcharge, can't burn out, guaranteed for 1 full year.

## Don't Buy Batteries Save \$—Recharge Them!

- \$5.95** • Charges 6 batteries at once
- factory price • Charges all types of batteries
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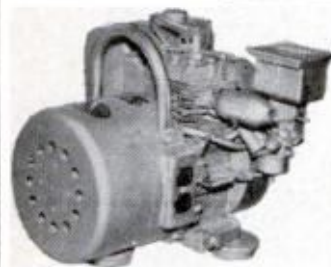
You will save real money by using the Everlite battery charger plus the convenience of always having fresh batteries when you need them. You'd have to pay \$17.85 for competitive models including all the attachments necessary to even approach Everlite performance—and then you still wouldn't have the power or ability to charge 6 batteries at one time.

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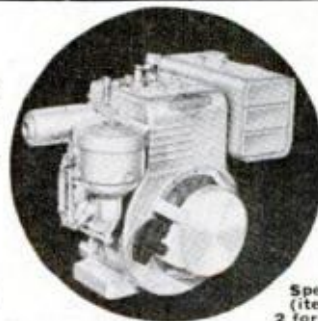
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**5 3/4 hp.**

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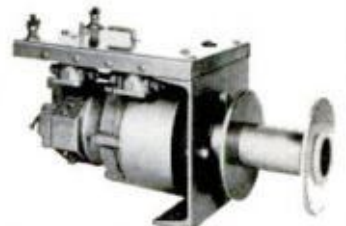
Briggs & Stratton 5 3/4 hp, Mdl. 143302. Recoil start. Std. 1" shaft w. keyway, and adjustable governor—a rugged big engine ready to tackle any job. Regular price \$92.60

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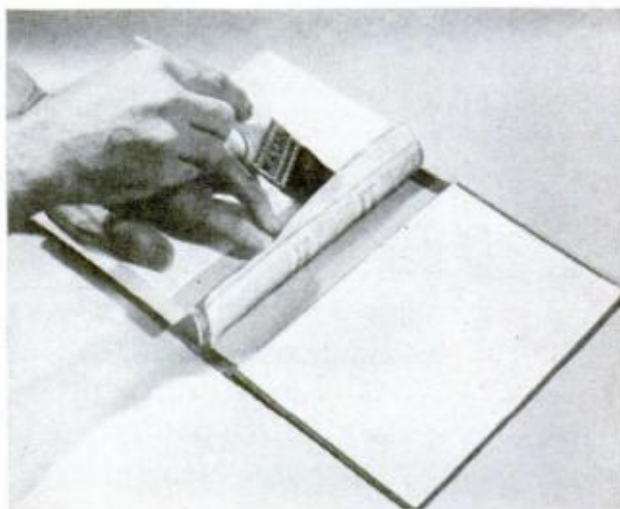
## Rebinding Damaged Books

(Continued from page 220)

Close the cover on boardpaper, then open and rub the boardpaper down with your fingers. Withdraw the newspaper, replace it with waxed paper or foil and close the cover, then glue the second boardpaper.

The book is now ready for a final pressing. Be sure to have waxed paper or foil between both boards and the book to prevent moisture from soaking through. Wrap waxed paper around the book and place it in the grooving jaws of press.

The title can be handlettered, typed, or printed if a small handpress is available,



**REPAIRING A TORN HINGE.** Where one or both boards are pulled away from the body of the book, cut the board free from the body of the book and lay it back. Then glue a strip of super to the spine (with flexible glue) covering its full width, plus about 3/4 in. to form the new hinge. Glue a strip of newspaper backing over the super. Cut a strip of Kraft paper 1 1/4 in. wide and as long as the page. Fold over 1/4 in. along one edge, paste this to the flyleaf and rub it down. When dry, apply paste or hard hide glue to the strip, as shown in the photo, fold the super over it and rub down. Close the board on the book with waxed paper under the Kraft strip and press between the grooving jaws for 24 hrs.

on a piece of colored artpaper. Glue the title to the back of the book and leave book in press at least 24 hrs.

To avoid breaking the back when the rebound book is opened, open it this way: Stand book on spine and let covers fall open. Open the book a few sheets at a time, a few at front, and rub them down in the groove; a few at the end, and rub them down. Continue thus until the middle of the book is reached. ★ ★ ★



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Why does Ford's optional automatic transmission give you three speeds when our major competition continues to offer only two speeds for just about the same price?

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actually saves you money on gas. That's because, with three gear ratios to call on, your engine is more efficient in every speed range. With engine speeds kept down, the Ford is smoother, quieter, more economical.

Drive this new 3-speed automatic. It's available on every 1965 Ford car—optional on Falcons, Mustangs, and Fairlanes . . . standard equipment on Ford Galaxie XL and LTD models, and on Thunderbird. You'll notice a measurable difference in smoothness, acceleration, response. And that's what a Ford is all about.

*Best year yet to go Ford!  
Test Drive  
Total Performance '65*

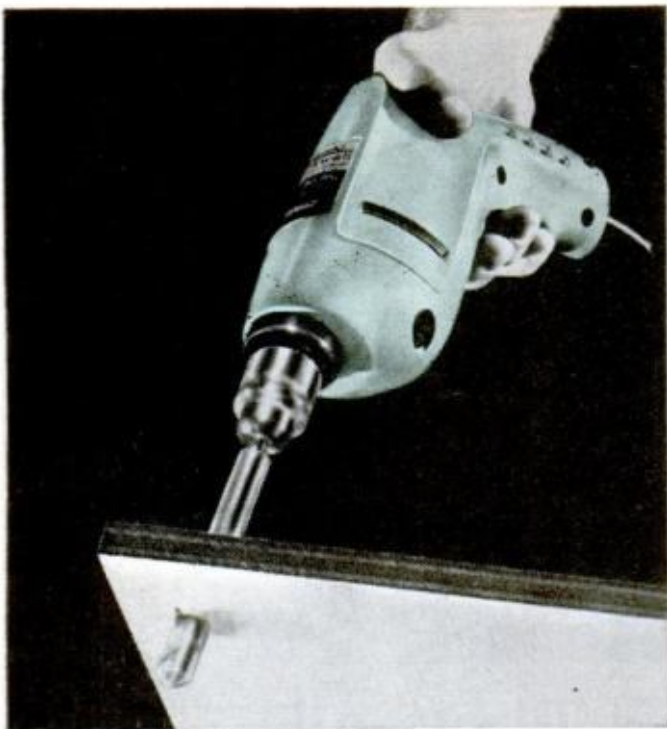
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**Rockwell**  
MANUFACTURING COMPANY

## Engine Analyzers

(Continued from page 183)

been filed as mentioned before so they have sharp corners. Round corners could give a "bad" indication, even with a plug that's in good condition.

- Make sure the plug insulator is clean and dry.

- Check the operation of a *new* spark plug, gapped the same as yours, in the tester first. Note the pressure at which the plug no longer fires.

- Now, check the pressure at which your reconditioned plug no longer fires. If the difference between the two does not exceed 30 percent, the reconditioned plug is suitable for reuse.

There's one other aspect of this testing procedure you should be aware of. Many plugs when checked in a pressure-type tester are condemned because of voltage flashover—that is, sparking from the plug terminal down the insulator, to ground on the shell. Flashover doesn't indicate a faulty plug. As a matter of fact, it proves the plug insulator's in good condition and signifies that the plug has no cracks or pinholes that could cause misfire. The only time flashover means trouble is when it's occurring through a *visible* crack in the insulator. And you probably would have spotted this crack before now and discarded the plug.

Furthermore, don't be concerned by "corona"—a glow that sometimes appears above the shell around the base of the insulator, especially if you operate the tester in a dark corner. It's caused by electrical stress in the air around the insulator, and is not harmful to plug operation.

When replacing discarded plugs, make sure you get ones of the correct heat range. These are not always the ones spelled out in the specifications for your engine, since they vary with driving conditions. However, the plug recommended for your engine is a good place to start. If you experience trouble with these, as pointed out in the chart, then you can switch to a hotter or colder type.

Plug heat range refers to the ability of a plug to transfer its heat from the firing tip to the cooling system. Plugs might have identical electrode configurations and be of the same size, but could be different in that they transfer heat at a slower or faster rate. This rate of transfer is controlled by the distance the heat must travel to reach the cooling agent, as shown in the drawing on page 183.

"Cold" plugs have relatively short insulator noses and transfer heat rapidly. These are generally recommended if a

car's normally driven under heavy duty and/or continuous high-speed conditions.

"Hot" plugs have longer insulator noses and transfer heat more slowly. By running hotter they burn off combustion deposits that might tend to foul the plugs during prolonged idle and low-speed driving. Keep in mind that a "hot" plug does not produce a hotter spark than a cold plug.

**Installing Plugs.** There's a definite science to installing spark plugs in modern automobile engines, say engineers at AC Spark Plug. Careless installation can cause a plug to overheat, strip the threads of the plug or cylinder hole, break the insulator or damage the shell.

Here's the right way to do it:

1. Make sure cylinder head threads and plug seats are clean and free of dirt and deposits that could interfere with proper seating. Cylinder head threads should be cleaned with a greased thread-chaser of the correct size. Clean plug threads with a wire hand brush, but be careful not to hit the electrodes or insulator tip.

2. Always check the gap setting, even of new plugs. The same type plug may fit a dozen different cars, so factory gap settings will not be right for all cars.

3. Always install new gaskets (except with plugs that don't require any gaskets). Screw the gasket up on to the plug threads finger-tight.

4. If possible, use a torque wrench to tighten the plugs. Suggested torque values:

Spark Plug Thread	Cast Iron Heads	Aluminum Heads
10 mm.	12 lbs. feet	10 lbs. feet
14 mm.	25 lbs. feet	22 lbs. feet
18 mm.	30 lbs. feet	25 lbs. feet
7/8 mm.	35 lbs. feet	30 lbs. feet
18 mm. taper seat	17 lbs. feet	_____

5. If a torque wrench isn't available, screw the plug into the cylinder finger-tight. Then tighten an additional 1/2 to 3/4 of a turn with a socket wrench.

6. Check the condition of spark plug wires and boots. Dried-out or cracked wires and bad boots could lead to a plug failure. They should be replaced. ★★★

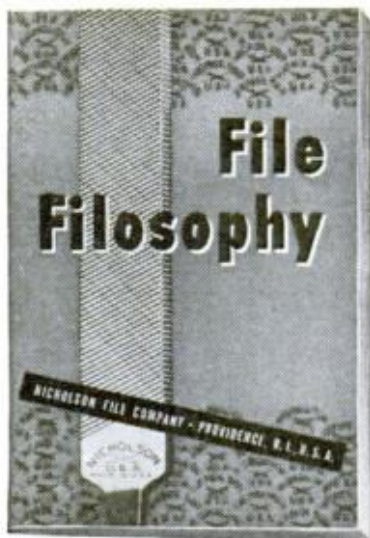
**The Air Force** is trying to find out how risky it is for a pilot to take an aspirin or a common cold remedy before flying. The School of Aerospace Medicine salvaged a scrapped B-47 trainer and will use it in the research. The subject will fly a simulated mission as is, then take medicines and fly it again. Medics will check his reaction times, judgment, etc.



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## Guide to Shortwave Receivers

(Continued from page 120)

signal you are trying to receive.

**Beat-frequency oscillator (BFO).** Most shortwave radios have this oscillator which is triggered by code signals you may want to tune in. The BFO keeps the pitch of code signals you receive constant. But receivers that have a BFO should include a variable pitch control so you can select both the most pleasing tone and one which can be most readily distinguished from background noise.

**Preselector.** Only better receivers include this extra tunable r.f. amplifier in front of the other receiver circuits. It helps bring in weak, hard-to-hear stations. To check its effectiveness, tune to a weak station on a set *without* a preselector and compare reception of the same station on a set *with* a preselector.

**Variable selectivity** of the i.f. (intermediate frequency) circuits is quite popular. One version of this circuit, called a Q-multiplier, lets you narrow the range of frequencies your receiver is amplifying. This helps separate crowded stations. Test by tuning to a crowded portion of some shortwave band, and seeing how many different stations you can get both using the Q-multiplier and with it off. Some Q-multipliers are more effective than others.

On some of the most expensive sets variable selectivity circuits include crystal filters to give really sharp narrow bandwidth.

**Calibrator (CAL).** On some receivers this circuit is built-in. It produces audible tones at precise frequencies, so you can zero the set's dial tuning indicator to conform exactly to the specific frequency it indicates. Make sure the dial itself can be easily adjusted. If you want even more tuning precision, your set should have a crystal type calibration circuit, which cannot drift off frequency. The crystal calibrator is also available as an accessory you can add later.

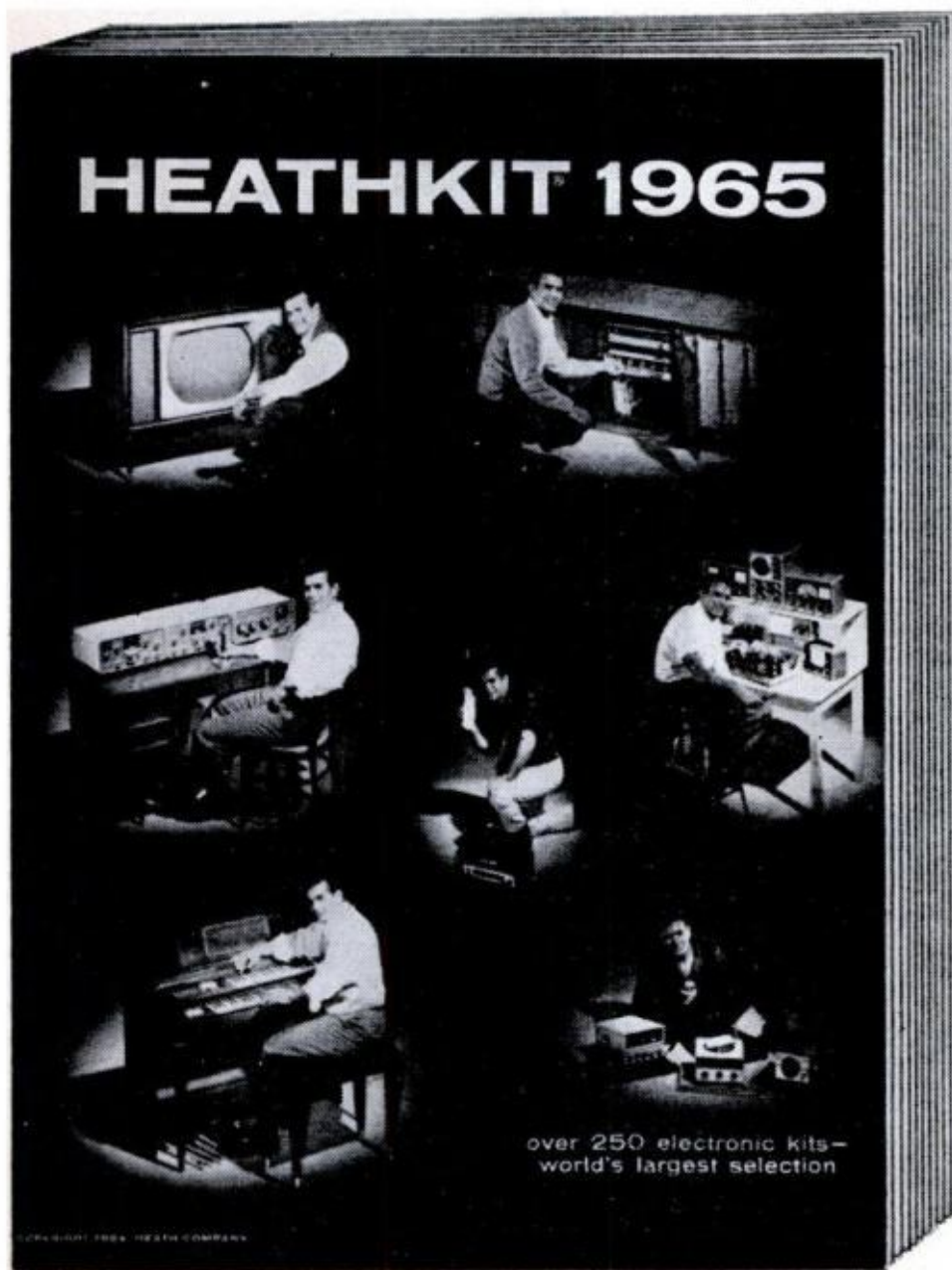
**Bandspread.** The ratio of how far you have to turn the tuning knob to how far the dial moves determines how finely you can tune to a station. Generally speaking, the more expensive the set, the higher the tuning ratio. But make sure the tuning control moves smoothly and easily.

**How many bands?** Most all-wave sets cover all frequencies between 550-kc. and about 34-mc. (Some special sets cover other frequencies.) But within the normal frequency limits, a set divides its range into a number of bands, usually four, five, or six. The more bands there are, the finer the tuning and the easier it will be to select stations. ★★★

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# World of Automatic Tires

(Continued from page 137)

buildup, thereby reducing both mileage and safety, particularly at high speeds.

## Design—Second Vital Factor

The way the rubber and cord are put together—the tire's design—is always a compromise. What helps one performance characteristic hurts another. A softer ride can be built into a tire, for example, either by using a more cushiony blend of rubbers, or a higher cord angle. But a softer rubber may wear more quickly. And the higher angle can let the tire flex more, producing tire-killing heat. It also reduces steering response and cornering ability.

Tire engineers, constantly juggling ingredients and design features, continue to come up with innovations. The two-ply tire is one of the best-known examples.

For many years, most passenger car tires used cotton cord, at least six plies—or layers—for enough strength. With rayon and nylon, the four-ply tire became practical. In recent years, manufacturers have increased the strength of cords still further and built two-ply tires. In these so-called two-ply, four-ply-rating tires, each individual cord is about twice as strong as those used in four-ply tires, so half as many give nearly the same total strength, and almost the same resistance to blow-outs, cuts, punctures, and sidewalk bruises.

And two-ply's thinner construction generates less heat, yet flexes more for a softer ride and bigger "footprint," hence better traction and skid resistance.

While the somewhat poorer performance of the earlier two-ply—particularly their tendency toward ply separation—gave them a bad name at first, most of the difficulty seems to have been overcome, and at least 19 out of 20 new cars this year will use them.

## Low Profiles Squirm Less

What about the low-profile tire making its appearance on most cars this year? (It was on Lincoln Continental and Thunderbird last year.) On this tire the cord angle (the angle at which the individual cords cross the tread) is lower, down from an average of about 37 or 38 degrees to near 33 or 34. This makes the tire firmer and steadier. It squirms less on the road, so tread wear is improved as much as five percent. The stiffer, more stable tire also gives better cornering and steering response and has better high-speed characteristics. The new tire also has rounded shoulders. When it heels over in a hard turn, an extra tread groove comes in con-

tact with the ground for better traction.

Of course, the better performance of the low profiles didn't come free. The lower angle brings with it a slightly harsher ride. The designer steals back a little softness with two-ply construction. And better auto suspensions give a smoother ride despite the slightly harsher tire.

## The Radical Radials

Far more radical than either the two-ply or the low-profile is another design just now appearing on the American market: the so-called radial-ply tire! The cords don't angle across the tire's tread in the usual crisscross pattern at all, but are laid straight across from bead to bead, at a 90-degree angle. Then a multi-layered belt fits like a hoop around the tire's rolling surface. The new doughnut, says P. W. Perdriau, president of Goodrich, "rolls as easily as a hoop. It is soft in the sidewalls where a tire should be soft, and rigid in the tread where a tire should be rigid."

"The belt lays the tread on the road without the twisting and squirming that occurs when the cord angles of a conventional tire change, scissorslike, under load," says J. J. Hartz of Goodyear. "This free-rolling tread lasts much longer and, because it has less rolling resistance, fuel economy is improved."

## More Miles per Gallon

John Antonson of Goodrich's advanced tire development department estimates potential gas savings at up to 12 percent. Among other benefits are better skid resistance, traction, and handling, and improved cornering and steering. At high slip angles—such as in panic turns—cornering may be improved as much as 30 percent. Radials also have better resistance to impact and penetration.

The radial tire also gets around a big weakness of glass cord. "In a radial-ply tire," says Firestone's Wolf, "you don't get compressive distortion. The cords are always under tension."

With all its advantages, the radial tire may have a hard time being widely accepted. Main drawback: a rough ride at slow speeds. "If you roll over a pencil," says one tire engineer, "you know it." Despite its ride, sports car fans will buy it—as they do in Europe—for its performance and economy. Some U.S. owners of foreign cars use imported radial tires now, principally the French Michelin "X" and Pirelli Cinturato. The belt around the Michelin's tread, incidentally, is made of woven steel wires, as is the band around the Goodrich radial. Goodyear offers either steel or rayon in Europe, but prob-

(Please turn to page 232)



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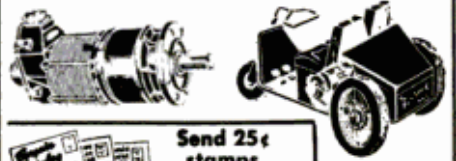
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# World of Automatic Tires

(Continued from page 230)

ably will go with the smoother riding rayon in this country. (Nylon, incidentally, is out here: too stretchy.)

## Which Line Should You Buy?

While tire quality varies from one brand to another, the various levels (premium, first, second or third line and promotional) tend to fall into certain broad categories. Here, generally, is what your tire dollar buys in the various levels, and where the individual levels work best:

**Premium tires** offer two things: extra-heavy construction and special features like an inner tire to let you keep driving after a flat or like an internal puncture sealant. One premium—the butyl tire—gives a ride as smooth as a cat licking butter. And it won't squeal. It doesn't, however, give long mileage. The radial tire, with its souped-up characteristics, is another premium.

For long tread life, extreme strength and safety, tremendous resistance to abuse, and special features—all at a price—the premium tire is a good value.

**First-line tires** are either those made by one of the original equipment (OE) makers—Firestone, General, Goodrich, Goodyear and U.S. Rubber—for factory installation on a new car, or by none-OE makers to compete with OE tires. They have engineered into them, especially if they're made by an OE company, a lot of the soft ride that car builders demand. "We get an envelope from Detroit every morning," says Firestone senior engineer Jim Corey. "This or that manufacturer says the noise level is unsatisfactory or the tire doesn't corner quite as well as they'd like. So we keep working until we meet their requirements."

While first-line tires also give better tread life than cheaper tires, a good bit of their cost buys what tire men call "aesthetics": ride and quietness. If these aren't important to you, you may get more miles per dollar with cheaper tires. (Since nylon-cord counterparts of OEs sell for a couple of bucks extra, some makers call them premiums.)

Under extreme conditions—off-the-road driving, for example—the extra strength built into first-line or even premium tires might be worth the extra cost on that basis alone. If you want low-profile tires, you'll have to buy first-lines. Eventually they should be available in other lines, but not yet.

**Second- and third-line tires** are hard to separate. They're both good general-purpose tires with few frills or extras. One is

a little stronger, a little longer lasting, a little more expensive. They're also the most misunderstood tires.

"Second- and third-line tires," says Firestone's Corey, "are designed for a special market. Why should the man who is only driving back and forth to work invest in an expensive tire when he can buy one at a lower price that does the same job? The differences between second- and third-line tires and the more expensive lines are primarily matters of tread wear, noise, appearance, and handling. To go to extremes, when you get into very high speeds the second-line tire will run faster without breaking up than the premiums or first-lines. (But it will, of course, wear out faster than more expensive tires.) The first-line's light construction makes it cool running so it takes speed well. And all of our tires are tested at 100 miles an hour, so they're safe.

"They may or may not be the best buys from the point of economy. At moderate speeds, our second-line tire gets about 90 percent of the mileage of the first-line; the third-line about 80 percent." Since second- and third-line tires cost about 75 and 65 percent of the first-line price, they're obviously a better miles-per-dollar buy.

"When speed is introduced, though," continues Corey, "a second- or third-line tire won't wear as long as it will at slower speeds. The tread doesn't have the wear resistance that the first-line does, and that difference is magnified with speed. So for the guy who does a lot of turnpike driving, the first-line tire is probably more economical."

**Promotional tires** are the cheapest ones the tire makers can put together and still meet reasonable standards—including the new safety standards.

Properly used and maintained, promotional tires are relatively safe. But of course, they can't take the abuse—such as occasional overloading—that stronger, sturdier, more expensive tires might shrug off.

Most manufacturers agree with these general rules for picking the right grade of tire, but some take vigorous exception. Harry C. McCreary, Jr., Chairman of McCreary Tire, is the most outspoken. "The manufacturers who make the second, third, and fourth line 'promotional' tires (we don't) are prone to making pious statements to the effect that each of their particular grades of tires are perfectly safe 'when used as the manufacturer intended.' The problem is that the manufacturer's intentions and the consumer's intentions are sometimes 180° apart and this is how people get killed."

Lower priced tires, says McCreary, don't have a large enough safety margin, and are likely to be overloaded in normal use. "How are you going to prevent the consumer from buying a cheap tire, loading the wife, kids, dog, and baggage into the car and then taking off down the freeway at high speed?" McCreary's suggestion: Remove all but the best tires from the market.

While such a plan would certainly make the highways safer it's not likely to happen. And no tire is safe or will deliver the mileage and performance built into it unless properly used, regularly inspected, and properly inflated. ★★★

## It's a Long, Long Day on Venus

Venus rotates on its axis once every 248 to 258 earth days, astronomers have measured, achieving an accuracy five times greater than the previous most accurate study. Earlier the rotation period was estimated between 239 and 293 earth days.

Using the world's largest radio-radar telescope at Arecibo, Puerto Rico, Cornell University astronomers also confirmed the previously reported observation that Venus rotates in the opposite direction

from that of the earth and most other planets in the solar system.

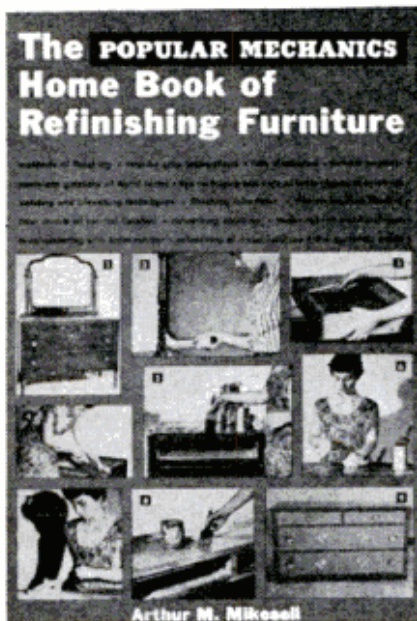
The findings were gained through the use of radar astronomy, which involves bouncing a radar pulse beam off the surface of a planet and studying its return reflection. The frequency with which a planet turns each "side" to the sun has a great effect on the temperatures and winds in its various regions.

## Ultrasonics for Mentally Ill

Some types of mental illness are now being helped by ultrasound waves of a million cycles per second which disrupt certain nerve pathways in the brain. Called PST (Prefrontal Sonic Treatment), the method works well with patients suffering from feelings of anxiety, depression and compulsion. But it doesn't help patients with personality disorders, severe social maladjustments or other chronic mental illnesses.

The technique was developed by Dr. Petter Lindstrom of the University of Utah College of Medicine as a substitute for frontal lobotomy operations in which portions of the brain are severed or removed. The treatment is said to be "relatively painless."

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## \$7 a Year Heats Solar House

(Continued from page 93)

ferentials under all conditions of weather I have learned that this reflector increased the output of my heat trap by as much as 30 percent.

As the lengthy testing proceeded, I found that I could sometimes heat water to the boiling point. If no water were being circulated through the heat trap, the temperature would go as high as 250 to 275 degrees Fahrenheit on hot summer days.

Now I went to work on the air conditioner. By circulating water from the tank over the north roof of the house at night, I chilled it through the process of radiation, evaporation, and contact with the cool night air. The cooled water in the tank chilled the stones around it. The next day, when the rooms needed cooling, I circulated air through the cooled rock bin and back into the rooms.

I was aware that airconditioning engineers recommended that home temperature be lowered only 10 to 15 degrees below that outside the house. Therefore I was pleased when my solar machinery reduced the interior temperature of my house as much as 15 degrees below the exterior temperature. But that was only under ideal conditions. The rooftop cooling wasn't always that effective. Consequently in an alternative system I have used a  $\frac{3}{4}$  hp. refrigerating unit to chill the water and stones at night as a means of storing coolness for the following day.

Although these facts were encouraging, they did not answer the vital question of practicality. Would my system actually save money for the householder?

The answer to this depended, to a considerable extent, upon the quantity of heat in the heat bin, and the cost of doing it all.

During the early winter of 1959-60, I sought the answers as one cold, cloudy day succeeded another. I kept close watch as my stored heat reserve dwindled. Some systems, I knew, could not keep the house warm if the stored heat level dropped below 90 degrees Fahrenheit.

When the heat level of my reserve dropped to 90, I was understandably anxious. Obliging, however my house remained comfortably warm.

But the cloudy weather continued. The stored heat level dropped to 85, 80, 75, and even lower. Even so, the interior temperature of my house remained close to 70.

At last, however, the house temperature dropped noticeably below 70 degrees. Then the auxiliary oil heater—which I had provided for just such long, cold, cloudy spells—cut on automatically to assist the solar

heat. On the day after Christmas, the *Washington Star* reported: "Mr. Thomason spends 30 cents for fuel so far this year."

That statement was true. We had used two gallons of fuel oil by that time. By the end of the long, cold, half-cloudy winter my fuel bill was only \$4.65. I had used 31 gallons of oil at 15 cents a gallon!

For three consecutive years I have heated a six room house in Washington, D.C. for the grand total of \$18.90. This averages \$6.30 a year. Airconditioning bills were reduced about 40 percent. According to the best estimates I can arrive at, it would cost about \$100 to \$150 a year to heat this some house with oil.

What about the cost of original equipment?

It cost about \$2000—roughly twice the price of an oil-fired hot air system. It promises to give long life. The few elements which must be replaced after five years or so are inexpensive and simple to install.

Since that first house went up in 1959, we have built two more. House number two, erected in 1960, had an outdoor swimming pool. The water in it was warmed by the solar heating system until snowfall. Our auxiliary heat in that one cost about \$35 a year. There were two reasons for this. First, the fuel was electricity—about three times the cost of oil in our area. Second, the collector was much smaller—560 square feet instead of the 840 in house number one.

Our newest solar house—still not completely finished—is the last word in Thomason design. While the first two were built strictly with a view to functional efficiency, this time we have endeavored to incorporate the huge, 940-square-foot collector into the architectural design of the house. A large indoor swimming pool, heated by the solar system, is an integral part of the building. As yet we have no figures on this one. But we have high hopes of spectacular results.

It is my firm belief that our own experiences, and those of others, presage a dramatic increase in solar heated homes. Many top solar authorities agree with this. In fact, I have read one published prediction that, by 1975, there will be a total of 13 million solar heated homes in the United States.

That estimate may be too high. But, if Congress authorizes the Secretary of the Interior to establish a Solar Energy Commission, as provided by the Honorable Hubert Humphrey's Bill S. 2853, this could well become a reality.

Whether it does or does not, it is my opinion that solar heat for homes is not only practical—it's good business! ★★

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THIN AS  
RAZOR  
BLADE

# YET IT CUTS THROUGH STAINLESS STEEL

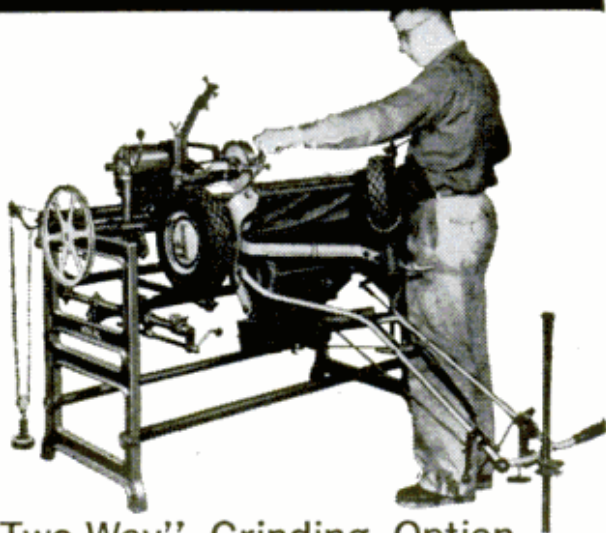
Here is a saw that must be used to be believed. Razor-thin, yet it cuts through wood, plastic and metal. It never chips... never splits...always leaves a smooth edge. Perfect for precision cross-cutting and notching...for trimming that extra  $\frac{1}{8}$ th of an inch...for sawing smoothly along the grain. Another quality tool from X-Acto. The Razor Saw with two different blades...only \$1.75. Refill blades always available. See the Razor Saw at all better hardware or homecraft stores or order directly from:



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## IDEAL 900 Lawnmower Sharpener



**"Two-Way" Grinding Option  
means bigger profits for you!**

The Ideal sharpens *any* reel-type mower by either "Hook" or "Straight-Line" methods. No limitations, every job perfect with no hand filing. Ruggedly built, screw adjustments can't slip,  $\frac{1}{2}$  hp. motor. Write for Full Details.  
**The Fate-Root-Heath Co., Dept. PM-2, Plymouth, Ohio**

## Owner's Report—Chevrolet

(Continued from page 98)

—Ohio electrician.

"Power steering is out of this world; I can turn around on a dime with my little finger."—New York mechanic.

"I like this power steering; I've had Chrysler products where you couldn't turn your head or the wheel would turn."—Ohio secretary.

**Chrysler's was "full-time power steering." This year the pull you put on the wheel rim before Chevy power comes on is down from about 8 pounds to about 3.**

"The car holds the road well; it seems heavy."—Illinois construction worker.

"There's good handling on turns because of the wide track and heavy-duty suspension I ordered."—Nebraska salesman.

**We suspect the optional suspension deserves more credit than the wide track.**

Returning to the complaint side, here are samples of numbers six through ten with the most widespread listed first:

"Curved windows aren't as strong and tight fitting as the old ones. They have slight leaks and wind is always whistling at the tops."—Louisiana bookkeeper.

"The windows do not roll up and down well. I see no reason for curved glass in the doors."—Tennessee insurance agent.

**Chevrolet trouble with curved glass started when their curved side windows did, in Chevelle. It should be over by now.**

"The paint job is poor. Paint quality on all cars is getting worse each year."—Illinois accountant.

**The factory is proud of its re-heat system, says it re-liquifies the paint surface after sanding so imperfections smooth out. Maybe it doesn't always work.**

"I thought the small V8 would use less gas than the '61 Galaxie I had. The Ford had the largest engine, but I still get about the same mileage (14 m.p.g. after 1900 miles)."—Texas carpenter.

"My 250-hp. engine gets 11.3 m.p.g. over-all and I sold a 285-hp. '59 Dodge wagon that averaged 16.3 m.p.g. for 90,000 miles."—Michigan staff supervisor.

"The body surface is wavy."—Nebraska insurance agent.

**There's a man on the line whose job it is to calm those waves with body solder.**

"The transmission linkage is loose and I had a noise in the clutch."—New York aircraft service man.

"The Powerglide transmission isn't any good. It's been in the shop for over a month."—New Jersey fork lift operator.

(Please turn to page 238)

# NEW DYNAMIC MARK 88 INDUSTRIAL TRANSFORMER ARC WELDER

ANYONE CAN WELD, BRAZE, CUT, SOLDER, HEAT ON STEEL, BRASS, ALUMINUM, AND OTHER METALS.

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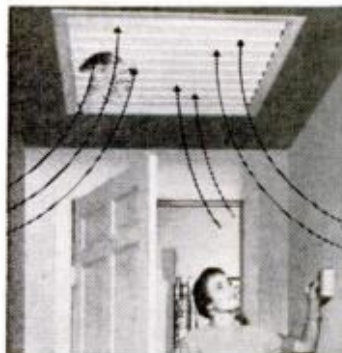
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AMERICAN EDELSTALL INC., Dept. G-B5, 350 B'way, N.Y. 13, N.Y.

## Owner's Report—Chevrolet

(Continued from page 236)

Owners have still more praises, however. Here's the last group, numbers 11 through 15, with the most popular first:

"I like the big, roomy trunk."—Iowa custodian.

"We can stand full bags of groceries up in the trunk."—Michigan checker.

*That's quite an achievement since Chevy stylists decreed a semi-fastback line.*

"I've had 35 years of driving Chevrolets. It's the most economical traveling salesman's car."—Pennsylvania retiree.

"I've owned three others and all were economical and dependable."—New York school crossing guard.

"The dash panel is the most beautiful Chevrolet has made."—Illinois clerk.

"You get the maximum in visibility."—Pennsylvania businessman.

*Agreed—if you're looking forward.*

"You sit up in it, so you see better."—Texas engineer.

"It's quiet running (although there's a little wind noise at high speeds)."—Michigan housewife.

*Finally, here are samples from the last five groups of complaints with the most common first:*

"It's a nuisance to have a separate key for the trunk."—Iowa farmer.

*He doesn't turn his car over to a strange city parking attendant.*

"The tires are too small."—Louisiana police chief.

"I don't like the instrument panel with only one ash tray."—Missouri mechanic.

"There's poor dash lighting and only one ashtray . . . and I can't find it at night."—retired Missourian.

*We found the soft glow pleasant and instruments well illuminated. As for that ash-tray, smoking passengers will just have to grow long left arms.*

"The right rear shock dropped from the frame."—rural Illinois mail carrier.

"The right rear shock wasn't fastened to the body at the top (standing loose on the bottom mount)."—Pennsylvania personnel man.

"The instrument cluster isn't as sturdy as in the other Chevies I've owned."—Pennsylvania teacher.

"The dashboard comes up too high."—Michigan telephone installer.

*There's the report from a panel of car testers who have racked up more miles than any others—the owners themselves. They totaled well over half a million miles to get the experience for this report. ★ ★ ★*



Be free as the breeze for only \$225.00\*

Take a test ride on the new Harley-Davidson M-50. See your dealer today.

\*Suggested retail, F.O.B. Milwaukee

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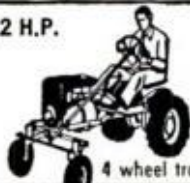
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4 wheel tractors

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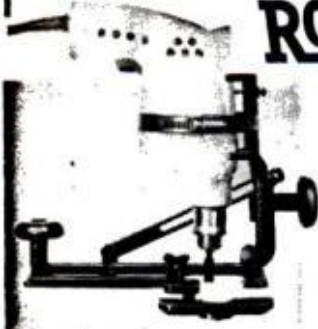
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Clamp this amazing new tool to your electric drill and you're ready to route, mortise, trim or shape wood to precision tolerances. Mortises for hinges made in seconds. Inside shapes and inlays are easy. Handles any kind of routing better by letting you take the tool to the work. Make mortise and tenon joints including mitre joints for picture frames. Perfect for fluting lathe work. Router-matic is a precision made tool, sturdy, light weight, portable. Once you've used it you'll wonder how you ever got along without it. Only \$6.95 including \$1.50 router bit. We can't sell thru stores at this low price. Fully guaranteed or money back. If you're skeptical write for descriptive folder.

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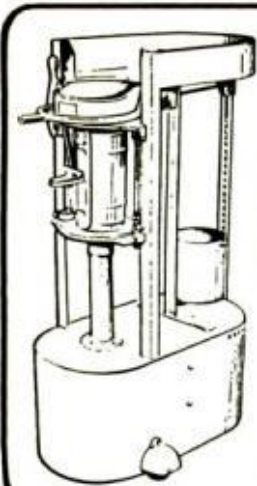
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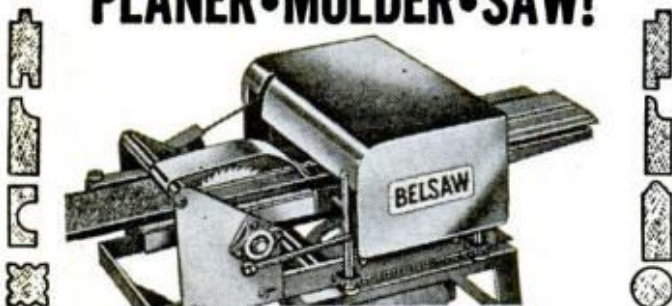
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2951 VINELAND STREET, S. E., GRAND RAPIDS 8, MICH.

## Owner's Report—Ford

(Continued from page 104)

—Indiana supervisor.

"Doors in the two-door are located so back seat passengers can get out."—Illinois professor.

**Those big gates do make it easier on grandma's knee action.**

"It has a good solid feel on the road."—Michigan salesman.

"It drives like a Lincoln without the extra \$1500."—Missouri office worker.

"The power steering is improved a lot over my '62 Ford."—Illinois farmer.

"Power steering is almost perfect."—Indiana farmer.

**It's fast and nearly effortless. A few owners reported leakage problems.**

"You feel relaxed when you finish a long drive."—New York retiree.

"Much of my driving is done in mountainous country but I'm not beat when I get home at night."—New York salesman.

**Gas mileage leads the second group of complaints—numbered 6 through 10. Here are representative comments, with samples of the most widespread listed first:**

"Poor gas mileage, 10 m.p.g. in town with 250-hp. engine."—Michigan maintenance worker.

"Gas mileage... I only get 10 m.p.g. in town, 11 over-all with 250-hp. engine."—Louisiana secretary.

**If her foot action is as feathery as her typing touch, she should get much better results.**

"Low gear in the Cruise-O-Matic transmission went out in less than 500 miles. There was a defective piston."—Louisiana drug salesman.

"Cruise-O-Matic transmission leaks."—Texas inventory clerk.

**Ford had some trouble near the radiator with transmission oil cooler hose, not the box. Better tell Henry.**

"I lost power steering due to a loss of fluid from a fitting not tightened."—Michigan fan assembler.

"The power steering vibrates badly."—Michigan retiree.

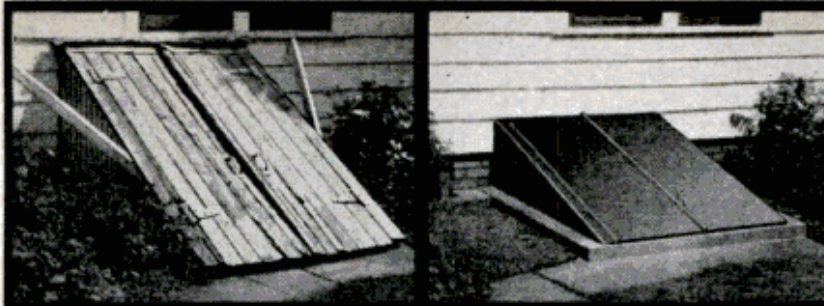
**The steering pump is just above the transmission and both fluids are red. Be sure of the culprit.**

"Wheel cylinder went out in my brakes."—Iowa insurance agent.

"Line to right rear wheel was loose and I lost brake fluid."—Washington truck fleet mechanic.

"It has an oil leak. They should tighten at least some of the bolts."—Iowa car-

[Please turn to page 242](#)



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**THIS MODERN WAY**



**AMERICAS FINEST  
BASEMENT DOOR**

Here's the way to add amazing new beauty and convenience to your home. Replace that troublesome wood door with a modern Bilco. All steel, permanent, watertight, opens and closes at a touch. A new Bilco Door will do wonders for your home . . . and for you!

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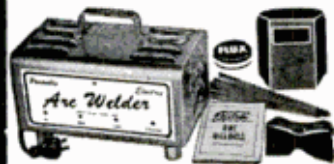
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Works on 110 volt plug in  
**10 WAYS! WELDS, BRAZES, SOLDER, CUTS, MELTS** most ALL metals! HEATS, SOFTENS, LOOSENS, THAWS, BENDS most ANYTHING. COMPLETE READY TO USE WITH face mask, clamps, arc torch, rod holder cables—and supply of welding, brazing carbon, solder rods, flux and ARC WELDING INSTRUCTION BOOK—Tells how YOU can use for CARS—HOME—FARM—SHOP or FACTORY all 10 WAYS—NO EXPERIENCE NEEDED!  
**SEND ONLY \$2.00** (cash, ck, M.O.) and pay postman \$12.95 plus C.O.D. postage or send \$14.95 for PP del. in USA. **BEST WELDER FOR THE MONEY IN THE WORLD. FREE: EXTRA "Helpers" dark goggles** if you order from this ad. Sold ONLY by **MIDWAY WELDER, Dept. DPM-2, Kearney, Nebraska.**



**NOW! WARN OVERDRIVE**  
**gives 'Jeeps' more Go!**



New approved accessory cuts engine RPM 33% at any speed, reduces noise, vibration so you can drive your Jeep 4-w.d. comfortably at freeway speeds. Amazing synchromesh OD lets you shift up or down, on the go, anytime, in any gear, at any speed. Adds six forward speeds, two reverse. At Jeep dealers, or write us.

**WARN SALES CO., Inc.**  
9050-A Empire Way South  
Seattle, Washington 98118

**STARCRAFT® 65**

**new fishing boats—every inch keepers!**

Starcraft '65 measures its fishing boats just as you measure a fish. A straight line down the center from bow to stern. Centerline length. Some people measure boats by gunwale length—which is like measuring a fish by half its circumference. Doesn't make sense. For greater values, choose from Marlin, Super Duty, Seafarer, and Sea Scamp. 12 to 16 ft. Write for free '65 catalog. Starcraft Boat Company, Dept. PM-2, Goshen, Indiana.





## ELECTROPLATING EQUIPMENT, SUPPLIES and INSTRUCTIONS for Home Workshop or Production Plant

Decorative Chrome, Hard Chrome, Precious Metals (Decorative & Electronics), Electro Polishing, Baby Shoe Metalizing and all other finishes. Also Portable Platers & Sample Plating Service. Send \$1 (refundable) for formulas, operating data and catalog.

**HBS Equipment Division - Dept. 165**  
3445 Union Pacific Avenue, Los Angeles 23, Calif.

## U. S. Oil & Gas Lease Drawing PUBLIC POSTING By Government Regulation

**EQUAL OPPORTUNITY TO WIN** valuable oil leases in United States Government public drawings monthly by U. S. citizens. Winners awarded oil leases in prolific producing areas promptly salable for large profits. Our clients winning—one put up \$60 and sold for \$7800.00 cash. For amazing information and how to share write:

**Federal Oil Lease Service**  
Box 867-PM Ft. Worth 1, Tex.

FAMOUS



## TEENUT® FASTENERS



Can't slip, flush-mounted, strong. ONLY nut that gives steel threads in wood!

- Now available in bright NEW finish!
- NEW red and yellow, skin-pack cards!
- Look for colorful NEW display carton, too!
- Handymen need TEENUTS!
- Sold at hardware stores.

**COLUMBIA  
FASTENER**

SUBSIDIARY OF UNITED-CARR  
3229 South Ashland Avenue  
Chicago, Illinois 60608

TEENUTS is a registered trademark of United-Carr

## ALUMINUM SIDING



Learn how you can earn up to \$1000.00 per sale, showing our quality aluminum siding on your home.

TO: ALUMINUM INDUSTRIES, Dept. P-25  
KANSAS CITY 11, MISSOURI

Please send me complete information

My Name \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

## Owner's Report—Ford

(Continued from page 240)

penter.

"I've had an oil leak."—Maryland sheet metal worker.

*Starting with the references to good vision, here are samples from the last group of five Ford features owners liked:*

"Better vision now that the hood is lowered."—Minnesota housewife.

**Virtually every point on the hood is in your line of sight, too.**

"The vision is okay forward and rear."—Missouri locomotive engineer.

"Holds the road well at 70 m.p.h."—Michigan moulding machine operator.

"I like 15-inch wheels instead of 14s."—New York electronic technician.

"The 15-inch tires will wear longer."—Michigan rural mail carrier.

**Remains to be seen. The new low profiles have about the same rolling radius, circumference, and revolutions per mile as the old tire sizes.**

"Riding quality is comparable only to sitting in your living room in your favorite chair."—Pennsylvania warehouseman.

"The bucket seat are well-formed."—Illinois inspector.

"All the gauges and controls are handy."—Indiana steelworker.

"I like the consolidation of instruments."—Missouri housewife.

*An unusually wide brake pedal stimulated the most widespread of the last group of five complaints. Other owners were unhappy with the new rear suspension, dust leaks, and trouble with the carburetor and electrical system. Here are representative comments:*

**There's hardly room to pivot your foot from gas to brake, sad to say.**

"The brake pedal is too close to the gas."—Pennsylvania mechanic.

"The rear springs are too light for the load I haul."—Indiana supervisor.

"Dust filters in freely on dirt roads, especially at bottom of the doors."—Texas attorney.

"Dust gets into the trunk and then on into the car."—Ohio line repairman.

"Pop back through the carb caught fire and burnt up air filter."—Ohio industrialist.

"Carburetor was lacking a part."—Maryland local union president.

"Had a defective voltage regulator."—Ohio physics professor.

"Electrical circuits not completed to minor accessories."—New Jersey chemist.

*Those are the reactions after we asked a thousand owners what they thought of their new Fords. Their experience is provided for your help.* ★ ★ ★

## AUTOMATIC

MAKES NEW PROFITS

## RETOOTHER

for HAND SAWS

Cuts new teeth in 50 seconds—any size 4 to 16 points. Old teeth fall off as chips. Easy to operate. A perfect job.

**BURR MFG. CO.**  
8933 VENICE BLVD.  
LOS ANGELES 34, CALIF.

Send For Free Literature



## SCUFFED FLOORS? SEND FOR FREE SAMPLE



Removes heel marks, stains, adhesive from asphalt, vinyl, vinyl asbestos. Send name of hardware or linoleum dealer.

**MY-RO** TILE CLEANER & ADHESIVE REMOVER

**MY-KO CHEMICAL CORP., Dept. PM**  
1736 N. Second St., Milwaukee, Wis. 53212

## MOTOR-MEDIC

- REDUCES ENGINE WEAR
- MAKES OIL LAST LONGER
- STOPS OIL BURNING

At Service Stations and Auto Supply Stores



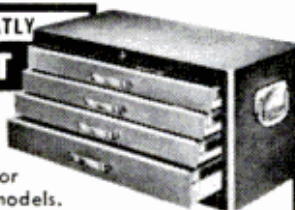
PROTECTS TOOLS, SORTS THEM NEATLY

## HUOT TOOL CHEST

Keeps tools organized. 4 sliding drawers, rugged steel Professional Style cabinet—blue or red—26" x 12 1/4" x 12 1/4". Write for FREE BULLETIN on this and 15 other models.

**HUOT MFG. CO.** 555 N. WHEELER ST., ST. PAUL 4, MINNESOTA

MODEL 107



## BIG CATALOG! FREE DECAL

BIKES • KARTS • PLANS • PARTS

Save up to 50% on karts, scooters, mini-bikes! Plans, drawings, parts, engines, clutches, wheels, helmets, etc. -- plus ready-to-ride units... all at factory prices! Build it yourself at home! Order catalog now -- get free decal!

**Go Kart** SEND \$1.00  
BOX 797P



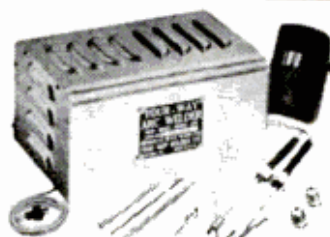
Janesville, Wis

**NOW! GET 3 REAL OLD LINCOLN CENTS**  
— for only **10¢**



Only 10¢ brings you 3 old Lincoln pennies — America's most sought-after collector's coin. 1929S, 1916, 1918. (Offer limited — only one set to a customer.) For all 3 Lincoln Cents, plus free catalog illustrating coins and supplies, plus other offers on approval, send name, address and 10¢ to **LITTLETON COIN CO., Dept. PM-2, Littleton, New Hampshire 03561.**

## BEST LOW COST ELECTRIC WELDER MONEY CAN BUY ONLY \$14.95



**5-YEAR GUARANTEE**  
**10-DAY MONEY BACK TRIAL.** WELDS, BRAZES, SOLDERS, CUTS ANYTHING OF METAL

No comparison for performance and value. No experience needed to make or repair auto bodies, fenders, trailers, boats, furniture, farm equipment, garden tools, anything of metal. Use up to 1/8-in. welding rods and 1/4-in. carbons on up to 1/4-in. metal. Operates on any 110 V. line. **WORLD'S GREATEST WELDING VALUE.** Over 500,000 in use by home owners, farmers, hobbyists, mechanics. **5-Year unconditional guarantee.** Order on 10-day moneyback trial, if not satisfied return for refund.

SEND ONLY \$2.00

You Get: **FULL FACE SHIELD**, heavy metal cabinet, ground clamp, 12 ft. of heavy duty welding cables, twin carbon arc torch, rod holder, carbons, welding and brazing rods, flux, solder, instructions. **SEND ONLY \$2.00.** Pay \$12.95 plus C.O.D. charges on delivery or send only \$14.95 and we will ship prepaid. Order today.

## FOUR-WAY WELDER CO.

DEPT. W2-B, 1810 S. FEDERAL ST., CHICAGO 60616

## EXCLUSIVE DOUBLE-BEARING HEAVY DUTY PUMPS

IRRIGATE • DRAIN • CIRCULATE • SPRAY  
Use 1/4 HP motor or larger . . . 1 HP for up to 5,200 GPH; 1,000 GPH 60" high; or 3,000 GPH from 25' well. 1 1/4" inlet; 1" outlet. Stainless shaft.

**TYPE X**—2 oil-less bronze bearings. **\$10.95**

Won't rust . . . . . **\$12.95**

**TYPE XB**—Ball bearing model. . . . . **\$12.95**

Best for belt drives. . . . .

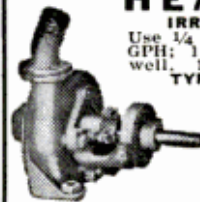
Postpaid if cash with order.

Don't delay—send for yours today!

**MONEY BACK GUARANTEE**

Centrifugal and Gear Pumps in All Sizes

**LABAWCO PUMPS, Belle Mead 2, N. J.**



## SAW SHARPENING IS EASY

Super Filer No. 11 joints and sharpens hand and circular saws 6" to 10" with all teeth correct in height, depth, pitch, bevel. When file hits steel roller, teeth are finished. Saw runs true with no side pull. Includes 8" file. **\$9.95**

PPD.



"**TRU-CIRCLE**"

saw set automatically sets teeth at 10° or more. **\$2.95**

PPD.

**MONEY BACK GUARANTEE**

**A. D. McBURNEY, 1610 Victory Blvd., Glendale, Calif. 91201, Dept. A-25**

FREE LITERATURE



## Bean's Free Spring Catalog

Ready February 15

Fully illustrated 100 pages of camping specialties, fishing tackle, clothing and footwear for men and women. Featuring practical outdoor items, many of our own manufacture.



**L.L.Bean, Inc.**

**247 Main St., Freeport, Maine 04032**

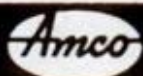
*Hunting, Fishing and Camping Specialties*

**PHIL RIZZUTO . . . Radio Network Sportscaster and Former Yankee Shortstop  
DISCOVERS A RICHLY REWARDING NEW NATIONAL PASTIME!**

"There's a new indoor pastime I'd been introduced to recently that has me wondering where it's been all my life. Until I outfitted the basement of my new home with a set of American Machine power tools, I had no idea how much fun it could be to make things out of wood—nor how easy it can really be. I am constantly amazed with the accuracy, speed and ease with which I can now make useful and beautiful things for the house, for the kids—and for my own pleasure and convenience. I don't know how they do it, but the remarkable low cost of these professional quality tools has taken nothing away from their ability to do a job."



BUY DIRECT FROM OUR FACTORY



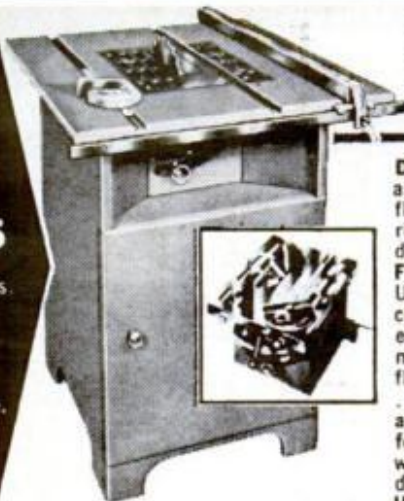
**POWER TOOLS SAVE AS MUCH AS 80%**

**8" TILT ARBOR  
POWER  
SAW**

**\$14.95**

f.o.b. factory Wt. 25 lbs.

Includes completely assembled cast iron and steel 8" tilt arbor power saw with ground cast iron table . . . less blade. If desired, RIP FENCE for easier work alignment, \$3.50 additional



**REVOLUTIONARY PATENTS DECREASE COSTS, INCREASE EFFICIENCY**  
Full scale power tools of heavy duty 100% cast iron and steel. Streamlined design reduces weight, cuts material and production costs. Special patents provide added efficiency, accuracy, savings. Parts made, assembled, tested and packed right in our own factories, shipped direct . . . save store profits.

**DOES WORK OF \$75 BENCH SAW**  
as is. Converts easily to equal any \$300 floor model cabinet units! Crosscuts, rips, mitres, cuts compound angles, dadoes, makes coves and mouldings.

**FREE CABINET BASE PLANS**  
Use as portable bench saw as received (inset photo) . . . or transform easily and inexpensively into floor model (as shown) guar. to do work of floor models costing \$300. FREE plans . . . sheet of 3/4" plywood and 3-4 hours are all you'll need. Use your AMCO saw for cutting. Plans provide 27" x 24" work surface, 33" height, pullout sawdust bin, tool storage compartment.

**UNCONDITIONAL 10 YEAR GUARANTEE**

**BLADE TILTS . . . TABLE STAYS LEVEL**

- Locks securely at any angle to 50°, raises, lowers 0"-2 1/4"
- Patented tilt mechanism, accurate etched scale
- Patented motor mount takes std. 1/4 h.p. or larger motor, keeps belt tight, assures perfect alignment at any angle, transmits full power
- Takes std. blade, saw insert removes to take dadoe heads, cutters, etc. (not incl.)
- Accurate mitre gauge assembly
- Ground spindle
- Enclosed steel base
- "Compo" bearings
- Accessories available at factory prices
- RIP FENCE, if desired for easier work alignment: Std. size (for bench saw) \$3.50; larger fence (for cabinet base, as ill'd.) \$4.50.

**6" SWING  
3-FT. LATHE**

**\$9.85**

f.o.b. factory

Optional Faceplate for turning bowls, trays, lamp bases, rosettes, etc. \$2.50



Complete as shown

**DOES THE WORK OF \$40 UNITS—**  
Sturdy all cast iron power tool turns wood or plastics with the precision and speed of machines selling for 4 times as much. Tubular steel bed, ball thrust cup center, spur center, T-Rest assembly, lever action tail stock, 2 speed pulley. Fits any motor.

**UNCONDITIONAL 10 YR. GUARANTEE**

**FULL 22" LONG, 4 1/2" JOINTER-PLANER**

**\$19.95**

F.O.B. Factory Complete as shown

100% precision ground cast iron and steel.



**DOES WORK OF \$60 UNITS**

Now, at little more than a hand tool price, a guaranteed professional quality precision machine which does same work as skilled hand planing . . . much faster, more accurately. Make accurate glue joints; rabbeting cuts for doors, window frames, table drawers; square taper cuts for chair legs; accurate beveling.

- Precision ground cast iron tables, adjustable for depth of cut
- Rigid iron base
- New patent-pending design holds clearance between knives and tables at any depth
- Rabbet depth 3/8"
- Hardened, ground high speed steel knives
- Patent-pending fence adjustable to any position, any angle 0°-50°
- Patent pending lift-off guard (nothing to loosen!)
- Balanced steel cutter head.

**UNCONDITIONAL 10-YEAR GUARANTEE.**

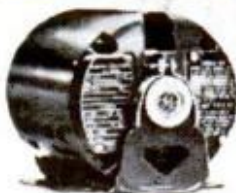
**PROVED BY  
MORE THAN  
500,000  
USERS**

**OR  
1/2 HP  
ELECTRIC MOTOR**

SPECIAL AMCO PRICE (when purchased with any unit in this ad)

**\$12.95**

f.o.b. factory if purchased separately, \$18.95



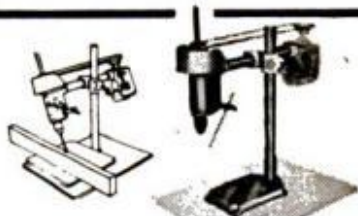
**SPECIAL LIMITED TIME ONLY**  
Brand new factory-fresh motors for use with any of the units on this page. Limited quantity purchase . . . first come, first served. Wt.: 17 lbs. **FULL 1-YEAR WARRANTY**

**32" RADIAL  
DRILL PRESS**

**\$29.95**

F.O.B. Factory 1/2" Cap. Jacob's Chuck Inc. Shipping Wt. 30 lbs.

**DOES WORK OF \$90 UNITS . . . AND A GREAT DEAL MORE**



Industrial quality precision machine with all features of standard drill press, many extras. Head raises, lowers. Greatly increased depth of throat. Can be pre-set to any angle or position for on-or-off table drilling . . . even horizontal drilling. All cast iron and steel. **UNCONDITIONAL 10 YEAR GUARANTEE**

**MAIL COUPON TODAY!**

AMERICAN MACHINE & TOOL CO., Dept. PM. 25B, Royersford Pa.

Please send me the units checked. Payment in full enclosed \$ . . . or \$3 deposit each item enclosed, balance C.O.D.  I MUST BE FULLY SATISFIED OR WILL RETURN UNIT WITHIN 10 DAYS FOR FULL REFUND. No questions asked.

- 8" Power Saw at \$14.95
- Jointer-Planer at \$19.95
- Long Rip Fence #354C at \$4.50
- Drill-Press at \$29.95
- Standard Rip Fence #354 at \$3.50
- Lathe at \$9.85
- 1/2 hp Motor:  \$18.95 (if purchased separately)
- \$12.95 (if purchased with other item)

NAME . . . . .  
ADDRESS . . . . .  
CITY . . . . . ZONE . . . . . STATE . . . . .  
(please print)

**10 DAY MONEY BACK GUARANTEE**  
You must be satisfied or money refunded.  
**AMERICAN MACHINE & TOOL COMPANY**  
Dept. PM-25B, Royersford, Pa.



# Noiseless portable

A few words about quiet.

Every motor manufacturer makes a lot of noise about quiet. But the Sportwin does for boating what the noiseless typewriter did for typing. If it's quieter than an Evinrude . . . it isn't running.

And a word about portability.

You never hefted a handier package of power than this. A suitcase-type lifting handle is at the point of balance. The Sportwin weighs in at 60 pounds. Not bad for 9½ horses, complete with full gearshift, thermostat controlled cooling, etc.

It's short enough to tuck snugly into compact car trunks — only 34 inches, top to skeg.

This sporty little shorty packs a wallop. Powers fishing boats at a 20-mile clip. Runs 80 miles or more on a 6-gallon tank.

It tilts and locks in 16 different running positions for shallow water trolling. The handle tilts up for stand-up trolling. Or down for stowing.

We only made one mistake in building the Sportwin last year.

We didn't build enough to meet the demand.

See the Sportwin at your Evinrude dealer, listed in the Yellow Pages. Free catalog. Write Evinrude Motors, 4042 N. 27th St., Milwaukee, Wisconsin 53216.

# EVINRUDE



FIRST IN OUTBOARDS

MILWAUKEE, WISCONSIN 53216  
DIVISION OF OUTBOARD MARINE CORPORATION

Camel Time

GOOD DAY. QUIET MOMENT. TIME FOR A CAMEL.

*Camel Time is flavor time!*

*Time for easygoing taste...honest enjoyment  
...choice quality tobaccos. Compared to any  
cigarette, Camel has the best taste of all.*

*Make it **Camel Time** right now!*

**THE BEST TOBACCO MAKES THE BEST SMOKE!**



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